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The arithmetic of outcome editing in financial and social domains

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ABSTRACT

Outcome editing refers to a set of mental rules that people apply when deciding whether to evaluate multiple outcomes jointly or separately, which subsequently affects choice. In a large-scale online survey (n = 2062) we investigate whether individuals use the same outcome editing rules for financial outcomes (e.g., a lottery win) and social outcomes (e.g., a party with friends). We also test the role of numeric ability in explaining outcome editing. Our results show that people's preferences for combining or separating events depend on whether those events are in the financial or the social domain. Specifically, individuals were more likely to segregate social outcomes than monetary outcomes, except for when all outcomes were negative. Moreover, numeric ability was associated with preferences for outcome editing in the financial domain but not in the social domain. Our findings extend the understanding of the arithmetic operations underlying outcome editing and suggest that people rely more on calculations when making choices involving multiple financial outcomes and more on feelings when making choices involving social outcomes.

1. Introduction

Outcome editing refers to the idea that people use simple mental rules for combining or separating multiple events before their evaluation (Thaler, 1985). Understanding how people edit outcomes is crucial for understanding many parts of everyday behavior such as coping strategies, price perceptions, financial decisions, subjective well-being, and evaluation of experiences (see e.g., Ariely & Zauberman, 2000; Cowley, 2008; Lim, 2006; Liu, 2013; Ranyard, Hinkley, Williamson, & McHugh, 2006; Sul, Kim, & Choi, 2016). How people choose to arrange multiple events in time can alter the appeal of different outcomes. For example, experiencing a negative event (e.g., getting a parking ticket) might be evaluated as less bad when it is combined with a positive event (e.g., receiving a bonus at work) compared to if these events are evaluated separately, and thus individuals might want to integrate negative outcomes with positive ones to feel happier. In this study we investigate to what extent preferences for integration and segregation of outcomes differ between monetary and social (nonmonetary) outcomes. Moreover, we explore the role of numerical ability in outcome editing across domains.

One of the first studies investigating outcome editing in different domains was conducted by Linville and Fischer (1991). They found that individuals typically use the same outcome editing rules for monetary and nonmonetary events. This finding is appealing, as it supports the assumption that nonmonetary outcomes can be translated into their monetary equivalents (see e.g., Galanter, 1990).

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Theoretically, this implies that the insights from studies on decisions about monetary outcomes will also apply to other decision domains with nonmonetary outcomes. Such claims have also been supported in studies on intertemporal decision-making comparing domains such as money, sex, and food (Sawicki, Markiewicz, & Białek, 2020) as well as money and environmental outcomes (Hardisty & Weber, 2009).

Contrary to this, several empirical studies have found that choices and preferences differ strongly across different domains of decision making. For example, Hardisty and Weber (2009) and Attema, Bleichrodt, L'Haridon, Peretti-Watel, and Seror (2018) found differences between monetary and health domains in terms of intertemporal choice. Weber, Blais, and Betz (2002) showed that the perception of risks varied significantly between social and financial domains, resulting in different levels of risk aversion. Suter, Pachur, Hertwig, Endestad, and Biele (2015) showed in a neuroimaging study that monetary gambles are processed and evaluated differently than nonmonetary gambles. In a similar vein, Chapman (1996) ruled out that differences in decisions across domains were due to different domain-specific utility functions, suggesting that people process monetary and nonmonetary information in different ways.

A possible mechanism underlying differences between domains is that individuals rely more on calculations when making choices involving money and more on feelings when making choices involving nonmonetary outcomes. In other words, people use more analytical, System 2 processing when editing financial outcomes and more affective, System 1 processing when editing social outcomes. McGraw, Shafir, and Todorov (2010) attribute the domain-specificity of preferences to the way that information is processed. They suggest that while monetary outcomes can be straightforwardly (even if approximately) combined, nonmonetary outcomes do not easily lend themselves to such combination. Instead, nonmonetary outcomes require a conversion into their numeric equivalent, such as a monetary value or utility, which rarely occurs automatically. This conversion into numerical values demand a certain level of numeric ability and cognitive effort. Thus, nonmonetary outcomes may be more difficult to evaluate and some people may therefore rely more on their affective reactions (i.e., an affect heuristic) when evaluating such outcomes (Slovic, Finucane, Peters, & MacGregor, 2002).

Another factor that might impact how outcomes are edited is numerical ability. For example, individual differences in numeracy — the processing of basic numerical concepts, ratios, and quantitative estimations — have been shown to influence how numbers are interpreted and used in judgements and decision-making (Peters, Västfjäll, Paul Slovic, Mertz, & Dickert, 2006; Cokely, Galesic, Schulz, Ghazal, & Garcia-Retamero, 2012; Peters, 2020; Skagerlund, Forsblad, Tinghög, & Västfjäll, 2021). Numeric ability is needed to conduct arithmetical operations on decision problems. Less numerate individuals tend to rely more on affect (Peters et al., 2006), are less likely to integrate multiple pieces of numerical information, and frequently process information sequentially (Pachur & Galesic, 2012). The ability to process numerical concepts may, thus, be a relevant factor in outcome editing. While processing of monetary outcomes (numbers) may depend on numerical ability, processing of nonmonetary outcomes may encourage noncalculative processing, which does not depend on numerical ability. This leads to the prediction that numeracy serves as a computational engine in editing outcomes in the financial domain, but not in the social domain.

