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# Choices and affective reactions to negative life events: An averaging/summation analysis

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**Abstract**

Three experiments investigated individuals' preferences and affective reactions to negative life experiences. Participants had a more intense negative affective reaction when they were exposed to a highly negative life experience than when they were exposed to two negative events: a highly negative and a mildly negative life event. Participants also chose the situation containing two versus one negative event. Thus, "more negative events were better" when the events had different affective intensities. When participants were exposed to events having similar affective intensities, however, two negative events produced a more intense negative affective reaction. In addition, participants chose the situation having one versus two negative life experiences. Thus, "more negative events were worse" when the events had similar affective intensities. These results are consistent with an averaging/summation (A/S) model and delineate situations when "more" negative life events are "better" and when "more" negative life events are "worse." Results also ruled out several alternative interpretations including the peak-end rule and mental accounting interpretations.

Keywords: decisions, averaging, summation, affect, negative events, peak-end rule, mental accounting.

## 1 Introduction

"More is worse" when it comes to negative life events. This is a conclusion that follows from behavioral approaches. From behavioral accounts, the addition of a negatively valenced stimulus to an already negatively valenced context should reduce approach and preference tendencies (e.g., Hull, 1943; Young, 1936). The averaging/summation (A/S) model (e.g., Seta, Crisson, Seta & Wang, 1989; Seta, Seta & Wang, 1991; Seta & Seta, 1992) demonstrated that individuals' feelings and preferences are sometimes, but not always, the sum of the affective values associated with each event; for example, individuals may not always feel more negative after experiencing a compound event containing both a highly negative plus mildly negative event than they feel after experiencing a singular highly negative one.

The model incorporates findings in the judgment and social-influence literatures (e.g., Anderson, 1974, 1981; Latane, 1981; Lichtenstein, Earle & Slovic, 1975). Averaging, for example, was found in the judgment literature when individuals were given traits or cues that had discrepant values (see, however, our discussion of set size effects in section 1.3), whereas summation of each individual's impact was seen in the social influence and audience literatures (e.g., Latane, 1981), where participants typically performed a task in front of spectators having similar impact ratings such as similar status levels.

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From the A/S model, averaging effects are not relegated to the judgment domain and summation effects are not relegated to the social influence domain. Rather, individuals' responses reflect sensitivity to the sum of the values associated with each event as well as to central seeking tendencies — the average value of events. (See the Appendix for a quantitative expression of this model). This model was initially developed to provide a theoretical account of how individuals respond to the simultaneous presence of one or multiple audience members having heterogeneous or homogeneous status levels (e.g., Seta et al., 1989). It was extended to homogeneous and heterogeneous life events more generally (e.g., Seta et al., 1991; Seta, Seta, & McElroy, 2002).

### 1.1 The Averaging/Summation (A/S) model

Averaging is a process that establishes a central tendency among stimuli. Establishing a central tendency among stimuli provides individuals with perhaps the best single index for predicting future events and a way of understanding a diverse set of events. If individuals are sensitive to the average level of negativity in their lives, adding a negative event of relatively low valence to a context in which a highly valenced negative event is present would produce a decrease in resultant negative affect. Summative information is also functional and makes individuals sensitive to the total quantity of resources that has been depleted or accumulated and can, for example, provide

information about the demand or availability of resources needed to successfully meet a goal. If individuals are sensitive to the summative level of negativity in their lives, adding a mildly negative event to a context in which a highly valenced negative event is present would result in an increase in negative affect. The A/S model assumes that individuals are sensitive to both the summative and average impact of life events. This assumption is consistent with suggestions that processes have evolved that result in the extraction of these types of statistical information (e.g., Chong & Triesman, 2003, 2005).

Several studies have supported predictions of the A/S model in audience settings using verbal, behavioral and physiological measures (e.g., Seta et al., 1989; Seta & Seta, 1992), as well as in situations containing negative or positive life events (e.g., Seta et al., 1989; Seta, et al., 2002; Seta, Haire & Seta, 2008). One prediction derived from the A/S model is that, when two stimuli are relatively discrepant in stimulus value (e.g., one highly negative and one mildly negative), the impact produced by these events in combination can be less than the influence of the highly negative event in isolation. One reason for this is that the addition of a mildly negative event significantly reduces the average value that characterizes the context while only marginally increasing the summative total of negative consequences. When the same mildly negative event, however, is added to a context containing similar valenced events, the mildly negative stressor increases the total amount of aggregated consequences but has only a marginal influence on the average value characterizing the situation (e.g., Seta & Seta, 1992; Seta et al., 1989, 1991). A possible reason why events discrepant in affective intensity are more likely to produce an averaging effect may be that these events increase the weight and use of averaging (versus summation) whereas similar events are more likely to increase the weight of summation. Thus, individuals may average, sum or both. When they are confronted, for example, with life events with similar affective levels, the central tendency is apparent and thus attention does not need to be directed at establishing a central tendency, allowing attention to be focused on summation — each event builds upon the other. When individuals are confronted with discrepant events the central tendency is not apparent and thus may draw a disproportionately large amount of attention. Thus, individuals may average, sum, or engage in both types of life event integration.

