



Simultaneous decision-making: An overview of theories and research results

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Abstract

The aim of this paper is to review empirical findings and explanations relevant to the issue when concurrent decisions are integrated and when they are not integrated. There are few directly related studies. Therefore, the review also covers related phenomena involving the effect of a prior outcome on subsequent decisions, sunk-cost effects, and escalation. An important question emerging from the literature review is the question why integration have been obtained in studies of effects of prior outcomes, sunk cost effects, and escalation, at the same time as this has not been the case with concurrent decisions? One reason may be the existence of mental accounting in these studies. Another is that choices are riskless. An idea for further research is to make subjects being able to think through all possible consequences in a concurrent decision problem. By explicitly illuminating the risk or uncertainty to the subjects, it may be possible to obtain integration in concurrent decisions.

Keywords: Concurrent decisions; prior outcomes; integration; sunk cost effects; escalation; mental accounting.

1. Introduction

People often find it difficult to make decisions, that is, to select among different available options, because of value conflicts and uncertainty. Besides, sometimes decisions are difficult because they are independent (Brehmer, 1992; Huber, 1990). In daily life, it is often the case that a decision maker (DM) has experienced the outcome of a previous choice when facing a new. A decision maker may also make several decisions at the same time.

Theories of decision-making are either normative entailing utility maximization or descriptive. Some of the latter aiming at explaining how people make decisions are similar to normative theories in that they are based on value or utility, that is, the decision maker (DM) is assumed to first assign a utility or value $v(x)$ to each outcome x , then to select the option with the highest value. An example is prospect theory developed by Kahneman and Tversky (1979; see also Tversky & Kahneman, 1991, 1992). Recently, an alternative “reason-based” approach has been proposed (Shafir, Simonson, & Tversky, 1992). This approach identifies various reasons and arguments that are purported into and influences decision. Choices are explained in terms of the balance of reasons for and against the various options. In the absence of a comprehensive descriptive theory, both value-based and reason-based analyses may contribute to the understanding of decision-making.

In contrast to normative decision theory developed in economics (e.g., von Neuman & Morgenstern, 1947), prospect theory (Kahneman and Tversky, 1979), have some similarity to reason-based approaches in its assumption that the DM edits options. Editing operations include framing outcomes as gains or losses relative to a reference point. Such framing also entails segregating or integrating prior outcomes or decisions (Kahneman & Tversky, 1984; Tversky & Kahneman, 1981). A decision frame based on a “minimal account” implies that outcomes of a particular choice are evaluated independently of prior outcomes. Such a decision frame may frequently be employed because it “(i) simplifies evaluations and reduces cognitive strain, (ii) reflects the intuition that consequences should be causally linked to acts, and (iii) matches the properties of hedonic experience which is

more sensitive to desirable and undesirable changes than to steady states” (Tversky and Kahneman, 1981, p. 457). According to this definition, a mental account can be looked upon as a frame for evaluation. Important questions are when does an individual take into account a prior experience and what mechanisms may account for integration? Integration is here seen as referring to a possible addition of values or utilities to the expected outcomes or consequences. Integration as a phenomenon may be explained as follows: Two decisions may be regarded as dependent (integrated), if the utility of the consequences of the first decision affects the evaluation of the utility of the consequences second decision. If this is not the case, the two decisions are independent (segregated). Consider the following example taken from Tversky and Kahneman (1981) which illustrates when concurrent decisions are made independently, although integration would lead to a higher value:

Imagine that you face the following pair of concurrent decisions. First examine both decisions, then indicate the options you prefer.

Decision (i). Choose between:

- A. *a sure gain of \$240*
- B. 25% chance to gain \$1000, and 75% chance to gain nothing

Decision (ii). Choose between:

- C. a sure loss of \$750
- D. *75% chance to lose \$1000, and 25% chance to lose nothing*

A majority of subjects chose A and D (in italics). However, in choosing between the following two alternatives they chose B’:

- A’. 25% chance to gain \$240, and 75% chance to lose \$760
- B’. *25% chance to gain \$240, and 75% chance to lose \$750*

As realized, alternative B’ is C and D combined whereas A’ is A and B combined. Thus, subjects did not make the choices which overall maximized expected utility. Presumably, they framed each of the decision problems in a minimal account.

The basic aim of this paper is to review empirical findings and explanations relevant to the issue when concurrent decisions are integrated and when they are not integrated. There does however exist only a few directly related studies, and because of this, this paper will also cover related phenomena, involving the effect of a prior outcome on subsequent decisions (Thaler & Johnson, 1990; Gärling & Romanus, 1997), sunk-cost effects (Arkes & Blumer, 1985; Laughhunn & Payne, 1984) and escalation (Brockner, 1992). These phenomena do have a lot in common, but may have different explanations.

2. Review of Previous Research

2.1 Prior Outcome Effects

Despite having experienced the outcome of a previous choice, a decision maker may disregard a prior outcome when evaluating the outcomes of a related new choice. This has been demonstrated in some studies. In a study by Kahneman and Tversky (1984), it was found that subjects that had lost a theatre ticket were unwilling to replace it with a new ticket. The authors also reported that subjects in another experimental group ignored the loss of the same amount of money when buying a ticket.

Kahneman and Tversky (1984) proposed that when an individual is about to evaluate an option, the individual sets up a mental account that specifies the advantages and disadvantages associated with the option. The overall value of an option thus derives from the balance of its advantages and disadvantages in relation to the reference state, usually the status quo. Tversky and Kahneman (1981, p.456) define a mental account as ”an outcome frame which specifies (i) the set of elementary outcomes that are evaluated jointly and the manner in which they are combined and (ii) a reference outcome that is considered neutral or normal”. Consider the following example, called “the theatre ticket problem”, taken from Tversky and Kahneman (1981, p.457):

Imagine that you have decided to see a play and paid the admission price of \$10 per ticket. As you enter the theatre, you discover that you have lost the ticket. The seat was not marked, and the ticket cannot be recovered.

Would you pay \$10 for another ticket?

and

Imagine that you have decided to see a play where admission is \$10 per ticket. As you enter the theatre, you discover that you have lost a \$10 bill.

Would you still pay \$10 for a ticket for the play?

Observe that these problems do not describe the same situation. In one case you have lost a ticket and in the other case you have lost a \$10 bill. However, your total wealth has decreased with \$10 in both situations. This implies that the difference in the two situations should be irrelevant from an economic point of view.

According to Tversky and Kahneman (1981) the outcomes can be framed in terms of a minimal, topical, or a comprehensive account. The minimal account includes only the differences between the options, while disregarding their common features. If the options were evaluated in terms of a topical account, the local context would also play a part in the evaluation. A comprehensive account would be accomplished by taking into account, for instance, savings or monthly expenses. Kahneman and Tversky (1984) attributed the differences found in their study (the theatre ticket problem) to the topical organization of mental accounts. The majority of subjects (88%) were unwilling to spend another \$10 bill after having lost a ticket, but they were willing to spend that sum after having lost an equivalent amount of cash. Going to the theatre is normally viewed as a transaction in which the cost of the ticket is exchanged for the experience of seeing the play. Buying a second ticket raises the cost of seeing the play to an unacceptable level for most subjects. The results found by Kahneman and Tversky (1984) in the theatre ticket problem may have been due to the fact that the two versions of the problem differed in substance. It may be more enjoyable to save \$5 on a \$15 purchase than \$5 on a larger purchase. It is also possible that it feels harder to deal with having to pay twice for the same ticket than to lose \$10 in cash. Kahneman and Tversky (1984) proposed that the observed modal preferences were reversed in the two problems because losses are more aversive than costs. Thinking of the \$5 as a payment makes it more acceptable than thinking of the same amount as a loss. This implies that an individual's subjective state can be improved by framing negative outcomes as costs rather than as losses. The possibility of such psychological manipulations may explain a paradoxical form of behavior named the *dead-loss effect* (Thaler, 1980). Thaler discusses as an example a person who develops a tennis elbow in a short time after having paid his membership fee in a tennis club, but continues to play in order not to waste his investment. This can be regarded as a sunk cost effect.

Singer, Singer and Ritchie (1986) investigated the role of transactions (e.g. exchanging the ticket for the play) as a mediator of responses to the "theatre ticket" problem (Tversky & Kahneman, 1981; Kahneman & Tversky, 1984), and tested this in three experiments. They included a clue that made the loss of money more closely associated with the play. By stating that the lost bill had been budgeted or set aside specifically for the play, 17% fewer subjects were willing to buy a ticket than in the lost condition without the budgeting cue. They also reported finding that the responses obtained for Problems A and B (similar to Kahneman and Tversky's problems) showed an even stronger "reversal effect" than what was obtained by Kahneman and Tversky. Singer et al.'s responses provided some further support to Kahneman and Tversky's argument that the (imagined) transaction is a salient feature of the problem that influences the way in which a problem is structured. Singer et al. also tested a hypothesis that proposed that social interaction also is an important feature of "the theatre ticket" problem, but this hypothesis received no support. Although their results provided some support for Kahneman and Tversky's (1984) interpretation that the transaction implied by "going to the theatre" triggers the topical organization of a mental account, individual differences in problem framing or mental accounting processes may be important in some contexts.