In this paper we set out to compare preferences for outcome editing across different domains, both at the aggregate and at the individual level. Furthermore, to foster a better understanding of outcome editing across domains, we investigate if outcome editing can be explained using the notion of numeracy. This allows us to understand if there are different mental processes behind the outcome editing that depend on the decision domain (Crusius, van Horen, & Mussweiler, 2012). In addition, we investigate whether preferences for integration and segregation of multiple outcomes can best be described by the prospect-theory based models proposed in the literature such as the hedonic editing model (Thaler, 1985) or the renewable resource model (Linville & Fischer, 1991).

We conduct a web-based survey with over 2000 adults (aged 20–75) in Sweden. To measure the preferences for the editing of multiple outcomes, we adapt the design of Linville and Fischer (1991), in which respondents are presented with two outcomes and are asked about their preference for temporal integration or segregation of these outcomes. We use monetary outcomes as well as social outcomes that involve interactions with both friends and colleagues.

2. Theoretical models and hypotheses

The most prominent model describing outcome editing – the hedonic editing model – posits that individuals integrate and segregate different outcomes,[1] in order to maximize the value derived from them (Thaler, 1985).[2] The model makes a series of testable predictions based on the shape of the value function from prospect theory (Tversky & Kahneman, 1992):[3] (i) people prefer to segregate positive outcomes to avoid the decrease in subjective value due to the diminishing marginal sensitivity toward gains; (ii) people prefer to integrate negative outcomes, because aggregated losses have less negative impact on their subjective value due to the diminishing marginal sensitivity toward losses; (iii) people prefer to integrate bigger gains with smaller losses to "cancel" the pain associated with

[1] Although this study focuses solely on outcomes, it is important to note that outcome editing can also be applied to other multidimensional options, such as products with multipurpose use, transactions, or risky choices, in which outcomes and probabilities can be considered together or separately (Du & Budescu, 2021).

[2] The existing models describing outcome editing assume that individuals know well what maximizes their hedonic experiences. See for example, Kahneman, Wakker, and Sarin (1997); Kahneman and Thaler (2006) for a discussion on and comparison of decision utility (inferred from revealed preferences) and experienced utility.

[3] An exemplary value function is illustrated in the Supplementary Material. Integration of two outcomes implies that individuals evaluate the joint outcome $v(x+y)$, while the segregation of outcomes entails that each outcome is evaluated separately $v(x)+v(y)$.

experiencing the loss; for mixed outcomes with bigger loss and smaller gain, however, there is no clear prediction that follows from prospect theory, since such a prediction would be dependent on the relative size of the outcomes involved in the editing process. When the difference between a gain and a loss is relatively small, integration should be preferred. However, when a loss is much greater than a gain, segregation should be preferred to focus on the "silver lining" from the positive experience.

Other studies, partly at odds with the hedonic editing model, have shown that people generally do not to integrate multiple losses, i.e., they prefer to evaluate losses separately rather than jointly (Linville & Fischer, 1991; Thaler & Johnson, 1990). As an alternative to the hedonic editing model, Linville and Fischer (1991) therefore proposed another model for when and why individuals segregate and integrate multiple outcomes – the renewable resources model. This model combines value maximization from prospect theory with the assumption that individuals have limited but renewable cognitive resources available when dealing with outcomes and decisions in everyday life. The general prediction that follows from the renewable resources model is that individuals prefer to experience outcomes of the same emotional valence one at a time and mixed outcomes together. This implies that: (i) people should segregate gains as they cannot fully enjoy multiple gains at once (see H1 below); (ii) people should segregate multiple losses as it is difficult to cope with all of them at once (see H2 below); and (iii) people should integrate positive outcomes with negative outcomes (see H3 below) to use as a buffer against negative outcomes.[4]

In the seminal work by Linville and Fischer (1991) the renewable resources model was tested empirically in three outcome domains: financial, in which the outcomes had an explicit monetary value, such as a winning a lottery; social, in which the outcomes concerned interactions with friends, such as sharing a pizza with friends; and academic, in which outcomes involved grades, such as a disappointing grade on a homework assignment. Assuming that temporal closeness of two outcomes facilitates integration, while temporal separation facilitates segregation, Linville and Fischer (1991) asked 105 subjects whether they wanted to experience two specified outcomes (each of them was either positive or negative) on the same day or on different days. All the predictions from the renewable resources model were supported in each outcome domain for large gains, large losses, mixed gains, and mixed losses. The patterns of outcome editing for two small gains and two small losses in the financial and the social domains were in line with the renewable resources model; however, they were not statistically significant from random (50/50).