## 1.2 Mental accounting

Prospect theory (e.g. Kahneman & Tversky, 1979, 1982) was originally formulated to model responses to a single unitary outcome. Nevertheless, Kahneman and Tversky (Kahneman & Tversky, 1984; Tversky & Kahneman, 1981) used prospect theory to account for responses to multiple events. Thaler's (1985) mental accounting analysis extended this analysis of multiple event judgments. Thaler reasoned that the value attached to multiple events depends upon whether the events are organized as belonging to the same mental account or to separate accounts. If, for example, they belong to one account, the events are mathematically combined before being evaluated subjectively by using the value function of prospect theory. For example, Thaler and Johnson (1990) showed that, even when events have the same mathematical value, individuals can prefer two separate positively valued events (e.g., $50 and $50) to one (e.g., $100) (see also Linville & Fischer, 1991).

Like mental accounting, the A/S model incorporates a negatively accelerating value function (Appendix). Individuals can assign more value to separate events of $50 & $50 than to a single event of $100. Because $100 is further along the negatively accelerating part of the curve than is either of the $50 events. Contrary to the predictions derived from theorizing about the mental accounting concept, however, the A/S model predicts that two separate events may or may not be preferred to one single event. These effects, for example, depend upon the discrepancy in the values of the events. The importance of discrepancy in predicting the impact of life events is discussed in more detail in the General Discussion.

## 1.3 Overview of Present Research

Research derived from the A/S model has examined individuals' affective reactions when confronted with negative life experiences. It has not examined individuals' preferences for different negative life experiences. Would individuals, for example, choose two negative events over just one? According to the A/S model, when confronted with a choice between option A (a highly negative event) and option B (a highly negative plus mildly negative event) individuals are expected to choose Option B — the two negative event option. However, when all of the events have a similar affective intensity level, such as when option A has one mildly negative event and option B has two mildly negative ones, individuals are expected to choose option A — the one negative event option. In Experiment 1, individuals were confronted with an option containing a single highly negative event and an option containing a highly negative plus mildly negative one. In addition to this condition, Experiment 2 included a second between-subjects condition — one in which individuals were exposed to a single mildly negative event and one in which they were exposed to two mildly negative ones. Support for averaging would be obtained if the one highly negative plus mildly negative event option was preferred over the option containing just a highly nega-

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tive event; and support for summation would be obtained if the one mildly negative option was preferred over the option containing two mildly negative events.

One might argue that, if one negative event is chosen over two negative events, summation is supported at a descriptive level but not necessarily at a theoretical level. Descriptively, summation occurs when the addition of a negative event increases negative affect or when the addition of a positive event increases positive affect. This pattern of results, however, may not always represent the operation of a process involving summation. Rather, it could represent a set size effect, which refers to a situation in which numerically different sets of identically valenced stimuli are perceived differently. The averaging model was extended to include this type of an effect and was explored within the impression formation literature (e.g., Anderson, 1974, 1981; Levin & Kaplan, 1974). For example, a set size effect exists when a target person described as having four negative traits, each with a scale value of $-4$, is not given the same evaluation as when the same person has only one or two traits with a scale value of $-4$. Without including perceivers' initial impression of the person, an averaging model would predict that perceivers would evaluate the two targets in the same way — both would be evaluated as a $-4$. However, when perceivers' initial impression of the person (based on dimensions such as physical appearance or race) is considered, an averaging model would predict that the targets can be evaluated differently (see Anderson, 1974, 1981 for a further discussion of set size effects). For example, if perceivers' initial impression of the target is a $+2$, then the average of the initial impression ($+2$) and one negative trait ($-4$) would be $-1$ ([$+2$ $-4$]/2) whereas the average of the initial impression ($+2$) and four negative traits ($-4$) is $-2.8$ ([$+2$, $-4$, $-4$, $-4$, $-4$]/5).

The same logic can be applied to situations involving negative life events. It may be the case that averaging, rather than summation, is the reason why one negative event can be preferred to two negative ones. This would occur if perceivers consider their initial affective states and if theses initial states were less negative than each of the two mildly negative ones, such as when perceivers' initial affective state is $-1$ and each of the mildly negative events is a$-4$. In this example, one mildly negative event (e.g., $-4$) would have a negative value of $-2.5$ ([$-4$, $-1$]/2), ten mildly negative events a reaction of $-3.7$([$-4 \times 10$, $-1$]/11 and one hundred mildly negative events a reaction of $-3.97$ ([$-4 \times 100$, $-1$]/101). If this is the case then it follows from an averaging analysis that the reaction to many mildly negative events will approach but not exceed the value of a single mildly negative one ($-4$). Thus, when added to a highly negative one, several mildly negative events should not produce a reaction that is more negative than the reaction produced by a highly negative plus mildly negative one. Further, it should not produce a reaction that is equal or more negative than the one produced by a highly negative event. To explore this issue, Experiment 3 included a six mildly negative condition and a highly negative one. It also included a highly negative plus mildly negative condition and a single mildly negative one.

