

## 주관적 안녕감과 정서가가 있는 사건에 대한 기억: 긍정적인 사건을 인식하는 비율과 기억 재구성의 관계

Subjective Well-Being and Memory of Valenced Life Events: The Relationship between Perception Ratio and Memory Reconstruction of Positive Events

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**Abstract** : This research investigated differences of perception ratio and processes of memory reconstruction. To examine the differences in perception for positive or negative events related to individual subjective well-level, 199 participants were asked to report the perceived ratio of positive versus negative events for the provided event list. Also, recall differences of positive versus negative events were examined in relation to individual differences in happiness. Results partially supported the hypothesis that happy people perceive more positive stimulus in a given situation than less happy people. Happy people also showed more positive percentage in recalled events than actual ratio while unhappy people reported less positive recall percentage than actual ratio. These findings indicate existence of cognitive process that enhances positive or negative memory related to subjective well-being. Significant correlation between perceived ratio and recalled ratio further supports this proposition. Finally, theoretical implications of the present research and suggestions for future research were discussed.

**Key Words** : Subjective well-being, memory reconstruction, perception ratio, positive life event,

**요약** : 본 연구는 주관적 안녕감이 긍정적인 사건을 인식하는 비율과 나아가 기억을 재구성하는 인지적 과정에 있어서 어떠한 영향을 미치는지 알아보기 위해 시행되었다. 199명의 학부생들이

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일상적으로 일어날법한 긍정적인 사건과 부정적인 사건 40개를 기술한 문장들을 본 후 이에 대한 회상 과제와 재인 과제를 수행하였다. 먼저 사건을 기술한 문장을 본 후 긍정적인 사건과 부정적인 사건에 대한 비율을 응답하게 한 결과, 삶에 대한 만족도가 높은 참가자들이 긍정적인 문장의 비율이 월등히 높은 조건에서 긍정적인 사건의 비율을 실제보다 더 높게 보고하였으며, 또한 긍정적인 비율이 높은 조건에서 주관적 안녕감이 높은 참가자들은 긍정적인 문장을 더 많이 회상했다. 참가자들이 처음 보고한 긍정적인 사건의 비율과 실제 회상한 기억들 중 긍정적인 사건의 비율은 정적인 상관을 가졌다. 그러나 예상과는 달리 재인 과제에서는 참가자들은 주관적 안녕감 수준에 따라 유의미하게 차이 나는 오류를 보이지 않았다. 마지막으로 이 연구의 이론적 함의와 후속 연구를 위한 제언이 논의되었다.

**주제어** : 주관적 안녕감, 기억 재구성, 인식 비율, 긍정적 사건

## 1. Introduction

As a trend emphasizing individual values has become larger, so as people concern the value of well-being in their life. Since people recognize that happiness is related to positive elements of their life, they put significant time and effort to grasp happiness through various dimensions of their life. Economic prosperity, social status, health, supportive family relationship, and social networks are examples of such expected ways of heading to happiness. However, research in Subjective Well-Being (SWB) has consistently revealed that not every people have the same level of happiness regardless of how much effort they invested. While adverse circumstance could be positive and hopeful for happy people [23, 37], some people keep complaining and are

pessimistic under objectively sufficient situation [21, 37].

In previous research on SWB, research on bottom-up factors of SWB has shown relatively small effect size for external, objective situations [11, 19]. Research then has tried to explain variability in SWB [25, 32, 52] and early studies in top-down approaches have focused on dispositional factors. Recently, studies have approached the happiness by understanding cognitive and motivational process that determines how events and circumstances are perceived [33, 34, 35]. People "cognitively process" all life events [45], and therefore life events are subjectively interpreted, reconstructed and remembered rather than being processed in objective forms [9, 44]. That is, individuals perceive subjectively different forms for the same context. Thus, a construal theory of SWB emphasizes cognitive and motivational process that enhances

happiness for further understanding of why some people are happier than others. Studies have revealed that factors such as social comparison, self-evaluation, and self-reflection are related to people's well-being [33]. For example, happy people do not frequently compare themselves to others and they have less impact under the social comparison situation. In contrast, unhappy people are heavily influenced by social comparison information [4, 10, 51, 53]. The present study also attempted to reveal further cognitive and motivational process that influences SWB based on the construal theory.