Based on previous findings we hypothesize that individuals will edit monetary outcomes in line with the renewable resources model:

H1. The majority of individuals segregate gains.

H2. The majority of individuals segregate losses.

H3. The majority of individuals integrate mixed outcomes.

Furthermore, given that social outcomes do not have a clear numerical value and thus do not easily lend themselves to arithmetic calculations, which makes them less likely to be integrated, we predict that social outcomes will be edited differently than monetary outcomes. In particular:

H4. Individuals are less likely to integrate social outcomes than financial outcomes.

Lastly, we predict that processing of monetary outcomes, which have a clear quantitative value, will be explained by the ability to process numeric concepts, while processing of social outcomes without clear quantitative value will not be explained by numerical ability.

H5. Numeracy explains patterns of editing of monetary outcomes, but not of social outcomes.

3. Methods and data collection

In the study we use data from an online survey conducted with 2062 individuals (51% female; Mean age = 49.2 years, SD = 16.1) in Sweden. The survey was administered by a data collection company, Origo Group. The sampling process aimed to collect a representative sample of the Swedish population with respect to age, gender, and region of residence. Our sample has similar characteristics to the Swedish population also with respect to income and education level (see Supplementary Material for comparison). The survey took about 30 min to complete and included a battery of questions about socioeconomic characteristics and individual preferences related to financial behavior. The full survey also included questions that were part of other research projects that are not directly linked to the current research question and therefore reported elsewhere (Lind et al., 2020; Strömbäck, Lind, Skagerlund, Västfjäll, & Tinghög, 2017). Respondents received a small payment for completing the survey. Data used in this study can be found on the Open Science Framework (https://osf.io/ng2e9/).

Outcome editing was measured by asking respondents about their preferences for temporal spacing of two outcomes (gains or losses with different magnitude). All outcome editing scenarios as well as their classification are provided in Table 1. Respondents answered whether they would prefer two specified outcomes to occur on the same day or on different days within one week. The former indicated the preference for integrating, and the latter the preference for segregating the outcomes. The outcomes included two gains (*Two Gains*), two losses (*Two Losses*), smaller gain and bigger loss (*Mixed Loss*), and bigger gain and smaller loss (*Mixed Gain*). Each

[4] The common feature of both of the models for outcome editing is that they do not predict differential behavior in the social and financial domains.

Table 1
Experimental scenarios measuring preferences for integration or segregation of financial and social outcomes.

Question number	Outcome	Outcome type	Domain
1	Event 1: You win a 2 500 SEK prize for shopping at your local grocery store. Event 2: You win 2 000 SEK in a Scratchcard lottery.	Two Gains	Financial
2	Event 1: You lose a valuable worth 2 500 SEK. Event 2: You accidentally backed into another car and have to pay 2 000 SEK insurance deductible.	Two Losses	Financial
3	Event 1: You lose a valuable worth 2 500 SEK. Event 2: You win 2 000 SEK in a Scratchcard lottery.	Mixed Loss	Financial
4	Event 1: You win a 2 500 SEK prize for shopping at your local grocery store. Event 2: You accidentally backed into another car and have to pay 2 000 SEK insurance deductible.	Mixed Gain	Financial
5	Event 1: You win a prize for "the best employee". Event 2: Your friends surprise you with a big party.	Two Gains	Social
6	Event 1: You were criticized at work and your colleagues are upset with you. Event 2: You act inappropriately in a social situation and feel bad afterwards.	Two Losses	Social
7	Event 1: You were criticized at work and your colleagues are upset with you. Event 2: Your friends surprise you with a big party.	Mixed Loss	Social
8	Event 1: You win a prize for "the best employee". Event 2: You act inappropriately in a social situation and feel bad afterwards.	Mixed Gain	Social

respondent answered eight questions divided into two domains: four with scenarios involving financial outcomes and four with scenarios involving social outcomes. The scenarios were designed to be similar to those used in Linville and Fischer (1991). However, in the social domain we had scenarios involving interactions with friends and colleagues to make them more suitable for a general sample of respondents.[5] Scenarios were presented in a fixed order; however, in a follow-up study we randomized the order of scenarios and obtained the same qualitative results (see Supplementary Material for the results).[6]

We measured numeric ability using a combined score of the three items from Schwartz, Woloshin, Black, and Welch (1997) and the first three items from the Berlin Numeracy Test (Cokely et al., 2012; Lindskog, Kerimi, Winman, & Juslin, 2015).[7] The combination of these two tests provides a good discriminability at both low and high levels of numeracy (Cokely et al., 2012). In total, individuals could score between 0 and 6 points, where 0 indicates low numeracy and 6 indicates high numeracy. Our regression model for the preference for integration of outcomes was specified as follows:

$$y_{ik} = \beta_0 + \beta_1 Type_k + \beta_2 Numeracy_i + \beta_3 Type_k \times Numeracy_i + \beta_4 X_i + \varepsilon_{ik}$$

where dependent variable y_{ik} is a dummy variable specifying if respondent i chose to integrate two outcomes in scenario k, *Type* is a categorical variable describing the type of outcomes (e.g., two gains), *Numeracy* is the score on the numeracy test, and $\boldsymbol{X_i}$ is a vector of control variables such as age, gender, and education. We use the same model specification to test outcome editing in the financial domain and in the social domain separately.