## 2 Experiment 1

Experiment 1 presented participants with choices containing a single highly negative event or containing a highly negative event plus a mildly negative event. When perceivers seek a central tendency among events they should choose a highly negative plus mildly negative event over just a singular highly negative one, regardless of the order of the events' occurrences. We predicted averaging, rather than summation, because the events were associated with different levels of negativity. Furthermore, the impact of each event on the accumulation of resources should not override averaging, as it would in a situation when the implications of one event building on the other is salient; in this situation, summation effects, not averaging, would be expected.

In a choice between events, averaging, for example, would not be likely when individuals who desire to maximize make a choice between options containing outcomes having the same metric or function (e.g., option A providing a single outcome of $-\$100$, and option B providing a $-\$90$ and a $-\$20$ loss). If there are no other differences between the options, then individuals' desire to maximize rewards and minimize losses would lead them to choose the option containing $-\$100$ over the one containing $-\$90$ and $-\$20$. In this example, the difference in the total amount of loss associated with each option is especially salient. Thus, it would be very easy for decision-makers to compare across options and to see how option A has a lesser negative influence on their wealth resources than option B. (See Hsee, 1996, for a discussion of how the characteristics of an item and the method of evaluation can alter the weight that decision makers place on an item.) It is important to note that we are not implying that averaging does not apply to financial outcomes. We simply are describing a situation in which it is easy for decision-makers to see how events would build upon one another — how $-\$90$ and $-\$20$ equal a loss of $-\$110$ and thus, a situation in which summation is likely.

Many everyday decisions involve outcomes that cannot be easily summed to determine movement toward (or away) from a quantitative goal. Experiment 1 was designed to capture the characteristics of these situations. Thus, we predicted that individuals would choose the

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highly negative plus mildly negative option over just a highly negative one.

## 2.1 Method

Twenty female students from Introductory Psychology classes participated in this experiment as an option that partially fulfilled a course research requirement. In this and the other studies reported in this paper, experimental sessions were conducted in small groups. We utilized a within-subjects design that included two negative stimulus conditions: a highly negative event condition; and a mixed condition that contained two events, a highly negative and a mildly negative one. We measured participants' affective response each condition, and their choice between the two.

Upon entering the experimental room, participants were told that the experimenter was interested in their reactions to different events. They then were given packets that contained the experimental manipulations. We used a manipulation commonly employed to induce affective states (e.g., Schwarz & Clore, 1983), in which participants were asked to think about, and write briefly about several negative events. This manipulation should increase the likelihood that participants are in contact with the event's implications. Thus, this type of manipulation is assumed to involve realistic affective consequences.

After considering the events, participants indicated the negativity of experiencing both a highly negative event alone and the negativity of experiencing both a highly negative plus mildly negative one. Participants indicated how negative they felt after thinking about the events happening to them on a 101-point scale where "0" indicated "low negative" and "100" indicated "super extremely negative." In addition, they also were asked to choose between the two options (the highly negative event versus the highly negative plus mildly positive one) by placing a circle around the letter (either A or B) that appeared in front of each option. Order of options and event presentations were counterbalanced. The events used in this experiment, and in Experiments 2 and 3, were events taken from a prior norming study. Participants either read about the highly negative event first or last; and, when asked to decide between options, the highly negative event option either preceded or followed the highly negative and mildly negative one.

Two different highly negative events were used in this study. They were as follows: "having an argument with a significant other" and "experiencing major car troubles." When "having an argument with a significant other" served as the event for the highly negative outcome condition, "experiencing major car troubles" was the highly negative event in the mixed condition — the highly negative plus mildly negative one. Conversely, when "experiencing major car troubles" served as the highly negative event in the highly negative condition, "having an argument with a significant other" served as the highly negative event in the mixed condition. The mildly negative event was "getting some food on your shirt during your last class."

## 2.2 Results and discussion

Participants tended to choose the option containing one highly negative outcome plus one mildly negative over the option containing only a highly negative outcome: 15 vs. 5, respectively ($\chi^2_{N=20} = 5.0$, $p < .05$). The order of the high and mild events was initially tested for and not obtained, $p = .39$.

A repeated-measures analysis was performed on the affect scores of the two within-subjects conditions. When participants were exposed to two discrepant negative events ($M = 47.05$) they reported less negative affect than when they were exposed to the one highly negative event ($M = 59.2$, $F_{1,19} = 14.04$, $p < .01$). Again, there were no significant order effects, p's>.35. The lack of order effects in this experiment demonstrates that averaging effects can be obtained over and above sequence effects, such as those predicted by the peak-end rule (e.g., Kahneman, Fredrickson, Schreiber & Redelmeier, 1993). We will discuss this concept in more depth in the general discussion.

It could be argued that these data support summation, rather than averaging if it is assumed that the perceived value of the highly negative event was assimilated (moved toward) the mildly negative one whereas the mildly negative one remained relatively constant. As long as the perceived value of the highly negative event was lowered sufficiently (e.g., from $-8$ to $-4$) and the mildly negative event remained relatively stable ( e.g., from $-3$ to $-3$), averaging would be explicable from an additive (summative) account; the sum of the highly negative ($-4$) plus mildly negative (-3) would be less than that of the highly negative event ($-8$) in isolation.