Studies of memory have revealed the positive relationship between positive recall of experience and individual SWB level. However, memory is reconstructive [30] and thus a process may exist to reconstruct memory. That is, to interpret the result as happy people recall more positive experience seems simple to explain complex process under memory construction. Rather, it is plausible that happy people actually experience more positive experience, memorize more positive events even for the same level of experience, or interpret events more positively than unhappy people so as to make different recall patterns. Thus, the present study was designed to further explain the underlying process of memory differences for events between

happy and unhappy people. Specifically, this study investigated differences in the perceived ratio between positive and negative events and differences in recall and recognition of events.

## 1.1 Theoretical Context

Happy people evaluate their lives more positively [35] and recall more positive versus negative life events than unhappy people [17, 41]. However, studies focusing on the effects of long term SWB on memory of life events do not have clear explanation of why happy people recall more positive versus negative events than unhappy people. Happy people may in fact experience more positive experience. Along with a study of individual characteristics related to SWB, happy people show higher extroversion and pursue more positive situation [16]. Or there may be individual differences in long-term SWB on cognitive process resulting in memory bias. Thus, in present study two possible explanations that the recall differences between positive versus negative events is caused by either actual experience differences or differences in cognitive process underlying memory are discussed.

### 1.1.1 Positive memory and possibility of difference in actual experience

It was consistently found in many studies that self report measure of long-term SWB is positively related with the recall number of positive versus negative events [17, 41, 47]. For example, European Americans reported increased retrospective week satisfaction while Asians showed no difference between actual week satisfaction and retrospective satisfaction in two weeks time interval [39]. This result could be an evidence of recall difference. Also, higher recall number of positive versus negative recall for past 3 year of life events for happy people [46] also support a pattern of recall difference by individual SWB level. However, participants in previous studies were given separate time-recall tests of positive and negative life events. Since recall is totally based on experience of participants, a potential retrieval explanation for the observed differences in the recall of valenced life events by happy and unhappy people can be found in the actual difference of experience.

Happy people are socially more adaptive than unhappy people. Smith [48] defined optimism, emotional stability, sociality and self-insight as characteristics related to happiness and extroversion is a typical individual characteristic that influence individual SWB level supported by many studies

[12, 19, 54]. Since extroverts are sensitive to rewards and such rewards are given by social activities, extroverts tend to enjoy and actively involve social situations [31]. According to previous findings, happy people are expected to be more active, involved in more social activity, and thus have more actual positive experience. Also, a possible difference in actual experience indicates the need for controlling experience level for more exact interpretation of recall difference along SWB level.

### 1.1.2 Cognitive and motivational process maintaining positive memory

People memorize their experience in individually evaluated, reconstructed form [9, 44]. It was founded in many studies that memory is not perseverance of original form like a picture. People reconstruct memory as a different form from original event [30]. Since episodic memory consists of many semantic memories, memory is easily influenced by various factors such as affect at the moment of recall [22]. Short-term event and experience could influence individual SWB level as many studies revealed. According to the previous studies that experience and memory are reconstructed through cognitive and motivational process, however, we proposed that those cognitive processes also influence the event recall difference related with SWB level. However, it has not clearly

revealed that through which process positive experiences are perceived and positive memory is reconstructed.

***Different ratio of perceived positive versus negative events***

Several studies have used a life-event recall measure to assess memory-SWB relationship. This recall measure made it difficult to control the influence of participants of actual experience level. However, alternative explanation of possible cognitive and motivational process related to recall difference has been suggested from previous research [33, 34, 35]. Thus, a possible intervention of cognitive and motivational process was discussed in the present study. Although we know of no research that has specifically examined difference in event perception among happy versus unhappy individuals, there is some suggestive evidence that individual differences related to recall level of happiness may be associated with the way such cognitive processes of self-esteem maintenance process are used.

People tend to think and behave in a way to maintain self [7, 20, 49]. People with low self-esteem (LSE) in particular seem not to accept internal positive feedback for self while reacting sensitively toward external positive feedback during their performance. In contrast, high self-esteem (HSE) people easily accept positive feedback regardless of feedback source [28].