Both Tversky and Kahneman (1981) and Singer, Singer, and Ritchie (1986) interpreted their results in terms of what they called the "transaction hypothesis". They argued that the presence or absence of a transaction would induce people to construct different mental accounts of the equivalent monetary loss and to make different choices. Henderson and Peterson (1992) accounted for the same phenomenon by script processes and categorization. According to their "cognitive script" hypothesis, the loss of a ticket was shown to be present in the going to the theatre "script", while the loss of the note was not included in this script. Henderson and Peterson (1992) argued that categorization theories focus on the processing and grouping of information, and mental accounting focuses on the outcomes of that processing and grouping. Both mental accounting and categorization theories allow for the formation of expectations concerning an event or element. Henderson and Peterson (1992) also reported that subjects were more willing to purchase another ticket when the loss was removed in time from the theatre. Distancing the ticket loss realization from the theatre simultaneously increased the percentage of subjects providing an affective rationale. 83% of the subjects stated that they would buy another ticket because they really wanted to see the play, compared to 65% of the subjects in the theatre condition.

Conducting four experiments and building upon the earlier work of Tversky and Kahneman (1981), Bonini, Rumiati and Legrenzi (1993) tested whether the previous found phenomenon was affected by the way the loss was presented. They also tested the predictive validity of the "transaction" and "script" hypotheses. In an experimental condition, the subjects lost a bank note that had been put by in order to purchase the ticket (referred to as a goal-directed note). In another condition the subjects lost a note of the same amount. This note had not been put by to purchase the theatre ticket (referred to as a generic note). The results of that experiment (replicated by Rumiati, Bonini, & Legrenzi, 1993) showed that the tendency to persist was greater in the generic note loss situation than in the goal-directed note loss situation. Bonini, Rumiati and Legrenzi (1993) argued that the differing status of the two types of loss (ticket and goal-directed note vs. generic note) as opposed to the going to the theatre script would be the cause of the different tendency to persist that was found in the two loss situations. The effects that was found by Tversky and Kahneman (1981) and by Singer et al. (1986) was not replicated when the economic transaction involved a cash outlay that was only a part of the total price of the ticket. In yet another condition, the subjects had not started any economic transactions as the ticket (or note) was presented as a birthday present. This allowed the authors to discriminate the validity of prediction between the economic transaction hypothesis and the cognitive script hypothesis. The results obtained from this particular experiment confirmed only the predictions of the cognitive script hypothesis.

The results of Bonini, Rumiati and Legrenzi's (1993; 1995) four experiments dealing with the theatre ticket problem suggests that the presentation modality of acquisition (or loss) of some goods, such as a theatre ticket or a bill, affects the tendency to persist in keeping to a previously taken decision. This is in line with the notion of "framing" and its effectiveness in affecting people's expressions of framing. Thus, framing effects provides evidence against the descriptive validity of utility theory, and the effects also violates the principle of description invariance which states that the way a situation is described should not affect one's decision.

Other studies (Arkes & Blumer, 1985; Gärling & Romanus, 1997; Gärling, Romanus & Selart, 1994; Laughhunn & Payne, 1984; Linville & Fischer, 1991; Thaler & Johnson, 1990; Tversky & Shafir, 1992) have shown that prior outcomes, or sunk outcomes as they also may be termed, have an effect on subsequent decisions. The questions these studies rise, are when, why and how subjects integrate instead of segregate a prior outcome?

2.2 The Hedonic Editing Theory

According to Thaler's (1985) *hedonic editing theory*, people prefer segregated over integrated gains, and integrated over segregated losses. Events can be integrated or segregated either or both topically (according to source) and temporally (according to time). Whether value is maximized if a prior outcome is integrated or segregated in the case of large losses and small gains (mixed losses) depends on their relative sizes. Thaler (1980) argues that individuals use a psychological accounting system established when the first choice in the sequence is made. This psychological accounting system keeps track of debits and credits for the DM as the outcomes from the sequential choice process develops over time. Thaler and Johnson (1990) argued that subjects integrate when it maximizes utility (hedonic editing). Using the value function of prospect theory, Thaler and Johnson (1990) noted that value is maximized if gains are segregated, losses integrated, and small losses integrated with large gains (mixed gains). Whether value is maximized when a prior outcome is integrated or segregated in the case of large losses and small gains (mixed losses) depends on their relative sizes.

Thaler's approach rests on the distinction between mentally integrating or segregating two events before they are evaluated. Two events are said to be mentally *integrated* if they are combined before being subjectively evaluated. The subjective value of the combined pair of events, denoted here by $V_c(x,y)$ is given by:

$$V_c(x,y) = V(x,y) \quad (1)$$

In this case, x and y are mentally combined. Two events are said to be mentally *segregated* if they are separately evaluated (by the prospect theory value function) before being combined. The subjective value of the separated events, denoted here by $V_s(x,y)$, is given by:

$$V_s(x,y) = V(x) + V(y) \quad (2)$$

What determines whether two events are mentally segregated or integrated? Thaler and Johnson (1990) suggested that events that are temporally contiguous (close in time) are more likely to be integrated. If events are integrated, they are combined before being evaluated. Temporal contiguity is likely to facilitate integration of two outcomes, while temporal separation is likely to lead to segregation of outcomes.

An important question then becomes: What difference does it make whether two events are integrated or not? Due to the prospect theory value function being nonlinear and steeper for losses than for gains, $v(x+y)$ will generally differ from $v(x)+v(y)$. The total subjective value that will be derived from a pair of events, will differ depending on whether they are integrated or segregated (if equations 1 and 2 are valid). This implies that segregation and

integration will typically lead to different value, because of the nonlinear function of the prospect theory value function.

Thaler tested these predictions in an experiment in which subjects compared four pairs of hypothetical financial scenarios, each corresponding to one of four types of possible outcomes. These outcomes were respectively pure gains, pure losses, mixed gains and finally mixed losses. Results obtained from Thaler's study provided evidence that a prior gain could under some circumstances increase a subject's willingness to gamble. This finding was labelled the "house money effect". In contrast, prior losses were found to decrease the willingness to take risks. It was also found in the same study that when subjects have had prior losses, outcomes which offered the opportunity to break even were especially attractive. People who do not adjust their reference point as they lose would be expected to take bets they normally would find unacceptable. Thaler's findings have been supported by the observation that bets on long shots are most popular on the last race of the day (McGlothlin, 1956).

One of Thaler's (1985) hypothesis was that people edit outcomes in the way that makes them happiest. The hedonic editing hypothesis (Thaler & Johnson; 1990) implies that subjects will choose to have the events occur separated when segregation would be preferred, and combined when integration would be hedonically optimal. Support for this prediction was only partial. Thaler and Johnson (1990) found that subjects preferred to temporally separate losses. To account for this violation of the hedonic editing model, they proposed an alternative quasi-hedonic editing hypothesis, according to which people follow the rules of hedonic editing for gains and for mixed outcomes, but are unable to integrate two losses into one single loss. Quasi-hedonic editing differs from hedonic editing in two ways. First, it is assumed that different editing rules apply to losses than to gains and mixed outcomes. And second, the quasi-hedonic editing model invokes an additional mechanism, *loss sensitization*. Results showed that subjects indicated that they preferred to experience the losses separately. This result was obtained repeatedly, for small and large losses, for monetary and for nonmonetary losses, as well as for related and unrelated events. The obtained results produced a severe blow to the hedonic editing hypothesis. A tentative interpretation of Thaler and Johnson's results, is that while a small to moderate loss may sensitize a subject to further losses of roughly the same magnitude, a large loss may actually numb the individual to additional small losses.

The results of Experiments 2 and 3 in Thaler and Johnson's (1990) study suggested that a prior loss would sensitize people to subsequent losses of a similar magnitude. Subjects reported that the loss of \$9 would hurt more after an initial loss of \$30 than if the \$9 loss had occurred by itself. This increase in loss aversion would tend to produce risk aversion for gambles that risk additional losses, and the results supported the quasi-hedonic editing hypothesis.