To address this possibility, we employed a separate group of participants who were given the same instructions as those provided to our participants in the highly negative and in the mixed condition (highly negative plus mildly negative). However, instead of asking about participants' overall negative affective reaction, we asked them to judge the negativity of each event separately in a between-subjects design. In the highly negative plus mildly negative condition, participants were asked to report on the negativity of the highly negative event and then on the negativity of the mildly negative one (order counterbalanced); in the highly negative condition, they were asked to judge on the negativity of just the highly negative event. To obtain a summed score we added the

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scores of the highly negative and mildly negative event in the highly negative plus mildly negative condition and compared these scores to the scores obtained in the highly negative condition. The combined negative implications of each of the two events (highly plus mildly negative) was significantly higher ($M = 77.68$) than the negative implications of just the highly negative event in isolation ($M = 52.63$, $F_{1,33} = 6.98$, $p = .01$). This effect is inconsistent with a summation account. From this view, the combined implications of two events (highly negative plus mildly negative) should have been lower, not higher, than that of those associated with the singular highly negative event.

# 3 Experiment 2

Additive models predict that "more is worse" when it comes to negative events. However, from an A/S perspective this is not always the case; adding a negative event to an already negative context can function to reduce negative affect (averaging). One critical factor that determines the likelihood of obtaining averaging or summation effects is the discrepancy between the stimulus events. Experiment 2 was designed to determine whether more is "worse" when participants are exposed to events having similar affective intensity levels — a summation effect — and whether adding negative events reduces negative affect — an averaging effect. This experiment also was designed to retest the A/S position that averaging effects can be obtained when a highly negative event precedes or follows a mildly negative one.

In Experiment 1, the affective rating scale always preceded participants' choices. It might be argued that participants' choice ratings were a consequence of their desire to be consistent with their affective ratings. Thus, when they demonstrated averaging in their affective ratings, they demonstrated a similar and consistent effect in their choice ratings. Would choice ratings be similar when participants are not given affective ratings? To address this question, Experiment 2 included a condition in which participants were given choice ratings without affective ratings.

## 3.1 Method

Sixty-nine students participated in this experiment. The design included 2 levels of the within-subject variable, manipulating the number of negative events presented in the options (one or two negative outcomes), 2 levels of a between-subjects manipulation of negative event discrepancy (discrepant and equal) and 2 levels of affective ratings (present or absent).[1] In the discrepant valence condition, participants were given choices between a highly negative event and a highly negative plus mildly negative one. In the equal valence or similar condition, they were given choices between options containing one mildly negative event and an option containing two mildly negative ones.

Similar procedures as used in Experiment 1 were used in this study, including counterbalancing and order controls. We also used the same highly negative events. In this study, however, three mildly negative events were used for the mildly negative options: "getting a bit of food on your shirt during your last class," "finding that the drink machine is out of order," and "disliking the music on the radio." "Getting a bit of food on your shirt during your last class" served as the mildly negative outcome in the highly negative plus mildly negative event condition and one of the two events in the two mildly negative event condition. The other two mildly negative events were counterbalanced across the one and two mildly negative outcome conditions. Choice and affective responses were collected in the manner described in the previous study.

## 3.2 Results and discussion

### 3.2.1 Choice analyses

A chi-square analysis of the choice data revealed a significant interaction between Negative Event Discrepancy and the Number of Negative Events conditions. Participants chose the highly negative event plus mildly negative event option over the highly negative one: 28 (76%) vs. 9 (24%), respectively ($\chi^2_{N=37} = 9.76$, $p < .01$). But they chose the two mildly negative option over the option containing a single mildly negative event: 29 (91%) vs. 3 (9%) ($\chi^2_{N=32} = 21.13$, $p < .001$). These two results produced an interaction between negative event discrepancy and the number of negative events ($\chi^2_{N=69} = 30.49$, $p < .001$). There were no effects of the order of events on participants' responses, all $p$'s$>$.26.[2]

[1] The condition in which the affective rating scale was absent was run in the same semester but at a somewhat later date than the affective rating present condition. We included this as a part of Experiment 2 because it was conducted by the same experimenter in the same academic institution and with the same population of participants. It included a smaller number of participants than the affective rating present condition because of the availability of participants.

[2] The Chi-Square analysis did not reveal an interaction involving the presence or absence of the affective rating scale. Nevertheless, we conducted two additional Chi-Square analyses to be sure that similar results were found regardless of whether affect ratings were or were not made. One analysis was conducted on participants' choice ratings in the affective present score condition and another on participants' choices in the absent condition. When the affective rating scale was present, the analysis revealed a significant interaction between Negative Event Discrepancy and the Number of Negative Events condition ($\chi^2_{N=42} = 16.29$,

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#### 3.2.2 Affect rating analyses

Participants rated the situations containing highly negative events higher ($M = 41.64$) than situations containing the lower valenced events ($M = 16.2$), $F_{1,40} = 20.93$, $p < .001$. More interestingly, and as predicted, this main effect was qualified by a significant Negative Event Discrepancy X Number of Event interaction, $F_{1,40} = 4.24$, $p < .05$. Although neither of the two contrasts were significant, the interaction was due to participants reporting a higher level of negative affect in the one high ($M = 46.64$) versus one high and one mildly negative event condition ($M = 36.64$), $F_{1,40} = 3.75$, $p < .10$ whereas an opposite pattern was obtained when 1 ($M = 13.5$) and 2 ($M = 18.9$) mildly negative event conditions were compared, $F < 1$. We found no order effects in this analysis, p's $> .34$.