Given our sample size, we can identify a small effect (Cohen's $g = 0.05$) with power 0.95 and significance level 0.005 (Benjamin et al., 2018) in binomial tests. Linville and Fischer (1991) reported average effects ranging from $g = 0.22$ to $g = 0.30$, and Thaler (1985) reported effects ranging from $g = 0.23$ to $g = 0.33$, which all are considered large effects (Cohen, 1988). Since there is no conventional way to measure effect sizes in McNemar tests, we use matched-pair t-tests as approximation and find that we can identify a small effect when comparing means within respondents (Cohen's $d_z = 0.10$). Given that individuals face multiple outcomes on a daily basis, even small effects in outcome editing can cumulate over time and have serious implications for individual decisions (Funder, David, & Ozer, 2019).

4. Results

We begin by looking at the tendency to segregate and integrate different outcomes at the aggregate level in both the financial and the social domains. Fig. 1 shows the proportion of individuals who preferred two outcomes to happen on the same day, i.e., who preferred to integrate multiple outcomes. For every scenario, the proportion of individuals who preferred to integrate multiple outcomes differed from 50%, which would indicate indifference between segregation and integration of outcomes (binomial tests, all $p <$ 0.001 except for multiple losses in the social domain where $p = 0.026$). These results are robust with respect to gender, age, and

[5] As a follow-up we conducted a short survey that asked about feelings when receiving each of the monetary and social outcomes. The results were largely in line with the classifications made prior to the data collection. More detailed results are presented in the Supplementary Material.

[6] The timing of the events was not specified in the survey, i.e., we asked whether respondents prefer two events to happen on two different days without explicitly stating which event would happen first. Previous studies (see for example Chapman, 2000; Loewenstein and Prelec 1991, 1993; Frederick & Loewenstein, 2008) have shown that individuals prefer improving sequences of outcomes. This, however, seems not to matter in our study as the majority of respondents indicated the same preferences for mixed outcomes regardless of whether the loss or the gain was introduced first in the scenario.

[7] We exclude the last question in the Berlin Numeracy test due to a coding error in the adaptive process. However, an additional analysis shows that results remain similar also when including the last question.

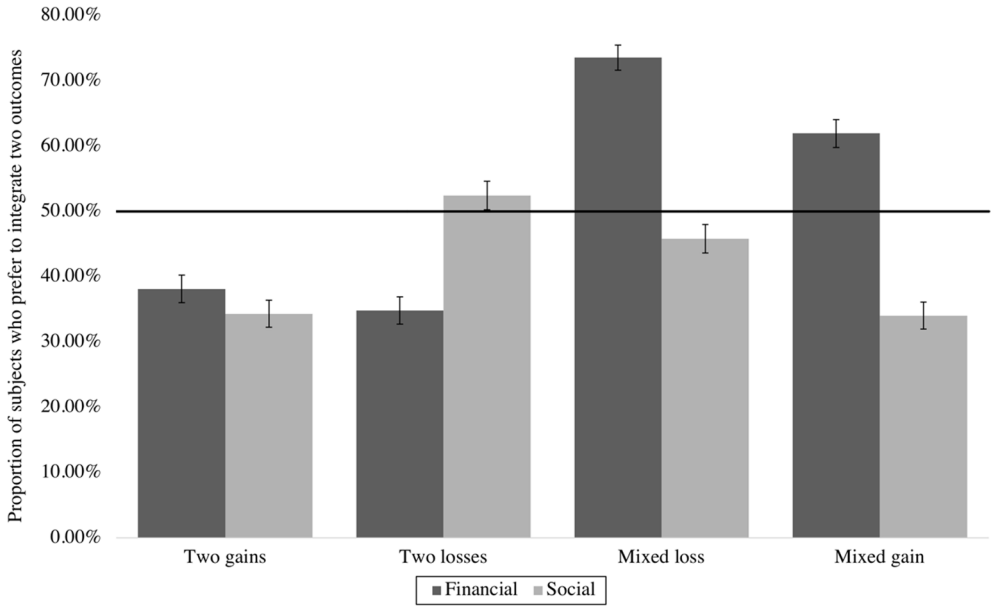

Fig. 1. Proportion (with 95% binomial exact confidence intervals) of respondents who prefer to integrate two outcomes in the financial and the social domains. Horizontal line indicates indifference (50% of respondents preferring integration).

education (see Supplementary Material for further details). The effect sizes in the financial domain range from medium (Cohen's g = 0.12) to large (Cohen's g = 0.24). The effect sizes in the social domain range from small (Cohen's g = 0.02) to medium (Cohen's g = 0.16). While the effect sizes in our study are smaller than in previous studies (Thaler, 1985; Linville & Fischer, 1991), we believe that they are meaningful since individuals deal with multiple outcomes repeatedly throughout a day, a week, a year, or even a lifetime. In fact, the effect of the type of outcome and domain on how people prefer to code multiple outcomes can cumulate over time, with important consequences for factors such as subjective well-being and price perception, which will further have impact on decisions (e.g., purchasing decisions).