Also, HSE people tend to do internal attribution for positive events [1]. Through those processes, HSE people maintain and enhance their self-esteem level, but LSE people do not fully benefit from positive life events.

People also show a different pattern toward negative feedback related to enduring level of self-esteem. Under failure, HSE people tend to make external attribution [1], underestimate the importance of failure part in their lives [6] or emphasizing their ability in non-failed area [8] so as to minimize the influence of failure. In contrast, LSE people feel themselves negatively under failure by internal attribution and generalization [7, 20]. Also, HSE people are less influenced emotionally under failure situation [5] and retrieve faster from negative mood [24]. Likewise, HSE people are more benefit from positive impact and less influenced by negative events, and therefore maintain their high self-esteem level. However, LSE people are less benefit from success (or positive event) but sensitive to failure, and thus preserve their low level of self-esteem in the long term.

Not only people think in a way they think, but also react, see and hear parallel to self-perception. According to Swann [49], LSE people tend to seek negative feedback since they feel negative feedback fits their negative self, rather than avoid negative stimulus

remaining negative consequences. Swann and Read [50] also found the consistent result that when participants could select feedback either fitting or not-fitting with their self-view, the participants prefer feedback that are felt to fit with their self view rather than its positivity. In sum, the findings of a self-esteem maintenance process are consistent with a construal approach to understand individual differences in happiness. In other words, we proposed that happy people may feel positive information more salient because it fits to their self view and therefore memorize easily than negative information. While unhappy people memorize negative information more since it is felt more salient and more fitted under the same amount of information.

***Memory reconstruction: Difference in recall and recognition***

Previous research has investigated other possible variables that influence happy people recall more positive versus negative event but the process underlying process of pre-recall stage to enhance positive memory has not been clearly explained. Positive affect at the moment of recall was one of alternative variables to be investigated. However, the studies of affect and memory have not shown consistent results [2, 3, 27, 36]. Parrott and Sabini [40] explain that only when participants recognized the fact that

particular affect was induced, participants recall affect-congruent memory. According to Parrott and Sabini's explanation, it is difficult to interpret previous results of positive versus negative recall as influence of affect because most of previous research did not have affect inducement step in experiment and also it is difficult to assume positive and negative affect was induced all participants in previous research.

Research that examined retrospective memory during a certain time interval shows persuasive evidence for cognitive process. According to Oishi [39], European American reported significantly increased positivity in retrospective study done after two weeks from week satisfaction report while Asians showed no difference between actual satisfaction and retrospective satisfaction. These results support the explanation that happy people think positive experience more frequently [13], which then causes more positive memory. In addition, those evidences suggest possibility for existence of cognitive process in memory recall.

**1.2 Overview of current study**

Self-reported positive versus negative life event recall method used to investigate individual differences along with SWB is based on

participant's actual experience. Thus, study results were not independent from actual experience difference and have limitation in interpreting results. In addition, underlying process of memory recall has not been clearly investigated. The purpose of the present study was to examine the relationship between SWB and difference in event perception and cognitive process of recall while controlling for participants' actual experience in memory. In particular, this paper addresses two main questions: (1) Do people differ in how they perceive positive versus negative events, and (2) Are such differences in how people view valenced events reliably associated with their recall and recognition differences in positive versus negative events?

To control for the influence of actual experience, the present study asked participants to recall provided event lists given during the experiment rather than recall experience. In addition, to investigate the possibility of individual differences related to happiness level at the time of perceiving valenced events, the present study examined ratio differences. For investigating cognitive and motivational process of recall difference, recognition error was examined.

Taken together, the previous studies suggest that cognitive and motivational process may exist in event recall. Thus, we proposed that there

may be a difference in perceiving positive and negative events related to individual differences of SWB if individuals accept information that fits with self-view more easily. Thus a hypothesis is that high SWB people recognize the portion of positive events higher than low SWB people and low SWB people recognize the portion of negative events higher than high SWB people for a given number of event lists.