According to Thaler and Johnson, integration is not always spontaneous. In general integration takes place when cancellation is not a possible strategy, and in more special cases when losses can be offset against larger gains. The importance of cancellation suggests that when the equivalence of outcomes is transparent, integration might occur. It seems plausible that the failure to integrate losses in Thaler and Johnson's study would be even stronger across attributes. This means that a loss in one domain will increase the loss aversion felt with respect to other domains. Or as Thaler and Johnson describes it, which would hurt most: a toothache alone, or a toothache after being rejected for a new job?

2.3 The Renewable Resources Model

Linville and Fischer (1991) proposed another model of hedonic editing based on temporal preferences, drawing on both decision theory and stress research. This hypothesis is referred to as the Renewable Resources (RR) model, and its aim is to account for why current outcomes are sometimes integrated with and sometimes segregated from prior outcomes. The RR model is based on four assumptions. First, evaluations of individual events are assumed to follow the prospect theory value function. Furthermore, people are assumed to possess *limited loss-buffering resources* that are consumed in the process of coping with negative events, but it is also assumed that these resources are naturally renewable over time. These loss buffers include physiological, cognitive, and social resources that act to moderate the adverse effects of negative (or stressful) events. If two negative events occur during the same time period, they will have to share the loss-buffering resources that are available during the actual time period. Similarly, people are assumed to possess *limited gain-savouring resources* that are consumed in the process of experiencing positive events that occur in close temporal contiguity (e.g. two events that occur in the same time period). These resources are also assumed to be naturally renewable over time. The gain-savouring resources include time, cognitive resources, and physical energy. For instance, savouring a positive event may involve cognitive processes such as cognitively elaborating the event and its implications for one's goals and for one's self-evaluation, and savouring the emotional high that is associated with the event. Such cognitive processes require time and considerable cognitive resources. If two positive events occur during the same time period, they must share the gain-savouring resources that are available during that period.

The final assumption rests on the premises that people are value maximizers whose preferences for segregating or integrating events are assumed to be based on the anticipated value that is associated with experiencing two events

separately or at the same time. The assumption that negative events deplete a person's resources is consistent with research that has showed that prolonged states of stress have a variety of negative emotional, cognitive, and physiological effects, including effects on the neuroendocrine and immune systems (Baum et al., 1987).

In Linville and Fischer's (1991) study, three different domains were investigated. The subjects were found to show similar preferences for events from these three domains (academic, social and financial). Subjects had to indicate whether they wanted to experience two negative or two positive events on the same or different days. Losses and gains were found to be segregated due to temporarily limited (but renewable over time) loss-buffering and gain-savouring resources. Mixed gains and mixed losses were always integrated because gains were found to have a buffering effect. Linville and Fischer (1991) obtained support for the assumption that gains or losses were segregated whereas mixed gains and mixed losses were integrated. In Linville and Fischer's (1991) study, no restrictions were imposed on whether a loss preceded a gain or the reverse. Subjects were found to be more likely to integrate a loss and a gain if the gain was social, regardless of which domain (academic, social, and financial) the loss occurred in. This may suggest that positive social events could be perceived to be better loss buffers than positive events in other domains, thereby leading to a stronger tendency to integrate a social gain with a loss in the same or another domain.

The implications of the quasi-hedonic editing model are very similar to those of the RR model. Both theories use as a starting point Kahneman and Tversky's (1979) prospect theory. The RR model has one conceptual advantage over the quasi-hedonic editing model, and this is that the RR model relies on a common set of processes to account for gains, losses and mixed outcomes. In contrast, quasi-hedonic editing uses different editing assumptions for losses than for gains or mixed outcomes. The two theories represent different views of the source of preferences for temporally segregating or integrating events. According to editing models, the segregation or integration of events at the encoding stage plays a critical role in the evaluation processes. Time thus becomes critical only because it constrains the encoding processes. According to the RR model, on the other hand, time is critical because the availability of gain-savouring and loss-buffering resources is seen to be time-dependent (renewable over time). Table 1 below gives a summary of the model predictions for segregating or integrating events.

Table 1. Summary of predicted preferences in the Hedonic Editing model and the RR model

Type of event	Hedonic Editing Model	Renewable Resources Model
Large gain	Different day	Different day (gain-savouring)
Small gain	Different day	Different day (gain-savouring)
Large loss	Same day	Different day (multiple-loss avoidance)
Small loss	Same day	Different day (multiple-loss avoidance)
Mixed gain	Same day	Same day (loss buffering)
Mixed loss	No prediction	Same day (loss buffering)

Note. Entries in parentheses are hypotheses names for the RR model.

2.4 The Loss-Sensitivity Hypothesis

A proposed explanation of integration of prior outcomes is the loss-sensitivity hypothesis (Gärling & Romanus, 1997). This hypothesis, states that subjects will take into account a prior outcome (gain or loss) only when considering a current loss. Thus, when making a second choice, it was hypothesized that subjects would take into account the outcome of the first choice. However, according to the hypothesis subjects will do that only if the outcome of the second choice involves a potential loss. The loss-sensitivity hypothesis rests on the assumption that subjects are prone to minimize disutility. The effect of a prior loss will therefore be to increase the dissatisfaction with an expected loss, and the effect of a prior gain to decrease it. These predictions were tested in a series of experiments by Gärling and (1997) and Gärling, Romanus and Selart (1994). Gärling and Romanus found in their study of gambling decisions (fictitious race-track betting) that subjects predominantly integrated a prior outcome when evaluating a current loss. As a consequence, subjects were found to be risk averse after a loss but risk seeking after a gain, which is in accordance with Thaler's (1985) results. In a subsequent study (Romanus, Hassing & Gärling, 1996) integration were found to be reduced when the instructions downplayed the loss. This finding was consistent with the loss-sensitivity hypothesis.

In a study by Boe and Gärling, (2015c) two experiments were conducted in order to test the hypothesis that the loss-sensitivity principle could be extended to explain integration of the outcomes of two concurrent risky decisions. According to the loss-sensitivity principle, only expected loss outcomes of concurrent decisions would then be integrated. The results of Experiment 1 revealed to be consistent with the loss-sensitivity principle in that a prior outcome was integrated with the expected loss outcome of a current decision. However, there was no evidence for integration of the expected loss outcomes of two concurrent decisions. A possible explanation implying that outcomes are ignored if they have not yet occurred was then followed up in Experiment 2 where participants were offered bonuses to increase their sensitivity either to gains or losses. An effect of the bonus was observed but again

there was no evidence for integration of the outcomes of concurrent decisions. Another study by Boe and Gärling (2015b) investigated whether causal relatedness and uncertainty of outcomes of concurrent decisions were more frequently integrated than unrelated outcomes, and whether certain outcomes were more frequently integrated than uncertain outcomes. Participants in one group was asked to choose between buying means-end related and unrelated pairs of everyday consumer products, whereas participants in another group were asked to choose between lottery tickets with the consumer products as prizes. The results from the experiment indicated that both causal relatedness and uncertainty of outcomes of concurrent decisions affected integration. The means and ends were more often chosen when they were presented in the same sets of two concurrent decisions than when they were presented together with unrelated options or singly. The observed differences were smaller when choices were made between uncertain outcomes. Following this line of research, a third study by Boe & Gärling (2015a) was conducted with the aim of investigating whether causally related options of concurrent decisions are not evaluated and therefore not chosen although their combinations are more attractive than single options. In two concurrent decisions participants had to choose between buying means-end related and unrelated pairs of everyday consumer products. Participants in one group were sometimes forced to choose the end (or the means), whereas participants in another group were always free to choose the end and means. It was found that in the forced choices condition, participants chose the means or ends presumably because they attended to the additional benefits. However, when free to make both choices participants only chose the ends and means 22% of the time. A possible explanation of why concurrent outcomes are not integrated may be because of an attentional bias. If participants encounter highly attractive single outcomes, then they may be satisfied with these and refrain from further search. Boe & Gärling (2015a) refer to this phenomenon as an *attentional bias*, assuming that the outcome of the bias is that participants choose single preferred outcomes rather than more preferred combined outcomes. In line with this hypothesis, Boe and Gärling (2015b) demonstrated that attractive combined outcomes were never chosen despite that they were riskless and causally related. Boe (2015) tested this assumption of an attentional bias in an experiment investigating whether an attentional bias explains why decision makers sometimes fail to integrate outcomes of concurrent decisions. The participants in this study were asked to make fictitious choices of stores located at different distances where they could purchase the same consumer products at different prices. In one condition the participants were asked to also make a choice between driving and walking to the stores, in another condition they were asked to choose between the stores when they had no other option than to walk or drive. Attitudes toward driving were independently assessed by means of a questionnaire. A finding supporting the attentional bias was that participants with a more positive attitude toward driving chose more frequently to drive to stores within walking distance than participants with a less positive attitude towards driving.