4.1. Outcome editing in the financial domain

In the financial domain, a majority of the respondents (62%) preferred multiple positive outcomes to occur on different days (i.e., 38% preferred to integrate multiple positive outcomes). This behavior is in line with both hedonic editing and the renewable resources model, which predict segregation of gains. Thus, we cannot reject hypothesis H1 that individuals prefer to segregate multiple gains. A majority of the respondents (65%) also preferred to segregate losses, suggesting that people prefer to cope with negative monetary outcomes one at a time. This finding is in line with the renewable resources model but goes against the prediction of loss integration in the hedonic editing model. Thus, we cannot reject hypothesis H2 that individuals prefer to segregate multiple losses. A majority of the respondents indicated preferences for integration of monetary losses with gains regardless of the net effect, i.e., they preferred to receive them on the same day. This behavior again corroborates the renewable resources model, which predicts that gains have loss-buffering property. This result is also in line with the hedonic editing model, which predicts integration of larger gains with smaller losses. Thus, we cannot reject hypothesis H3 that individuals prefer to integrate gains with losses. To sum up, at the aggregate level, the renewable resources model describes individuals' preferences concerning temporal spacing of financial outcomes better than the hedonic editing model, especially when it comes to how people prefer to deal with negative financial outcomes.

Concerning the patterns of outcome editing at the individual level, only 19% of the respondents expressed preferences that corroborate the predictions of the renewable resources model for all four combinations of outcomes, i.e., they segregated gains, segregated losses, but integrated losses with gains. Thus, even though the renewable resources model described the preferences at the aggregate level well, it only captured the complete behavior of every fifth respondent. In comparison, 14% of the respondents expressed preferences that are in line with the hedonic editing model, i.e., they segregated gains, integrated losses, integrated bigger gains with smaller losses, and either integrated or segregated smaller gains with bigger losses.

4.2. Outcome editing in the social domain

In the social domain, 66% of the respondents preferred multiple positive outcomes to occur on different days. This finding is in line with both the renewable resources model and the hedonic editing model, predicting the segregation of gains. Slightly more than half of the respondents (52%) preferred multiple negative social outcomes to occur on the same day. Integration of losses is in line with the prediction that follows from the hedonic editing model, due to the decreasing disutility from losses. However, this result contrasts with

the renewable resources model, which assumes that multiple losses are difficult to deal with and hence preferably should be dealt with one at the time. Individuals showed a general preference for segregating any mixed outcome in the social domain. This behavior is at odds with both the renewable resources model and the hedonic editing model. Thus, neither the renewable resources model nor the hedonic editing model accurately describes how people in general edit social outcomes.

At the individual level, about 5% of the respondents expressed preferences for integration and segregation of outcomes in line with the renewable resources model. Further, 11% of the respondents expressed preferences in line with the hedonic editing model, i.e., they segregated gains, integrated losses, integrated bigger gains with smaller losses, and either integrated or segregated smaller gains. Furthermore, 13% of the individuals preferred to segregate any social outcome that involves at least one gain, but integrate multiple losses (i.e., expressed the majority preferences as depicted in Fig. 1).

4.3. Comparing outcome editing in financial and social domains

As illustrated in Fig. 1, outcome editing in the social domain differed from outcome editing in the financial domain. The only behavior that was consistent across social and financial domains was that individuals generally preferred to segregate multiple positive outcomes, although more so in the social domain. Interestingly, individuals were significantly less likely to integrate any two social outcomes than financial outcomes except for when it came to dealing with multiple losses.[8]

Our study design allowed us to additionally test whether preferences for outcome editing are the same across domains at the individual level. Since each respondent answered questions relating to both monetary outcomes and social outcomes, we can test within respondents whether the preferences for outcome editing were consistent across domains, i.e., whether individuals expressed similar preferences for integration or segregation of outcomes. In the analysis below, each combination of outcomes was considered separately. Fig. 2 illustrates how individuals chose to edit outcomes across the financial and the social domains in bubble graphs. The values shown in the bottom left and top right corner of the graphs represent the total percentage of individuals who had the same preferences for outcome editing across the financial and the social domains.