In the recall task, if individuals remember information that fits self view, we hypothesized that high SWB participants recall more positive events while low SWB participants recall more negative events than the opposite group. To control for the possibility of differences in actual positive or negative experience, event lists were provided by the researcher rather than actual life event recall.

Lastly, if cognitive and motivational process influences memory which enhances positive or negative memory, there may be a pattern in memory bias. Thus, we hypothesized that high SWB people show more memory bias in the positive recognition task and low SWB people show more memory bias in the negative recognition task.

## 2. Pre–Study: Event Selection

The goal of the pre–study was (a) to estimate the valence intensity and perceived relevance of sentences describing life events and (b) to select events having similar intensity and relevance for the further experiment. In the present study, the participants were asked to memorize provided event lists rather than to recall their experienced life events to control for the influence of difference in previous experience on the memory. The intensity of the event in the provided list could influence on recall such that participants recall events with high intensity more easily rather than show recall differences based on positivity or negativity of the events. To control for the possibility of intensity effect, the pre–study examined the valence intensity of each event.

### 2.1 Method

#### *Participants*

20 undergraduate students enrolled in a psychology course participated in this study in exchange for course credit.

#### *Procedure*

Participants were asked to evaluate valence intensity and relevance of 200 sentences describing either positive or negative life events on a 7–point scale

(1 = strongly disagree to 7 = strongly agree).

#### *Materials*

Some of items in the event list were drawn from other the scale of life events designed for adolescents [38] and Social Readjustment Rating Scale [26]. Some other items were drawn from daily report of 21 volunteers (8 men and 13 women). Volunteers reported daily valenced events for one week via e–mail. Among selected events, 100 positive events included "coffee break with friends after having lunch," "travel with friends" while 100 negative events included "grade was worse than expected," and "retirement from work."

### 2.2 Results

For selecting events, mean valence intensity was calculated. Mean score of positive events was 5.267 (SD= .86) and mean score of negative events was 5.209 (SD = .66). 32 events each for positive and negative lists were selected in order of closeness from the mean. 40 events out of 64 selected events were provided to participants during the experiment by randomly assigned condition.



### 3. Main Study: Perception and memory reconstruction

This study attempted to investigate differences of perception ratio and the process of memory reconstruction. To examine the differences in perception for positive or negative events related to individual SWB level, participants were asked to report the perceived ratio of positive versus negative events for the provided event list. The list was divided into 5 conditions in terms of positive versus negative ratio. Also recall differences of positive versus negative events were examined in relation to individual differences in happiness. Lastly, participants were asked to judge whether they saw the sentence on the monitor in the first session of the experiment while suggesting sentences either provided or similar but not provided. Errors were calculated for each positive and negative sentences then were examined in the relationship with individual SWB level.

#### 3.1 Method

##### *Participants*

210 undergraduate students enrolled in a psychology course participated in study in exchange for course credit. 199 participants, excluding 11 participants who showed exceptionally low total number of recall or high

recognition errors, were subjected to the analysis.

##### *Procedure*

Participants were introduced the goal of experiment as investigating the relationship between stress and cognitive performance to control the influence of attention if they know the true dependent variable is memory. Before starting a computer task, they completed satisfaction with life scale (SWLS) [15] and frequency of emotional experience scale (The Intensity time Affect Scale) [18]. After completing scales, participants were randomly assigned to one of five versions of a computer-based task. In first session of all versions, participants were asked to rate how often they thought an event described in the sentence on the computer screen would occur to the common twenties for total 40 sentences on a 7-point scale (1 = "never happen" to 7 = "very often") under the pseudo goal of assessing stress level. In all five conditions, all process and task were the same but the ratio of valenced events for 40 sentences was different. This frequency prediction task was conducted for deeper cognitive processing of the stimuli without recognizing the fact that those sentences would be requested to remember in the following session and the mean response time for the task was 3 minute. Following frequency judgment task the participants were

asked to write perceived ratios of positive events and negative events in the previous task. Then, participants solved three cognitive tasks: pattern recognition, calculation, and reasoning task designed for memory interruption for 8 minutes on average. After completing the cognitive tasks, participants were asked to recall and briefly list as many events that they saw during previous frequency prediction task as they could in 3 minutes. And then participants judged sentences showed up in the screen whether they saw in previous session. Lastly, participants rated valence intensity and relevance of 40 sentences for manipulation check.