2.5 The Informativeness Approach

Another model called the informativeness approach (Klar, 1995) also seeks to explain people's preferences for integrating or segregating events. This approach suggests that people find outcomes to be informative about both the target of the outcomes and about the likelihood that similar outcomes will or will not reoccur in the future. As found by Klar, people generally preferred positive outcomes to be unrelated to one another, and negative outcomes to be related to each other (integration). Three experiments were conducted in order to test the predictions of the informational approach. Both in the tested skill dependent and chance driven events, people were found to prefer segregated positive outcomes and integrated negative outcomes. The three experiments conducted by Klar, suggest that informational considerations contribute to segregation-integration preferences together with the perceptual considerations described by mental accounting theory.

Ross and Simonson (1991) found in their study that subjects had a preference for happy endings. In order to examine the effect of happy endings on preferences for integration versus segregation, Ross and Simonson (1991) focused on whether people became happier if two opposite sign outcomes were temporally separated or if the two occurred simultaneously being reduced to one integrated outcome, as in Thaler's (1985) study. In one study (Study 1), they presented subjects with a series of hypothetical choices between sequences that ended with a loss (e.g. win \$85, then lose \$15) or a gain (e.g. lose \$15, then win \$85). Subjects preferred sequences that ended with a gain. Subjects were also prone to prefer segregation when the gain occurred last, no matter what size the loss was. Both in Study 1 and in their Study 2, preferences for happy endings were shown to increase preferences for segregation of outcomes at the expense of integration. Ross and Simonson (1991) showed that, in situations in which events are temporally separated, preferences for integration or segregation of outcomes are determined by the temporal order of the events.

Laughunn and Payne (1984) conducted a study to investigate how practising managers would choose decision frames for sunk outcome problems when the current choices involved risk. The authors investigated two types of sunk outcomes, a continue/discontinue variant and an asset disposal variant. In presenting the sunk outcome problems to the subjects (60 managers), each problem was described as a brief business scenario that described the choice problem, identified the data, and asked the managers to make a choice between two risky options. A second business scenario, representing the base gamble, was developed and described the same business scenario except

that the reference to earlier history and the sunk outcome were eliminated. According to the authors, choosing managers as subjects in the study was justified because of the central role the managers played in resource allocation decisions. Depending on the presence of sunk costs or sunk benefits, changes in the percentage of risk seeking choices in the subsequent decisions was found. The presence of a sunk outcome problem was predicted to result in more risk-seeking choices than compared to a reference base gamble. Results showed that a substantial fraction of the managers made choices that were consistent with the use of a psychological account in both of the sunk outcome problems. This point to a violation of the principle of framing based on a minimal account. The findings also indicated that a substantial number of managers did not cancel history, resulting in that the managers utilized the psychological account in some way for framing the sunk outcome problem.

Laughhunn and Payne (1984) also found that managers were generally more inclined to make choices using the psychological account when making personal choices than when making corporate choices. When making corporate choices the presence of sunk losses were found to induce a more apparent use of the psychological account, compared to sunk benefits of the same amount. For personal decisions the differential impact of sunk losses and sunk benefits was mixed based on the problem type. It was found that for the continue/discontinue problems the effects of sunk benefits was larger than for that of sunk losses, while the reverse was found for the asset disposal problem. Use of the psychological account was found to be extensive in both the continue/discontinue problems and for the asset problems, as well as for sunk costs as well as sunk benefits.

Gärling and Romanus (1997) aimed to investigate whether integration was asymmetric or not, as noted by Laughhunn and Payne's (1984). A prior gain and loss alike tended to be integrated in the evaluation of the current loss but not in the evaluation of status quo and the current gain. The possibility of such an asymmetric integration was predicted by Thaler and Johnson (1990), using prospect theory. Predictions of asymmetric integration to be used in Gärling and Romanus study were made from the RR model (Linville & Fischer, 1991). According to these predictions status quo would not be affected. The evaluation of a current loss would then be made less unattractive by a prior gain as compared to no prior outcome, but was not expected to be affected by a prior loss. On the other hand, the evaluation of a current gain was predicted to be made less attractive by a prior loss, but would not be affected by a prior gain.

In Experiment 1 (Gärling and Romanus, 1997) a prior outcome had already occurred. The results of Experiment 1 were shown to be consistent with previous research in demonstrating effects of prior outcomes on risky decisions (Laughhunn & Payne, 1984; Linville & Fischer, 1991; Thaler & Johnson, 1990; Tversky & Shafir, 1992). It was also found that risk seeking changed to risk aversion after a loss. A prior gain also tended to increase risk seeking, leading to the conclusion that prior outcomes appeared to be integrated with current outcomes. The results from Experiment 1 showed that integration was asymmetric although inconsistent with the principle of hedonic editing. An important difference between the conditions of Linville and Fischer's study and Gärling and Romanus study may have been that a prior outcome already had occurred in the latter study. Therefore, a Experiment 2 was conducted in order to investigate whether the degree of uncertainty about the prior outcome was an important condition in order for hedonic editing to occur. The results suggested that subjects had a tendency to take into account a prior loss even though it was uncertain. However, no other effects were found of the prior outcome.

The results obtained from the study by Gärling and Romanus (1997) failed to support that integration followed value maximization as assumed by Thaler and Johnson (1990) drawing on prospect theory. Neither did the results support the RR model based on stress buffering assumptions proposed by Linville and Fischer (1991). As noted by Larrick (1993) and Weber (1994), people in risky choices may often be more concerned about avoiding negative outcomes than attaining positive ones.

2.6 The Mobilization-Minimization hypothesis

Taylor (1991) has suggested another explanation for the occurrence of asymmetrical effects of positive and negative events. This hypothesis is called the mobilization-minimization hypothesis. Adverse or threatening (negative) events mobilize an individual to try to cope with the situation. This mobilization phase is followed by physiological, cognitive and behavioral responses that damp down, minimizes and even erases the impact of that event (Taylor, 1991). The individual responds to negative events with short-term mobilization and long-term minimization. Fiske (1980) found that subjects attended disproportionately to negative information by looking at it longer than they looked upon positive or neutral information. Peeters and Czapinski (1990) has showed that negative events elicit more causal attributional activity than positive events. They also concluded that negative stimuli lead to more cognitive work and more cognitive representations than positive stimuli did. One exception is the Pollyanna principle (Matlin & Strang, 1978), which refers to a persistent recall advantage of positive over negative events. Negative information may stand out and be disproportionately weighted in judgements.

A number of recent studies have shown that people typically favour sequences that improve over time (Loewenstein & Sicherman, 1991; Ross & Simonson, 1991; & Varey & Kahneman, 1990). Ross and Simonson (1991) noted that

the final outcome in a sequence is likely to be the most salient to the DM after the end of the sequence. Preferences for improvement appear to be driven in part by adaption and loss aversion (Kahneman & Tversky, 1979). Loss aversion refers to that people are more sensitive to a loss than to a gain of the same magnitude. The adaption and loss aversion explanations are closely related to the concept of a "contrast effect" (Tversky & Griffin, 1991). Contrast effects refer to the effect on one's evaluation of the present compared with the past or future. If backward-looking contrast effects are more potent than forward-looking ones, then the net impact of contrast effects will be to raise the preferences for improvement over time (Prelec & Loewenstein, 1991).

Slovic (1972) proposed a "concreteness principle" stating that a DM does not frequently allocate the cognitive resources required for changing the given format of supplied information. According to the concreteness principle, no integration of prior outcomes would be expected unless the format of the decision problem is changed. The concreteness principle as an explanation of integration, gained support in a study by Romanus, Gärling and Karlsson (1995). In this study, two experiments were conducted in order to test if concreteness and loss sensitivity could explain why a DM sometimes add (integrates) a prior outcome to the expected outcomes of a current risky decision. Subjects were presented with different descriptions of gambling choices, where they had to imagine that they had not gambled, that they had gambled and won, or that they had gambled and lost. In one session subjects had to rate the likelihood that they would gamble in a subsequent race. In another session they had to rate how satisfied they would be with not betting, with betting if they won, and with betting if they lost, respectively, in the subsequent race.