As shown in Fig. 2, around 60% of the respondents exhibited the same editing preferences across the financial and the social domains for each combination of outcomes.[9] Still, only 25% of the respondents made consistent choices across the domains for all four combinations of outcomes, i.e., they showed the same editing preferences for both financial and social outcomes. McNemar's test on matched samples for each of the four combinations of outcomes separately showed significant differences in preferences for segregating or integrating outcomes between the financial and the social domain ($p = 0.005$ for multiple gains and $p < 0.001$ for other types of outcomes). Thus, individuals mentally coded social outcomes to a large extent differently than monetary outcomes. These results were confirmed in matched-sample t-tests, which also allowed us to measure the size of the effects detected in the tests: $d_z = 0.064$ for multiple gains, $d_z = 0.317$ for multiple losses, $d_z = 0.470$ for mixed losses, and $d_z = 0.470$ for mixed gains. Thus, the effect sizes can be considered meaningful (medium size).

To summarize, as predicted (H4), individuals were more likely to segregate social gains than monetary gains and mixed social outcomes than mixed monetary outcomes. However, contrary to H4, individuals were more likely to integrate social losses than monetary losses.

4.4. The arithmetic of outcome editing

The differences in outcome editing across the financial and the social domains suggest that it is more difficult to conduct mental arithmetic (i.e., the integration of outcomes) on non-numerical (qualitative) outcomes. While it can be easy to add two numbers, "summing" together a party with friends and a prize for the best employee is not as intuitive to many people. Hence, individuals might be less likely to integrate social outcomes. Our results show that except for slightly higher proportion of respondents who preferred to integrate multiple social losses, only a minority of respondents expressed preferences for integration of any social outcomes. In fact, segregating any two social outcomes was the most common pattern at the individual level with 22% of the respondents indicating preferences for any social outcomes to occur on different days.

To further investigate if arithmetic operations are relevant for understanding the underlying processes in outcome editing, we performed regression analysis using the choice to integrate any two outcomes as the dependent variable, while including numeric ability as an explanatory variable. The results are presented in Table 2. In the financial domain, individuals with higher numeric ability were less likely to integrate multiple gains ($\beta = -0.020,\ p = 0.007$) and more likely to integrate mixed outcomes ($\beta = -0.020 + 0.042 = 0.022, p = 0.001$ for mixed losses and $\beta = -0.020 + 0.053 = 0.033, p < 0.001$ for mixed gains). However, there was no significant relationship between numeric ability and the integration of multiple negative financial outcomes ($\beta = -0.020 + 0.028 = 0.008, p = 0.243$). In other words, increased numeric ability was largely associated with editing preferences predicted by the renewable resources model in the financial domain.

In the social domain, in contrast, there was no statistically significant relationship between numeric ability and the integration of outcomes (multiple gains $\beta = -0.008, p = 0.27$; multiple losses $\beta = -0.008 + 0.006 = -0.002, p = 0.793$; mixed loss outcomes $\beta = -0.008 - 0.003 = -0.011, p = 0.133$; and mixed gain outcomes $\beta = -0.008 - 0.002 = -0.010, p = 0.186$). Consequently, numeric ability was significantly linked to editing preferences in the financial domain, but not in the social domain. Thus, we cannot reject

[8] These findings have been additionally corroborated in a regression framework (see Supplementary Material).

[9] If individuals chose randomly to integrate and segregate outcomes this value would amount to 50%.