#### 3.2.3 Results summary

Participants chose a single highly negative plus mildly negative event over a single highly negative one but chose the option containing a single mildly negative event over the one containing two such events. These results were obtained when participants' affective ratings of the options did or did not precede their choice ratings. In addition, participants' perceptions of the options' negativity were consistent with their preferences. In addition, these averaging and summation effects were independent of the way in which the events were ordered.

# 4 Experiment 3

In Experiment 2, participants chose the option containing a single mildly negative condition over the option containing two mildly negative ones. The negative affect associated with two mildly negative events was greater — but not significantly so — than that associated with a single mildly negative one. In Experiment 3, we included a six event mildly negative condition. This condition allowed us to determine whether participants felt significantly more negatively about six versus one mildly negative event. It also allowed us to determine if the descriptive summation effects obtained in Experiment 2 were due to a theoretical summation process. Theoretical summation would be shown if several mildly negative events produced a more negative reaction than one mildly event, and if they also produced a negative reaction that was equal to or more negative than that produced by a highly negative event.

## 4.1 Method

Participants were 64 students from Introductory Psychology classes who participated in this study for partial fulfillment of course credit. We used a between-subjects design in which participants were assigned randomly to one of four negative events conditions: they considered either a highly negative event, a mildly negative event, a mildly negative plus highly negative event or six mildly negative events.

Similar to previous experiments, participants were asked to think and write about events and were asked to indicate how bad they felt after thinking about the events happening to them, on the 101-point scale described earlier. The highly negative event used in this experiment was "being put on academic probation." Six relatively mild negative events were used. They were: "having some difficulties with friends, "having some car troubles," "waking up and finding the shower won't rise above lukewarm," "owing someone some money," and "having too many responsibilities," "misplacing or losing something." All of these events were used in the six mildly negative condition (order counterbalanced). In conditions containing one mildly negative event, each of these events was assigned as the mildly negative event, counterbalanced across conditions. The presentation of events having different affective intensity levels was also counterbalanced in this condition.

## 4.2 Results and discussion

The four conditions did not produce equivalent ratings ($F_{3,60} = 7.69$, $p < .001$). The means are contained in Table 1. Planned contrasts showed that the one highly negative condition produced more negative affect than the mixed highly negative plus mildly negative condition ($F_{1,60} = 10.04$, $p < .01$) — the expected averaging effect. The lack of order effects ($p > .8$) in the mixed condition supports the A/S position that averaging can be obtained over and above sequence effects.

In addition, this experiment demonstrated summation in that the six mildly negative condition produced more negative affect than the one mildly negative condition ($F_{1,60} = 11.3$, $p < .01$), and it produced a similar nega-

$p < .001$). Participants chose the highly negative plus mildly negative option over the highly negative one, ($\chi^2_{N=22} = 6.55$, $p < .01$), whereas they chose the two mildly negative option over the option containing a single mildly negative event ($\chi^2_{N=20} = 9.8$, $p < .01$). No other significant effects were obtained.

Consistent with the previous analysis, an analysis of the affect rating absent data also revealed a significant Negative Event Discrepancy X Number of Negative Events Interaction, ($\chi^2_{N=27} = 14.85$, $p < .001$). Participants chose the highly negative plus mildly negative option over the highly negative one ($\chi^2_{N=15} = 3.26$, $p < .07$) whereas they chose the two mildly negative option over the option containing one mildly negative event ($\chi^2_{N=12} = 12.0$, $p < .001$). No other significant effects were obtained. Thus, averaging and summation effects were obtained when affective ratings did or did not precede participants' choice ratings.

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Table 1: Mean negative affect ratings by condition.

| Number of Negative Events | Negativity Rating |
|---|---|
| 1 highly negative event | 63.25 |
| 1 mildly negative event | 25.33 |
| 1 highly and 1 mildly negative event | 35.76 |
| 6 mildly negative events | 55.44 |

tive affective reaction as that produced by the one highly negative event condition ($F < 1$).

# 5 General discussion

Three studies were conducted that tested assumptions of the A/S model in the context of perceivers' choices and affective reactions to negatively valenced events. Consistent with this perspective, "more" negative events were "worse" when participants were confronted with stimuli of similar affective intensity levels whereas "more" negative events were "better" when they were confronted with stimuli of discrepant affective intensities.