In Experiment 1, in a condition without concrete integration descriptions, as has been found previously (Gärling & Romanus, 1997, Gärling et al., 1994), subjects were expected to integrate the prior outcome only with the expected loss. In a second condition of Experiment 1, subjects were expected to also integrate the prior outcome with the other outcomes. The results of Experiment 1 showed more integration for descriptions of the bets which concretely integrated the prior outcomes with all the outcomes of the current choices. A consistent finding of Gärling and Romanus (1997) and of Gärling et al.'s (1994) studies has been that multiple reference points were employed. This point to a violation of both normative principles and prospect theory. Results, supporting the loss-sensitivity hypothesis have implied that in evaluating an expected loss, one reference point was used. Here the prior outcome was not assimilated with the reference point. In evaluating the other outcomes, when the prior outcome has been assimilated with the reference point, another reference point was used. The question that was raised in Experiment 2 was therefore if concrete integration descriptions likewise would lead to such an inconsistency. This was expected if subjects were to integrate only the prior outcome when the description made it concrete. The results that were obtained from Experiment 2 showed a specific effect of concrete-integration information. The subjects tended not to integrate a prior outcome with any other outcome than those included in the concrete-integration descriptions. This can be seen as a violation of both normative principles (von Neumann & Morgenstern, 1947) and prospect theory (Kahneman & Tversky, 1979).

2.7 The Sunk Cost Effect

Sunk costs may be regarded as a special case of prior outcome when the DM has invested in one of the current options. A sunk cost involves any prior investment of "money, effort, or time" (Arkes & Blumer, 1985, p.124). Sunk cost effects on decision-making are irrational from the perspective of both classical economic and normative decision theories. Laughhunn and Payne (1984) chooses to replace sunk cost with the term *sunk outcomes*, which can be either positive (a sunk benefit) or negative (a sunk cost).

Arkes and Blumer (1985) reported a series of experiments which demonstrated sunk cost effects. In several questionnaire experiments, contrary to normative decision theory a majority of subjects chose a less preferred option which they had bought at a higher price. For instance, a majority of subjects chose to cancel a less expensive weekend ski trip although knowing that they would like it better than a more expensive alternative. In another scenario subjects playing the role of presidents of a company were asked to decide to continue or discontinue investments in the development of a product facing anticipated difficulties to sell it. Subjects who were informed that large investments had already been made chose more frequently to "throw good money after bad money". Demonstrating external validity of these findings, subjects participating in a field experiment were found to attend more theatre shows if they had paid the full price for the subscription to a series than if they received a discount on this price.

A surprising result found by Garland (1990) is that incremental costs had absolutely no effect on subjects willingness to make further investments in the project. This means that the subjects willingness to authorize additional resources for a threatened research and development project was both positively and linearly related to the proportion of the budget that already had been expended. This is a result that is contrary to normative decision models. Garland and Newport (1991) also found that there was one strong and significant sunk cost effect on the decision to continue with an unprofitable course of action, based on the proportion of a total budget expended on that particular action. Garland and Newport's (1991) results suggest that sunk cost effects on decision making are a

function of the proportion of allotted resources (e.g., a budget), expended on the project rather than absolute expenditures. Another result from the same study was that relative rather than absolute magnitude of sunk cost had a significant impact on subjects reported likelihood of committing additional funds to some action. These findings support the idea that a topical organization of mental accounts underlies sunk cost effects in decision-making.

2.8 The Status-Quo and Omission Biases

Closely related to sunk cost are two types of biases named status-quo and omission biases. The term status-quo bias has been used to describe people's tendency of "doing nothing or maintaining one's current or previous action" (Samuelson & Zeckhauser, 1988). Preferences for the status quo, in risky as well as in riskless choices, is generally explained in terms of loss aversion (Thaler, 1980; Kahneman and Tversky, 1984).

An alternative explanation of status-quo bias is that changing the status quo requires an act, while keeping the status-quo requires only an omission or inaction. Preference for the omission option may also result from unwillingness to choose between the available options (Ritov & Baron, 1992). Samuelson & Zeckhauser (1988) found that the status quo bias was manifested in an anchoring effect, in which current decisions would be anchored to prior decisions. The same authors also found that a status-quo bias can be revealed as a tendency in a multistage betting game to become risk averse after not betting. Kahneman and Tversky (1982) found that people experienced a more intense emotional reaction to events that involve actions relative to events that had identical outcomes but which did not involve actions. Individuals felt better when a positive outcome resulted from action rather than inaction. Anticipation of such positive or negative feelings could account for the status-quo bias or the omission bias (Ritov & Baron, 1992). Kahneman and Miller (1986) explained this phenomenon in terms of norm theory. Outcomes are perceived as worse when subjects can easily imagine that a better outcome could have occurred.

Brockner & Rubin (1985) has shown that in sequential decisions, a persistence in status quo choices may be motivated by the individual's reluctance to "cut his losses". Or explained in more general terms, motivation may be triggered by a desire to justify previous commitments to a (perhaps failing) course of action by making subsequent commitments. From a prospect theory perspective, withdrawal from any project before one has recouped previously invested resources should be perceived as a certain loss. Thus, sunk costs might indeed influence decisions to withdraw from or persist with projects in the face of positive as well as negative feedback. The results of Garland and Newport's (1991) study provide an important base of empirical support for Kahneman's and Tversky's (1979) propositions.

2.9 Escalation or Escalating Commitment

Escalation or escalating commitment refers to the tendency for decision makers to persist with failing courses of action. Escalation may be seen as similar to sunk costs, or as a chance to recover sunk costs, although escalation is extended across several trials while sunk costs refers to the total accumulated investment (whether the investment is of monetary value, effort or time). In an escalation dilemma, costs are incurred, at the same time as there exists an opportunity to withdraw or to persist, and the consequences of withdrawal or persistence are uncertain (Staw & Ross, 1987). An escalation dilemma is thus related to a situation where things not only have gone wrong, but where potential actions aimed at curing the problem may actually deepen the difficulty. Escalation dilemmas occur when for instance a job, career, or marriage has grown increasingly frustrating, and it is uncertain whether greater effort or withdrawal will be able to improve the situation. The typical response to an escalation dilemma like this, is an irrational persistence (Brockner & Rubin, 1985) carrying the hope that things will turn out better in the end.

There is some controversy concerning the explanation of escalation (see Brockner & Rubin, 1985; Staw & Ross, 1987, for reviews of theory and empirical research). What is clear is that the different escalation situations have some common factors. First, all of the situations entail some loss or costs that have resulted from an original course of action. Second, the predicaments involve some continuity over time, and third, they comprise situations where simple withdrawal is not the solution to the problem. Escalation is believed to result from a combination of four macro variables, known as project, psychological, social, and structural determinants (Drummond, 1994). The project factors are concerned with the perceived benefits of a venture and with the costs of withdrawal. DM's may be reluctant to forego previous investments especially where recoupment depends upon project completion (Arkes & Blumer, 1985). The social factors include what Fox and Staw (1979) called external justification (face-saving). This is the desire not to lose face or credibility with others. DMs may persist in a course of action not only because they do not want to admit to themselves that they made a mistake, but also because they may be especially hesitant to expose their errors to others. Other relevant social factors that may motivate escalation include personal identification with an issue (Staw & Ross, 1987) and competition (Teger, 1980). Structural factors include political support, economic, and technical sidebets, administrative inertia and institutionalization (Staw & Ross, 1987). Institutionalization refers here to the fact that a project is tied integrally to the values and purposes of the firm. The four preceding factors are believed to come into play sequentially. Escalation begins with project variables, notably

the perceived benefits of embarking upon a venture. Received questionable feedback is initially ignored, and then as failure becomes undeniable, and the social pressure precludes withdrawal. As the project grows, the responsibility diffuses. Social and psychological pressures therefore recede and persistence reflects structural factors (Staw & Ross, 1987).

The tendency to escalate may also be explained, at least in part, by expectancy theory (Vroom, 1964). According to such a viewpoint, DMs assess the probability that additional resource allocations will lead to goal attainment, as well as the value of goal attainment (i.e. rewards minus costs). This leads to generating a subjective expected utility associated with the decision to allocate additional resources. Brockner and Rubin (1985) discovered that individuals persistence at a task at which they were failing was greater both when they sensed that they were drawing ever closer to their goals, and when their goals were relatively high in value. A second category of explanations views people as following a self-justifying or rationalizing behavior rather than being guided by the tenets of expectancy theory. Couched originally in Festinger's (1957) theory of cognitive dissonance, this viewpoint posits that DMs become entrapped in a previous course of action because of their unwillingness to admit that the prior resources were allocated incorrectly. Put simply, this means that people do not like to admit that their past decisions were incorrect. So it seems that the best way to reaffirm the correctness of earlier decisions is to be even more committed to them. A strategy that has been adopted in several studies of escalation has been to explore whether other behaviours stemming from the self-justification motive (besides continued resource allocation) are systematically influenced by conditions that are known to affect escalation. As noted by Conlon and Parks (1987), DMs that are concerned with self-justification, will search for retrospectively focused information as they contemplate subsequent resource-allocation decisions. Studies that have used different investment situations and operationalisations of the negative feedback and need-to-justify variables have yielded results consistent with the self-justification explanation of escalation (Brockner 1992).