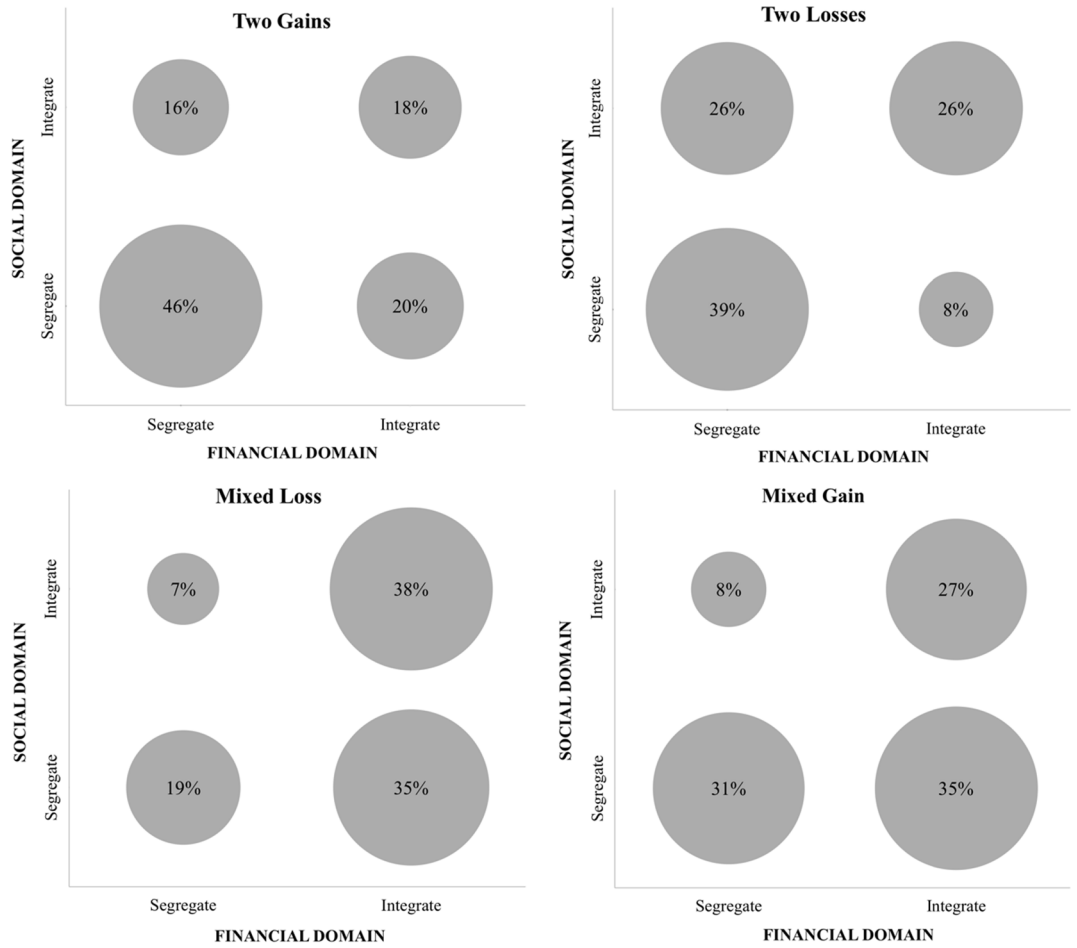

Fig. 2. Comparison of preferences for integration and segregation of combinations of outcomes in the financial and the social domains.
Note: The values in the bottom left and top right corner on each graph represent the total percentage of individuals who had the same preferences for outcome editing across the financial and the social domains. If individuals expressed the same preferences across both domains, these values would sum up to 100%.

hypothesis H5.

5. Discussion and conclusions

In this study we set out to explore outcome editing in social and financial domains and the role numerical ability plays for understanding such editing preferences.

5.1. Main findings

The first main finding from this study is that our results clearly show that social outcomes are edited differently than monetary outcomes. In particular, individuals are more likely to segregate events in the social domain than in the financial domain. This tendency exists for all scenarios except for when all outcomes are negative, in which case people increasingly prefer to combine social losses but deal with monetary losses separately. The differences in preferences for outcome editing across domains at the aggregate level are also translated into the differences in outcome editing at the individual level. Individuals are far from consistent in their preferences across the financial and the social domains. In fact, only 25% of the participants showed consistently the same preferences for outcome editing in the financial and the social domains.

The second main finding from this study is that numeric ability was significantly linked to outcome editing in the financial domain, but not in the social domain. This is a novel contribution to the literature on outcome editing, that extends our understanding of the arithmetic operations underlying outcome editing. In particular, this finding suggests that people rely more on calculations when making choices involving multiple financial outcomes and more on feelings when making choices involving social or other nonmonetary outcomes.

Table 2
The role of numeracy in the explanation of outcome editing preferences.

DV: integrate the outcomes	Financial	Social
Two Losses	−0.084***	0.171***
	(0.023)	(0.022)
Mixed Loss	0.279***	0.121***
	(0.020)	(0.021)
Mixed Gain	0.143***	0.000
	(0.022)	(0.021)
Numeracy	−0.020**	−0.008
	(0.007)	(0.007)
Two Losses # Numeracy	0.028**	0.006
	(0.010)	(0.009)
Mixed Loss # Numeracy	0.042***	−0.003
	(0.009)	(0.009)
Mixed Gain # Numeracy	0.053***	−0.002
	(0.009)	(0.009)
Age	0.000	−0.001*
	(0.000)	(0.000)
Female	−0.009	−0.036*
	(0.014)	(0.014)
Education, upper-secondary	−0.007	−0.024
	(0.023)	(0.022)
Education, post-sec. lower	0.028	−0.022
	(0.027)	(0.027)
Education, post-sec. higher	0.018	−0.014
	(0.024)	(0.024)
Constant	0.401***	0.436***
	(0.036)	(0.036)
Observations	8,244	8,244
Number of respondents	2,061	2,061

Note: Panel regressions with random effects and robust standard errors clustered at the respondent level in parentheses. Dependent variable is the likelihood of integrating multiple outcomes. The reference category for outcome type is Two gains. The reference category for education is lower-secondary. *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$.

Thirdly, our study helps to identify limits of the two most prominent theoretical accounts for describing outcome editing – the hedonic editing model and the renewable resources model. Our findings showed that at the aggregate level (but not at the individual level) the renewable resources model describes the editing behavior in the financial domain well. The hedonic editing model (Thaler, 1985) could partly describe editing preferences in the financial domain, but the finding that people preferred to segregate losses was not in line with the model. In the social domain, however, both models did poorly in describing editing patterns, both at the aggregate and at the individual level. Thus, future theoretical work should focus on trying to develop models that more satisfactorily describe how people edit social outcomes.