These studies provide information on when predictions from additive accounts, such as hedonic calculus, will and will not occur. Additive accounts predict that "more negative events are worse" — a summation effect. As seen in the present series of studies, "more" negative events can be "worse" as predicted by additive accounts but more negative events can also be diminutive — an averaging effect. The discrepancy between the negative stimuli was the key variable in this study affecting the likelihood of obtaining averaging and summation effects.

When the affective intensity discrepancy between events was large, an averaging effect was obtained; when the discrepancy was small, summation was obtained.

## 5.1 Peak-end rule

Kahneman and colleagues (e.g., Kahneman et al., 1993; Fredrickson & Kahneman, 1993; Redelmeier & Kahneman, 1996) have shown that participants often neglect the duration of an episode and concentrate on the episode's peak and end intensities and thus follow a peak-end rule of judgment. This rule is now a part of a "judgment by prototype" model (e.g., Ariely, 1998; Ariely & Carmon, 2000; Hsee, Salovey & Abelson, 1994). Like the A/S model, the peak-end rule concludes that utility is not always positively related to the sum of the values associated with events.

In one study, Kahneman et al. (1993), asked participants to experience sequences of aversive sensations. In the short duration sequence, participants immersed their hand in cold water for 60s whereas in the long sequence they were exposed to the same cold water for the first 60s, but also were exposed to a less aversive water temperature for the last 30s. The majority of participants chose to experience the long sequence even though this sequence represented 30s of additional aversive stimulation. Thus, participants preferred the episode containing longer durations of aversive stimulation. Other studies have extended this "duration neglect" finding to other forms of aversive stimulation, such as aversive sounds (e.g., Ariely & Zauberman, 2000), unpleasant movie clips (Fredrickson & Kahneman, 2003) and medical procedures and treatments (e.g., Chapman, 2000; Redelmeier, Katz & Kahneman, 1997; Redelmeier & Kahneman, 1996).

People also have been shown to neglect the duration of positive episodes. For example, Fredrickson and Kahneman (1993) showed that the duration of a movie clip had little impact on viewers' evaluations of an unpleasant movie when the peak and end intensities were taken into consideration. And Diener, Wirtz, and Oishi (2001) found that participants rated another person's "wonderful life" as more desirable when it ended abruptly than when it lasted longer but the additional years were only relatively good ones.

In addition to an episode's peak and end intensities, evaluations and memories for events have been shown to depend upon an episode's rate of improvement (e.g., Baumgartner, Sujan & Padgett, 1997; Hsee & Abelson, 1991; Hsee, et al., 1994; Loewenstein & Sicherman, 1991) and how good and bad aspects of the episode are distributed over time (Loewenstein & Prelec, 1993). The importance individuals place on the pattern of a sequence, such as duration, peak and end intensities is not static. Ariely and Zauberman (2000), for example, found that the pattern of an episode — its peak and end intensities — had less of an impact on participants' judgments when the hedonic experience was composed of multiple segments.

## 5.2 Comparison of models

The A/S and peak-end rule differ in important ways. First, and in contrast to the peak-end rule, the A/S model predicts that, even when the sequence of events is not salient, a mildly negative plus highly negative event can still produce less negative affect than the highly negative one in isolation. Second, the A/S model takes the discrepancy between events into consideration in its predictions concerning when averaging versus summation effects are likely to occur. Thus the A/S model makes predictions about when individuals' reactions to life events will reflect summation and averaging effects.

Research on the peak-end rule has dealt with an unfolding continuous experience (e.g., Kahneman et al., 1993;

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Loewenstein & Prelec, 1993). The temporal sequencing of events was a salient feature of these procedures. In contrast, research on the averaging/summation model has dealt with contexts, such as audiences, in which sequential information was not available or salient. For example, when an audience was composed of multiple members, performers were exposed simultaneously to all members in this context. Thus, the impact of the arrangement of stimuli cannot be interpreted via changes in the sequencing of the audience members over time.

In our prior research, and in the present study, the events that were presented were discrete and unique from one another, and were not presented as having unfolded as a meaningful stream. Therefore, the sequencing of events was not a salient feature in this research testing the A/S model. Consequently, neither the peak-end nor improvement rules were driving forces in the results of these studies. Rather, we found that, because of the operation of central seeking tendencies, a mildly negative plus highly negative event produced less negative affect than just a highly negative one, regardless of the sequencing of the stimuli.[3] Thus, the results of these studies provide evidence that averaging effects can be obtained over and above sequence effects.

It is important to note that sequencing effects like those predicted by the peak-end rule can be accounted for within the A/S model. For example, in situations in which the peak and end is especially salient, participants' judgment would be heavily influenced by these two factors — these factors would have an especially high weight. (See the Appendix for a mathematical presentation of weights). If participants average the peak and end values and the end is less negative than the peak, then the average of the peak and end would be less negative than a sequence without this end event. If the end is more negative, however, the average of the peak and end would be more, not less, negative than a sequence without this end event. Of course, from the A/S model, when the peak and end are critical factors, the discrepancy between the peak and end's intensity levels would influence the likelihood and strength of averaging.