Despite existing evidence for sunk-cost effects, numerous questions remain about the relation between sunk costs and decisions to escalate investments in ongoing projects. The strong effects observed by Garland and Newport (1991) may have been due to a normatively rational, prospective consideration of incremental costs rather than sunk costs. Laughhunn and Payne (1984) proposed two alternative views to explain how a DM will frame a sunk cost (in their terms, sunk outcome) problem. This may be done either by use of a minimal account or by use of a psychological account. A frame based on the minimal account is premised on the assumption that history (the sunk outcomes) will be ignored by the DM, and that the sunk outcome problem will be framed to have a structure that is identical to that of the base gamble (that is the same problem but without history). One rationale for this framing of the sunk outcome problem is based on the cancellation effect of prospect theory. Laughhunn and Payne (1984) argue that cancellation allows a DM to disregard components of options that are common to them in order to focus attention on the components that distinguish them. Cancellation of sunk outcomes function to simplify the structure of a choice problem. A use of a minimal account to frame the sunk outcome problem, has a normative justification according to economic theories and theories of rational choice in business decision making. Framing based on the psychological account involves a presumption that DMs will not ignore the sunk outcome problems history when making a present choice. Staw (1981) developed a model of entrapment to explain why DMs, once committed to a course of action, stays committed to it over a time period longer than a rational analysis can justify. In Staw's model, the DM will adopt a psychological account, when confronted with a sequence of choices over time, because of strong motivations to appear rational on a retrospective (historical) basis and to appear consistent in decisions made over time.

3. Concurrent Decisions

In a concurrent decisions situation several decisions are made simultaneously. Future outcomes of one decision is possibly integrated with future outcomes of a second decision. In situations with prior-outcomes, sunk-cost effects or in an escalation, the common nominator is that one or more outcomes have already occurred. One concurrent decision problem referred to as the jacket and calculator problem, was originally presented by Tversky and Kahneman (1981). Here the question is whether the outcome of two simultaneous choices (buying a jacket and a calculator) are integrated or segregated. In this situation the decision maker has to decide whether to buy two items at the same store, or to buy one of the items at another store located 20 minutes away:

Low-price condition

Imagine that you are about to purchase a jacket for \$125 and a calculator for \$15. The calculator salesman informs you that the calculator you wish to buy is on sale for \$10 at the other branch store, located 20 minutes drive away. Would you make the trip to the other store?

High-price condition

Imagine that you are about to purchase a jacket for \$15 and a calculator for \$125. The calculator salesman informs you that the calculator you wish to buy is on sale for \$120 at the other branch store, located 20 minutes drive away. Would you make the trip to the other store?

This problem presents two simultaneous alternatives, each with three attributes, the jacket price, calculator price, and shopping convenience. The problem is concerned with the acceptability of an option that combines a disadvantage of inconvenience (driving to the other store) with a financial advantage that can be framed as a minimal, topical or comprehensive account. The minimal account includes only the differences between the two options and disregards the features that they share. In the minimal account, the advantage associated with driving to the other store is framed as a gain of \$5. A topical account relates the consequences of possible choices to a reference level that is determined by the context within which the decision arises. In the preceding problem, the relevant topic is the purchase of the calculator, and the benefit of the trip is therefore framed as a reduction of the price from \$15 to \$10. Because the potential saving is associated only with the calculator, the price of the jacket is not included in the topical account. The price of the jacket, as well as other expenses, could well be included in a more comprehensive account in which the saving would be evaluated in relation to for instance, monthly expenses.

Tversky & Kahneman's (1981) original results showed that the two versions of the jacket and the calculator problem were markedly different. 68% of the respondents were willing to make the trip to the other store in order to save \$5 on a \$15 calculator (low-price condition), while only 29% were willing to exert the same effort when the price of the calculator was \$125 (high-price condition). The respondents did not frame the jacket and the calculator problem in a minimal account, which involves only a benefit of \$5 and a cost of some inconvenience (driving to the other store). Instead they evaluated the potential saving in a more inclusive account, which includes the purchase of the calculator but not the jacket. Applying the prospect theory value function it can be shown that a discount of \$5 has a greater impact when the price of the calculator is low than when it is high, due to the principle of diminishing sensitivity.

Henderson and Peterson (1992) conducted a study to investigate the jacket and calculator problem, resulting in approximately the same results as was found by Tversky and Kahneman. Henderson and Peterson posit through their categorization and script theory explanation that a reference state will always be developed and used to evaluate novel elements, options or events. A script can be defined as a sequence of causally related expectations of a familiar event. 25% of Henderson and Peterson's subjects stated that they were willing to drive to the other store, and this is a percentage not significantly different from Tversky and Kahneman's (29% for the \$125 condition). In the low-price condition, 68% of the 88 subjects were willing to make the trip to the other store. Kahneman & Tversky (1984) proposed that individuals spontaneously would frame decisions in terms of topical accounts. Topical organization, in conjunction with the prospect theory value functions concavity of value, entails that the willingness to travel to the other store for a saving of \$5 on a calculator should be inversely related to the price of the calculator and should be independent of the price of the jacket. The comprehensive account assumes that the jacket and calculator prices of each alternative are edited by being integrated since they are attributes on the same monetary scale. This leads to the prediction of no change in preference across the two original versions of the problem, since the changes in jacket and calculator prices in opposite directions cancel each other out. The topical organization of mental accounts leads people to evaluate gains and losses in relative rather than absolute terms, resulting in large variations in the rate at which money is exchanged for other things. This points to a violation of the standard theory of consumer behavior, which assumes invariance and does not recognize the effects of mental accounting.

Ranyard & Abdel-Nabi (1993) aimed to replicate Tversky and Kahneman's investigation of a calculator price effect. Another more important aim in their study was to investigate the effect of independently varying the price of the jacket. Results from their study showed that only about a quarter of the sample (23%) said they would make the trip to save £5 on the expensive (high-price) calculator. With the cheaper (low-price) calculator, most people (52% and 70%) would make the trip. An effect of mode of travel was apparent. People were more inclined to walk to save £5 than to drive. Just over half (52%) were prepared to drive to the other store, but significantly more (70%) were prepared to walk in order to save the same amount of money. When asked to drive to the other store, people were slightly more inclined to do so when buying the cheaper jacket (56%) than compared to the more expensive one (44%).

Ranyard and Abdel-Nabi (1993) also reported an interesting new result, namely that changes in the price of the jacket affected choice. The effect on choice was relatively small, compared to that of the calculator price. The jacket

price effect suggests that subjects may evaluate choice alternatives with respect to a comprehensive account which included the price of the jacket. The authors also performed a think-aloud study of the jacket and calculator problem. The coding scheme was divided into four mutually exclusive categories, ranging from low to high comprehensiveness on an ordinal scale. Results from the think-aloud part of the study showed that subjects generally adopted a minimal account. The subjects framed the choice as a conflict between an advantage of 20 minutes less driving time versus a £5 price advantage, and their evaluation strategy, according to the authors, was simply to compare the two alternatives.

Bonini and Rumiati (1996) reported five experiments in their study on mental accounting and the acceptance of a price discount. In their Experiment 1, the findings reported by Tversky and Kahneman (1981) in the jacket and calculator problem were replicated. Experiment 4 was used as a baseline for comparing the other three experiments. The underlying strategy in four of the five experiments was to manipulate the mental segregability of the planned purchases (buying a jacket and a calculator) when a price reduction was assessed. The authors proposed and gained support for the hypothesis that by making the segregation of the planned purchases more difficult (by strengthening the relation between them) one could induce people to use a comprehensive mental account instead of a topical one. By using a more comprehensive mental account subjects were inclined to integrate in the jacket and the calculator problem. By providing a categorical link between the items, to embed the items in a shopping list, and to make the items part of an explicit expense budget, subject were shown to integrate the two items by using a more comprehensive mental account than when using a topical mental account as in Tversky and Kahneman's (1981) original problem. Table 2 summarizes the findings in the jacket and calculator problem.