An unexpected and possibly intriguing finding is the strong aggregate preference to segregate mixed social outcomes. This finding is surprising as it is opposite to what was found in the seminal work by Linville and Fischer (1991). It should of course be interpreted with caution until replicated, but it is in line with the idea that people apply different arithmetic operations for affective and non-affective outcomes. When dealing with more affective social outcomes people may increasingly be influenced by magnitude (and probability) neglect, making it difficult to integrate and evaluate social outcomes when combined (Västfjäll, Slovic, Burns, Erlandsson, Koppel, Asutay, & Tinghög, 2016). The finding that social outcomes are preferably dealt with when segregated is in line with the phenomenon of compassion fade (Västfjäll, Slovic, Mayorga, & Peters, 2014). Individuals may struggle to sum up the value of two or more identified human lives and thus may be willing to donate more to save people's lives when asked to help a singular victim or a coherent unit of victims (e.g., a family) compared to a number of victims.

It should also be noted that when comparing our study with the work of Linville and Fischer (1991) there are some key methodological differences. Our sample consists of a diverse sample of the Swedish population, while Linville and Fischer (1991) surveyed a student sample in the United States. Thus, we are dealing with a different sample in a different culture, in a different time. Further, the events that we use in our scenarios may be considered to involve outcomes of smaller magnitude compared to Linville and Fischer (1991) which potentially also could contribute to differences.

5.2. Limitations

Since outcomes in the social domain do not have numerical value, it can be argued that the outcomes used in this study are not equivalent to the financial outcomes and hence the financial and the social domains cannot be compared. For example, Sawicki et al. (2020) established that domain differences in temporal discounting can be attributed to magnitude effects. However, most of the theoretical predictions in this study are based on whether the outcome is a gain or a loss and should hold regardless of the magnitude of

the outcome. Hence, even though the magnitude of the outcomes may vary across the domains, we can still compare the general preference for integration or segregation of different combinations of outcomes between the domains.

Since the order of the outcome editing questions was fixed in the survey, we cannot rule out that the results are biased by the order in which questions were presented. To test this, we conducted an additional data collection with a student sample (n = 255), in which we randomized the order of blocks (financial/social) and the order of questions within each block. The results were to a large extent similar (see Supplementary Material). In an additional regression analysis, we found no order effects. Thus, it seems unlikely that our results are affected to any large extent by order effects.

It should be acknowledged that our study used hypothetical scenarios. This is of course due to the fact that it is more or less practically impossible to realistically incentivize outcomes in the social domain for an experimental study like this. Given that a key aspect of the study was to make comparisons across domains we did not want to use real incentives in one domain but not the other. Incentivizing financial, but not social, decisions would introduce an additional confound. Although some studies have shown that real incentives affect people when making risky and pro-social decisions (Camerer & Hogarth, 1999; Bühren & Kundt, 2015) there are also studies showing that behavior in temporal choice tasks is similar for incentivized and hypothetical choices and that experiments with hypothetical rewards validly apply in everyday life (Locey, Jones, & Rachlin, 2011).

5.3. Implications

Our findings help to explain why it is sometimes preferable for policymakers to present several outcomes as a joint event and sometimes as separate events depending both on the decision domain and on the individual when trying to gain public support for public policies and investments. Our findings also help to more accurately describe and understand individuals' behavior in both the financial and the social domains when dealing with more than one outcome. For example, we show that after experiencing a social loss (e.g., an argument with a friend) individuals prefer to separate this negative event temporally from positive social outcomes. Moreover, our results can also help to explain why some policies are more attractive than others. For example, putting away money in a savings account every month is less unpleasant than making a substantial lump sum payment every couple of years. Presenting savings in more granulated terms has indeed been shown to be more attractive in a field experiment by Hershfield, Shu, and Benartzi (2020). Furthermore, installment payments are appealing as they entail a stream of segregated smaller losses instead of an aggregated loss. What is more, the way that services are presented can affect an individual's willingness to pay for them. This was also shown in a recent study by Mugerman, Sade, and Winter (2020), who found that individuals had a higher willingness to pay for financial advice if the fee was charged at the same time as the investment was realized (i.e., facilitating integration of the two outcomes) compared to when the fee was paid separately in advance (i.e., facilitating segregation of the two outcomes). In addition, our results are relevant for how to best communicate multiple outcomes to individuals. For example, presenting retirement savings as multiple monetary gains received over a course of time will increase their attractiveness. In the social domain this can be used, for example, in giving feedback at work. Separating good news (for example, recognition) from bad news (for example, critique) seems to work best for the majority of subjects in the social domain.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.joep.2021.102408

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