The sequencing of events also may change the value of the end event. When multiple events comprise a meaningful stream, events that precede the end event can easily alter the value of the end event. For example, when improvement goals are salient, a positive (successful) end event that follows a few negative (unsuccessful) events may be perceived to be more positive than either the same positive end event that follows a single negative event or the same positive event in isolation (e.g., Festinger, 1957; Seta & Seta, 1982).

The weight assigned to events also may be influenced by the discrepancy in the affective intensity levels of events. In some situations, a mildly intense event may have little or no impact (see Seta & Seta, 1996). For example, when the discrepancy between events is very large, as when a mildly negative event is only slightly negative and a second event is highly negative, the mildly negative event may be given little or no weight in perceivers' reactions. Thus, in this situation, perceivers would respond in a similar way to a context containing a highly negative event and a situation containing the same highly negative event plus a very mild negative one.

### 5.3 Conclusion

The results of these experiments demonstrated the operation of averaging and summation in situations in which individuals are confronted with negative life events. In doing so, they delineated situations when "more" negative events can be "better" and when "more" can be "worse." More negative events produced decrements in negative affective reactions and increments in preference level when individuals were confronted with events having discrepant affective intensity levels; more, however, produced increments in negative affective levels and decrements in preference levels when individuals were confronted with events having similar affective intensities.

[3]It is not entirely clear from the peak-end rule whether a mildly negative event plus a highly negative one will be preferred to a singular highly negative one when the highly negative event is presented last. For this effect to occur, the mildly negative plus highly negative event would need to have less value when it appears in combination versus when it appears by itself. This might be the case because, when a highly negative event is preceded by a mildly negative one, it is the second experienced negative event and thus it may have less value than when it the only experienced negative event. However, because the highly negative event is counter to improvement goals it may have more, not less, negative value in combination than in isolation.

## References

Anderson, N. H. (1981). *Foundations of information integration theory.* New York: Academic Press.

Anderson, N. H. (1974). Cross-task validation of functional measurement using judgments of total magnitude. *Journal of Experimental Psychology, 102*, 226–233.

Ariely, D. (1998). Combining experiences over time: The effects of duration, intensity changes and on-line measurements on retrospective pain evaluations. *Journal of Behavioral Decision Making 11*, 19–45.

Ariely, D., & Carmon, Z. (2000). Gestalt characteristics of experiences: The defining features of summarized events. *Journal of Behavioral Decision Making, 13*, 191–201.

Ariely, D., & Zauberman, G. (2000). On the making of an experience: The effects of breaking and combining

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experiences on their overall evaluation. *Journal of Behavioral Decision Making, 13*, 219–232.

Baumgartner, H., Sujan, M., & Padgett, D. (1997). Patterns of affective reactions to advertisements: The integration of moment-to-moment responses into overall judgments. *Journal of Marketing Research, 34,* 219–232.

Chapman, G. B. (2000). Preferences for improving and declining sequences of health outcomes. *Journal of Behavioral Decision Making, 13*, Special Issue: Time and Decision, 203–218.

Chong, S. C., & Treisman, A. (2003). Representation of statistical properties. *Visual Research, 43,* 393–404.

Chong, S. C., & Treisman, A. (2005). Statistical processing: Computing the average size in perceptual groups. *Vision Research 45*, 891–900.

Diener, E., Wirtz, D., & Oishi, S. (2001). End effects of rated quality of life: The James Dean effect. *Psychological Science, 12*, 124–128.

Festinger, L. (1957). A theory of cognitive dissonance. Stanford, CA: Stanford University Press.

Fredrickson, B. L., & Kahneman, D. (1993). Duration neglect in retrospective evaluations of affective episodes. *Journal of Personality and Social Psychology, 65*, 45–55.

Hsee, C. K. (1996). The evaluability hypothesis: An explanation for preference reversals between joint and separate evaluations of alternatives. *Organizational Behavior and Human Decision Processes 67*, 247–257.

Hsee, C. K., Salovey, P., & Abelson, R. P. (1994). The quasi-acceleration relation: Satisfaction as a function of the change of velocity of outcome over time. *Journal of Experimental Social Psychology, 30*, 96–111.

Hsee, C. K., & Abelson, R. P. (1991). Velocity relation: Satisfaction as a function of the first derivative over time. *Journal of Personality and Social Psychology, 60*, 341–347.

Hull, C. L. (1943). *Principles of Behavior, an Introduction to Behavior Theory.* Oxford, England: Appleton-Century.

Kahneman, D., Fredrickson, B., Schreiber, C., & Redelmeier, D. (1993). When more pain is preferred to less: Adding a better end. *Psychological Science, 4,* 401–405.

Kahneman, D., & Tversky, A. (1979). Prospect Theory : An analysis of decision under risk. *Econometica, 47*, 313–327.

Kahneman, D.,& Tversky, A. (1982). The psychology of preferences. *Scientific American, 246*, 160–173.

Kahneman, D., & Tversky, A. (1984). Choices, values and frames. *American Psychologist, 39*, 341–350.

Latane, B. (1981). The psychology of social impact. *American Psychologist, 36*, 343- 356.