Table 2. An overview of respondents' willingness to make the trip to the other store in the jacket and calculator problem. Mean percentages responding "yes" and "no" with different calculator prices

Problem	Sample size	Mean % yes	Mean % no
<i>Tversky and Kahneman (1981)</i>			
Calculator price \$125	93	29%	71%
Calculator price \$15	88	68%	32%
<i>Ranyard and Abdel-Nabi (1993)</i>			
Calculator price £ 115 (drive)	75	23%	77%
Calculator price £ 15 (drive)	200	52%	48%
Calculator price £ 15 (walk)	175	70%	30%
Think aloud study (average results)	48	56%	44%
<i>Bonini and Rumiati (1996)</i>			
Replication condition (exp. 1)			
Low-price calculator	50	60%	40%
High-price calculator	50	40%	60%
Same category condition (exp2)			
Low-price calculator	50	64%	36%
High-price calculator	50	46%	54%
Shopping list condition (exp.3)			
Low-price calculator	33	52%	48%
High-price calculator	28	46%	54%
Expense budget condition (exp.4)			
Low-price calculator	67	67%	33%
High-price calculator	68	56%	44%
Jacket mentioned twice (exp.5)			
Low-price calculator	50	54%	46%
High-price calculator	68	54%	46%

An earlier paper investigated whether the loss-sensitivity hypothesis would be capable of also explaining how concurrent decisions are integrated (Boe, 1995). It was then assumed that one of the decisions were superordinate to the other. In my previous experiment this was operationalized by imposing an order on the choices. Thus, when making the second choice, it was hypothesized that subjects would take into account the potential outcome of the first choice. However, according to the loss-sensitivity hypothesis subjects would do that only if the outcome of the second choice was a potential loss. Therefore, the second choice was either between a sure loss and a risky loss or a sure gain and an risky gain. Integration was expected in the first but not in the latter case.

In three between-subjects conditions, different subjects were given pairs of concurrent decisions, decisions with prior outcomes, and two-stage gambles, respectively. The prior outcomes were either gains or losses which corresponded exactly to the outcomes of the dominant options of the first decisions in the condition with concurrent decisions, whereas in the two-stage gambles the probability of reaching the second stage was the same as obtaining

the outcome of the dominant options of the first decisions in the condition with concurrent decisions. The second decisions were the same in all conditions. All subjects were also given a second block with only the second decisions. Thus, the existence of integration effects were possible to assess in within-subjects comparisons in each of the between-subjects conditions. Based on prospect theory it was predicted that subjects in the second decisions would chose the sure gain but the risky loss. However, if integrating a prior gain, subjects would when facing a sure and a risky loss chose the former because it would be framed as a sure gain. If integrating a prior loss, subjects would be even more inclined to choose the uncertain loss. No integration was predicted for second decisions entailing only gains. Under the conditions of the experiment (imposed order, a small number of possible outcomes of the prior decision) the same integration results were predicted in the condition with concurrent decisions. Consistent with the findings of Kahneman and Tversky (1979), subjects were expected to ignore the uncertainty of the first stage in the two-stage gambles, thus leading to no integration in this condition. This result would also be consistent with integration in the condition with concurrent decisions. The design was mixed factorial with type of decision problem (concurrent decisions, decisions with prior outcome, and two-stage gambles) as a between-subjects factor. Within-subject factors were whether the first stage was included or not, whether the outcomes of the second decision were gains or losses, and, in the between-subjects conditions with concurrent decisions and with prior outcomes, whether the outcomes of the first decisions (or the prior outcomes) were gains or losses. In the stage-gamble condition the latter was treated as a dummy factor. Different amounts of gains/losses were nested under the other conditions. The materials consisted of fictitious bets which were presented on a computer screen. In all conditions there was one block of single decisions, half of them consisting of a choice between an even chance of winning a certain amount or nothing and winning half the amount for sure. The other half consisted of an even chance of losing a certain amount or nothing and losing half the amount for sure. One option always dominated the other one. The second choice was the same as in the block of single decisions. Each one was combined once with gains in the first choice, once with losses. The obtained results showed that integration did not take place under the experimental conditions, and the results also failed to support the loss-sensitivity hypothesis, as no integration occurred in the conditions with concurrent decisions and prior outcomes. My suggestion is that no integration occurred since there were small differences between the single decisions and the other conditions. However, as expected in accordance with prospect theory, subjects became risk seeking when choosing between losses and risk aversive when choosing between gains. Prior outcome had an effect on current choices between losses but not on current choices between gains, which is in accordance with the loss-sensitivity hypothesis. After a prior loss, subjects became more risk aversive and were more willing to choose the certain alternative. An interaction condition by prior outcome was obtained, suggesting that the effect of prior outcome and the interaction between current decision and prior outcome was only reliable in the concurrent-decisions condition. The effect of prior outcome in the concurrent-decisions condition may not reflect integration. Despite the uncertainty in the experimental condition involving concurrent-decisions, prior outcome was found to have an effect in the concurrent-decisions condition, whereas no effect was observed in the prior-outcome condition where the prior outcome was known. In the stage-gamble condition subjects seemed to ignore the uncertainty. This has been shown to be the case in a study by Tversky and Shafir (1992).

A well-known rationality principle of decision theory under uncertainty is named the sure-thing principle (henceforth called STP) by Savage (1954). STP holds as its basic assumption that if prospect x is preferred to y both when situation A occurred and when situation A did not occur, then x should be preferred to y when one isn't sure whether event A has occurred or not. The STP rule has a great deal of both normative and descriptive appeal, but Tversky and Shafir (1992) has shown that subjects have a pattern of preferences that clearly violates Savage's STP.

Uncertain situations may be thought of as disjunctions of possible states, either one state will obtain, or another. When facing two gambles, a majority of respondents in Tversky and Shafir's (1992) study accepted the second gamble both after having won as well as after having lost in the first gamble, but a majority rejected the second gamble when the outcome of the first gamble was not known. When the outcome of the first gamble is unknown, people do not know whether they are ahead and cannot lose or whether they are behind and need to recover their losses. This pattern of preferences is referred to as the *disjunction effect*, when subjects not knowing whether situation A has occurred or not, therefore may lack a good reason for making a decision. The following pattern: accept when win, accept when lose, but reject when one do not know, was the single most frequent pattern of preferences found by Tversky and Shafir (1992). The authors attributed the observed violation of STP to a loss of acuity induced by uncertainty about an outcome when the reasons for choice differ depending on that outcome. Gärling and Romanus (1997) replicated Tversky and Shafir's findings that subjects segregated a prior outcome which was equally likely to be a gain as a loss.

Gärling and Romanus (1997, Experiment 2) proposed a possible explanation to why subjects do not integrate the two decisions in a concurrent decisions problem. They found that a prior outcome was segregated in one condition, when it was considered a loss, and also segregated in another condition when the prior outcome was a likely gain. According to Gärling and Romanus, the uncertainty of the outcome of the first decision may counteract integration of concurrent decisions. Since loss-sensitivity is related to affective control and reactions and concreteness to

cognitive factors, it does not seem unlikely that there are larger individual differences associated with loss-sensitivity than with concreteness as explanations of integration.

Another example of a disjunction effect, in a one-shot prisoner's dilemma game (henceforth called PDG), has been described in a study by Shafir and Tversky (1992). In a total of 444 PDG's where the other's strategy was known to the respondents, the majority of respondents chose to compete. When subjects had been informed that the other had chosen to compete, only 3% of the subjects answers resulted in cooperation. When subjects were informed that the other person had chosen to cooperate, a larger percentage of subjects chose cooperation. In another 444 PDG's in which the other's strategy was unknown (the disjunctive version), 37% of the subjects answers resulted in cooperation. Competition was found to be the most popular strategy in all conditions in the study. The single most frequent pattern was to compete in all three versions of the PDG. The next most frequent choice pattern, 113 out of 444 PDG's, was of the following form: compete when the other competes, cooperate when the other cooperates, but cooperate when the other's strategy is not known. A consequentialist subject who chooses to compete both when the other competes and when the other cooperates, should also compete when the other's decision is not known, according to the STP. Instead, uncertainty promotes a tendency to cooperate, which disappears once the other player's decision has been determined. Shafir and Tversky (1992) interpreted the violations of STP as an indication that people do not evaluate the outcomes in a consequentialist manner, and they proposed two explanations for the findings. First, subjects might have cooperated in the disjunctive version of the game because they were afraid that their choices would be relayed to the other player before he or she made a decision. Second, Shafir and Tversky argued that the results could be explained by the hypothesis that the tendency to compete increases as the experiment progresses. Disjunctions of multiple outcomes are more difficult to think through, and as a result, are more likely to give rise to nonconsequential reasoning.

4. Discussion

The basic goal of this paper was to review empirical findings and explanations relevant to the issue when concurrent decisions are integrated and when they are not integrated. As there are few directly related studies, the paper has covered related phenomena, involving the effect of a prior outcome on subsequent decisions (Thaler & Johnson, 1990; Gärling & Romanus, 1997), sunk-cost effects (Arkes & Blumer, 1985; Laughhunn & Payne, 1984) and escalation (Brockner, 1992). These phenomena have a lot in common, but may have different explanations. Most of the explanations may, however, be complementary. By comparing in this discussion the jacket and calculator problem (Tversky & Kahneman, 1981) with Kahneman and Tversky's (1979) study of concurrent decisions and Boe's (1995) replication of their study, it will be possible to point to some similarities and differences in design and results which may give a clue to why or why not concurrent decisions are integrated.

An interesting observation that arises from studies of the jacket and calculator problem is that a strong effect of the use of mental accounts has been observed in some studies of this problem (Bonini & Rumiati, 1996; Ranyard & Abdel-Nabi, 1993). Several possibilities to obtain integration in concurrent decisions problems has been tested by Bonini and Rumiati (1996). It was, for instance, possible to strengthen the relation between the outcomes or events. One way is to provide a categorical link between them. For instance, in the jacket and calculator problem, replacing the jacket and calculator with a table and a chair makes their mental integration more likely. Thinking about one purchase induces a person to also consider the other purchase, because of their categorical link. If the categorical link between two purchases facilitates their mental integration, then a price reduction of one purchase should be related to both purchases. Another way to strengthen the relation between purchases was to embed the purchases in a shopping list including several products. When the two purchases are inserted in such a list, they may form a sort of "mental unit". For example, when a person is planning to buy several products, he or she may consider how much money he or she would spend that day, and consequently, be induced to think in terms of a global expense budget. In this case, a price reduction of one purchase would be related to the planned purchases rather than to the target purchase. A third similar way to strengthen the relation between purchases was to refer them to an explicit expense budget. A person may plan to buy two products knowing their prices in advance. Thinking in terms of an explicit expense budget, for instance, knowing that one leaves home with a certain amount of money, may favour integration of the two purchases. In this case, the calculator price reduction will thus be related to the planned purchases. Finally, a relatively simple way to relate the two items in the jacket and calculator problem is to remind the subjects that they can also buy the jacket at the other store. If one considers the instructions used in the original formulation of the problem, one can note that the jacket is mentioned only in the first line. This problem formulation may have induced subjects to focus their attention only on the calculator price. In order to defocus subject's attention from the calculator price, the jacket purchase could be mentioned just before the presentation of the choice dilemma. Bonini and Rumiati (1996), in testing this reported that the effect found by Kahneman and Tversky (1984) disappeared when a defocusing possibility was provided.

An attempt to replicate Tversky and Kahneman's study was done by Ranyard and Abdel-Nabi (1993) in order to investigate the calculator price effect. Another more important aim in their study was to investigate the effect of

independently varying the price of the jacket. In Ranyard & Abdel-Nabi's study, a minority of the subjects said that they would make the trip to save £5 on the high-price calculator. With the cheaper calculator, a majority of the subjects stated that they would make the trip. An effect of mode of travel was found. Ranyard and Abdel-Nabi also reported that changes in jacket price were found to have an effect, although this effect was relatively small, compared to that of the calculator price. This effect suggests that subjects in their study evaluated choice alternatives with respect to an account which included the price of the jacket.

Ranyard (1995) emphasizes the role of goals and aspirations in determining the "mental accounts" a DM uses. As an example one may mention that if the primary goal is to earn a fortune, any monetary loss or gain is likely to be registered and integrated. This means that the use of different mental accounts will be dependent upon the individual's goals and aspirations. In this way, regarding the use of mental accounts, it may be more useful to think of the comprehensive accounts as more comprehensive *topical* accounts. It seems then that people construct mental models which incorporate topical mental accounts of varying inclusiveness.

An important question emerging from this literature review, is the question why integration has been obtained in studies of effects of prior outcomes, sunk cost effects and escalation, at the same time as this has not been the case with concurrent decisions? Heath (1995) makes the interesting suggestion that people set mental budgets in order to track their investments. An individual first must notice the investments (prior outcomes, sunk costs) and, second, he or she has to assign the investments to their proper accounts. Borrowing terminology from financial accounting, Heath argues that the accounting process is divided in two stages: Expenses are first booked, meaning that in order for an investment to affect a budget, people have to recall or attend to the investment. Booking will be affected by the familiarity of the stimulus. Then, people must classify the investment as relevant to the mental budget, a process named as posting. Posting will be affected by issues that affect categorization judgements and judgements of similarity. This includes the relative complexity of the stimulus object and the target, and also the other items in the choice set. Heath distinguishes these two processes because they depend on different cognitive mechanisms. Booking processes are driven by attention, either you notice an expense or you do not. On the other hand, posting processes is driven by similarity judgments and categorization. A plausible explanation for integration of concurrent decisions is that subjects will have to book the different items in the same account.

A second reason for integrating or not in concurrent decisions, may be whether or not the problem involves risk. Risk and not using mental accounts are thus possible explanations of why subjects do not integrate in concurrent decision problems. One difference between Tversky and Kahneman's (1981) study of the jacket and calculator problem, on the one hand, and Kahneman and Tversky's (1979) study of concurrent decisions and the replication of their study (Boe, 1995), on the other hand, is that the jacket and calculator problem does not include risk. In Tversky and Kahneman's (1981) study and in my study risk was included. In the prior-outcome condition of my study, subjects had to imagine that they already had won/lost a certain amount of money in the first gamble, before attending to the second. The second gamble consisted of two alternatives, either to win/lose a certain amount of money for sure or a 50% chance to win or to lose a certain amount of money or to win or to lose nothing. In the concurrent-decisions condition, two gambles were played. Both gambles were to be considered at the same time. In the first there was a 50% chance to either win/lose a certain amount of money. In the second there was a sure win/loss or a 50% chance of winning/losing a certain amount of money or nothing. A possible explanation of why subjects did not integrate the two decisions is that the uncertainty of the outcome of the first decision counteracts integration. This explanation was proposed by Gärling and Romanus (1997, Experiment 2). Shafir and Tversky (1992) showed that when the outcome of the first gamble is unknown, people lack a clear reason for making a decision. They do not know whether they end up winning or losing after the second gamble because of the uncertainty of the first gamble.

The study by Boe and Gärling (2015c) testing whether the loss-sensitivity principle could be extended to integration of the outcomes of two concurrent risky decisions did not receive supported. When investigating whether causal relatedness and uncertainty of outcomes of concurrent decisions would be more frequently integrated than unrelated outcomes, and whether certain outcomes were more frequently integrated than uncertain outcomes, it was shown that this affected integration. The means and ends of regular consumer products were more often chosen when they were presented together in two concurrent decisions as compared to being presented together with either unrelated options or singly (Boe & Gärling, 2015b). In another study it was found that when participants were forced to make choices, the means or ends of consumer products were chosen because the participants attended to the additional benefits, indicating an attentional bias. However, this was not the case when participants were free make both choices (Boe & Gärling, 2015a). The attentional bias was further tested to see if it could explain why decision makers sometimes fail to integrate outcomes of concurrent decisions. The attentional bias was supported as participants that revealed a more positive attitude toward driving were found to choose more frequently to drive to stores within walking distance compared to those with a less positive attitude towards driving (Boe, 2015).

In the described studies of concurrent decisions, the possible options were either risky or riskless. Choices involving risk is concerned with known probabilities. If uncertainty is introduced into a concurrent decision, this means that

one does not know the probabilities. On top of dealing with uncertain probabilities, the individual has to deal with not knowing the possible outcomes of his or her decisions. In choosing between two uncertain concurrent decisions, it is even more plausible that an individual cannot assess the possible future consequences of the decisions that are to be made. This also affects the ability to integrate in a concurrent decision.

It seems that when subjects were about to consider the two decisions in the concurrent problem simultaneously, they were not able to consider all the possible outcomes, even when one of the options consisted of a sure gain in decision one and a sure loss in decision two. The consequence was that the pair of decisions made independently of each other. Perhaps the salience of the sure gain and the sure loss made subjects ignore the other options with different probabilities of winning or losing. Failing to consider the consequences of each decision, may result because of a lack of ability to think through the possible consequences of the decisions in a concurrent decisions problem. Even when knowing the associated risk, this can be a problem. Risky prospects are by definition characterized by possible outcomes and by the probabilities of these outcomes (Kahneman and Tversky, 1984). A complete representation of risky prospects requires that all possible outcomes of concurrent decisions are taken into consideration when making a decision. This is however difficult even in simple problems, due to limited cognitive capabilities.

This paper has shown that there exist several possible explanations of why integration of concurrent decision does not occur. Bonini and Rumiati (1996) has shown that by manipulating the mental segregability of the items in a concurrent decision problem, it is possible to induce subjects to take into account previous decisions or outcomes when making decisions in concurrent decisions. It is also possible that integration of concurrent decisions will not occur unless some other conditions are prevalent. If risk is involved in a concurrent decision, this may make it difficult for the individual to relate the concurrent decisions to each other and integrate them.

An idea for further research is to make subjects being able to think through all possible consequences in a concurrent decision problem. By explicitly illuminating the risk or uncertainty to the subjects, it may be possible to obtain integration in concurrent decisions.

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