Levin, I. P., & Kaplan, M. F. (1974). The set-size effect in personality impression formation is not an artifact. *Bulletin of the Psychonomic Society, 3,* 187–188.

Lichtenstein, S., Earle, T. C., & Slovic, P. (1975). Cue utilization in a numerical prediction task. *Journal of Experimental Psychology: Human Perception and Performance, 1,* 77–85.

Linville, P., & Fischer, G. (1991). Preferences for separating or combining events. *Journal of Personality and Social Psychology, 60*, 5–23.

Loewenstein, G., & Prelec, D.(1993). Anomalies in interpersonal choice : Evidence and an interpretation. In J. Elster & Loewenstein, G. (Eds.) *Choice over time.* New York: NY: Russell Sage Foundation.

Loewenstein, G.,& Sicherman, N. (1991). Do workers prefer increasing wage profiles? *Journal of Labor Economics, 9,* 67–84.

Redelmeier, D. A., & Kahneman, D. (1996). Patients' memories of painful medical treatments: Real-time and retrospective evaluations of two minimally invasive procedures. *Pain, 66*, 3–8.

Redelmeier, D. A., Katz, J., & Kahneman, D. (2003). Memories of colonoscopy: A randomized trial. *Pain, 104*, 187–194.

Schwarz, N., & Clore, G. L. (1983). Mood, misattribution, and judgments of well-being: Informative and directive functions of affective states. *Journal of Personality and Social Psychology, 45*, 513–523.

Seta, C. E., & Seta, J. J. (1992). Increments and decrements in mean arterial pressure as a function of audience composition: An averaging and summation analysis. *Personality and Social Psychology Bulletin, 18*, 173–181.

Seta, C. E., & Seta, J. J. (1996). When more is less: An averaging/summation analysis of social anxiety. *Journal of Research in Personality. 30,* 496–509.

Seta, J. J., Crisson, J. E., Seta, C. E., & Wang, M. A. (1989). Task performance and perceptions of anxiety: Averaging and summation in an evaluative setting. *Journal of Personality and Social Psychology, 56,* 387–396.

Seta, J. J., Haire, A.,& Seta, C. E. (2008). Averaging and summation: Positivity and choice as a function of the number and affective intensity of life events. *Journal of Experimental Social Psychology, 44,* 173–186.

Seta, J. J., & Seta, C. E. (1982). Personal equity — An intrapersonal comparator system analysis of reward value. *Journal of Personality and Social Psychology, 43*, 22- 235.

Seta, J. J., Seta, C. E., & McElroy, T. (2002). Strategies for reducing the stress of negative life experiences: An averaging/summation analysis. *Personality and Social Psychology Bulletin, 28*, 1574–1585.

Seta, J. J., Seta, C. E., & Wang, M. A. (1991). Feelings of negativity and stress: An averaging-summation analysis of impressions of negative life experiences. *Personality and Social Psychology Bulletin, 17*, 376–384.

Thaler, R. H. (1985). Mental accounting and consumer choice. *Marketing Science, 4*, 199- 214.

Thaler, R. H., & Johnson, E. J. (1990). Gambling with the house money and trying to break even: The effects of prior outcomes on risky choice. *Management Science, 36*, 643–660.

Tversky, A., & Kahneman, D. (1981). The framing of decisions and the psychology of choice. *Science, 211*, 453–458.

Young, P. T. (1936). *Motivation of Behavior.* New York: John Wiley & Sons, Inc.

# Appendix

The averaging/summation (AS) model can be expressed more precisely by the equation below.

The first bracketed section contains an averaging rule; the second bracket contains a summation rule. $R$ refers to the individual's overall response (e.g., stress level); $S$ refers to stimulus value; $S_0$ represents the initial state of the individual as he or she enters the context as well as the individual's initial expectation concerning the type of information that will be contained in the context; $S_1$, $S_2$ refers to the defining features of each stimulus such as its properties and implications; $W$ refers to the weight or influence of the stimulus that is determined by factors such as importance or attention; $V$ refers to the strength or influence of these two integration rules; $V_1$ corresponds to the strength of averaging; $V_2$ refers to the strength of summation.

Essentially, this formula expresses a method of integrating various components of a setting and includes individuals' sensitivities to both the average (or central tendency) impact of the various components (first bracketed section) and the summative (or accumulated), impact of every individual component (second bracketed section). Each stimulus within the context ($S$) contributes to the determination of a central tendency (the average) and the summative impact of the components, and these stimuli combine to produce an overall response to the setting ($R$). Each stimulus has a value along some dimension of judgment. These values may be along dimensions such as the magnitude of negativity, positivity, status level, confidence, or consequences. In addition, the summation procedure is raised to a power ($t$) with an exponent less than 1 to reflect the commonly found marginally decreasing utility function for increments in the number of stimuli in the setting.

$$R = \frac{V_1 \left[ \dfrac{W_0 S_0 + W_1 S_1 + W_2 S_2 + \ldots}{W_0 + W_1 + W_2 + \ldots} \right] + V_2 \left[ W_0 S_0 + W_1 S_1 + W_2 S_2 + \ldots \right]^{t<1}}{V_1 + V_2}$$

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