### **Coding**

A team of two trained research assistants rated the recalled sentences. Sentences with correct subject, adjective and verb were considered as correctly recalled. The number of correct positive event recall and negative recall were coded and the difference between two recall score was used for analysis. Correlations between two raters' coding results were .913 for positive event recall and .917 for negative event recall.

### **Material**

Subjective Well-Being. The SWLS [15] asks participants to rate their agreement on a 7-point scale (1 = "strongly disagree", 7 = "strongly agree") to five statements such as "In

most way, my life is close to my ideal" and "If I could live my life over, I would change almost nothing". Cronbach's Alpha for this measure was .82. Mean score of SWLS was used for analysis. The participants also rated how frequently they feel 8 positive affects (e.g., love, pleasure) and 16 negative affects (e.g., sad, shame) during a month on a 7-point scale [18]. Cronbach's Alpha for this measure was .77. Sum score of each positive and negative affect was used for analysis.

Event list. The ratio of positive versus negative events are 4:1 for condition one, 3:2 for condition 2, 1:1 for condition 3, 2:3 for condition 4, and 1:4 for condition 5.

Task. Academic intelligence tasks from Samsung Aptitude Test (SSAT) and Mensa IQ test were selected for the cognitive task session. The session consisted of pattern recognition test, mathematic test, and reasoning test.

## **3.2 Results**

### **3.2.1 Perception ratio, recall and recognition between five conditions**

Table 1 presents the means for the differences between reported portion and actual portion of positive event, the differences between percentage of reported positive events and actual portion of positive event, and error rates for both positive and negative

events. An analysis of variance (ANOVA) resulted in a significant effect of condition on the differences between percentage of reported positive events,  $F(4, 194) = 17.618, p < .001$ , and a significant effect of condition group (group 1, 2, and 3) on the differences between percentage of reported positive events,  $F(2, 196) = 26.706, p < .001$ . Mean differences across five conditions were further analyzed using Bonferroni post-hoc tests. People tend to report positive ratio of event list larger than actual ratio ( $M = .0416, SD = .16$ ),  $t(198) = 3.628, p < 0.01$ . The analysis confirmed that condition 1 and condition 2,  $p < .05$ , condition 1 and condition 4,  $p < .01$ , condition 1 and condition 5,  $p < .01$ , condition 2 and condition 5,  $p < .01$ , and condition 3 and condition 5,  $p < 0.01$ , were significantly different from one another for the difference in response positive ratio versus actual positive ratio. The analysis also confirmed that the condition group of more positive events (group 1: conditions 1 and 2) and neutral group (group 2: condition 3) were significantly different from the more negative event group (group 3: conditions 4 and 5),  $ps < .01$ .

Positive percentage in recalled event was higher than given percentage ( $M = .0264, SD = .15$ ),  $t(198) = 3.628, p < 0.05$ . However, ANOVA did not show any differences among conditions (groups) for the differences

between percentage of reported positive events and actual portion of positive event,  $F(4, 194) = 2.365, p > .05$ . For positive error rate ( $M = .14, SD = .09$ ), ANOVA showed a significant effect of condition on positive error rate,  $F(4, 194) = 5.729, p < .01$ , and a significant effect of group on positive error rate,  $F(2,196) = 7.244, p = .001$ . Bonferroni post-hoc test results confirmed the differences between condition 2 and condition 3,  $p < .05$ , and condition 2 and condition 4,  $p < .01$ . The differences between group 1 and group 2,  $p < .05$ , and group 1 and group 3,  $p < .01$  were also confirmed. For negative error rate ( $M = .11, SD = .09$ ), ANOVA results showed a significant effect of condition,  $F(4,194) = 12.753, p < .01$ , and a significant effect of group,  $F(2,196) = 3.065, p < .05$ . The differences between condition 1 and condition 2, and group 1 and group 3 were confirmed by Bonferroni post-hoc test,  $ps < .01$ .

**Table 1.** Mean scores of four dependent variables across five conditions

Condition	RP-AP	PRP-AP	P-Error	N-Error
1(80%)	4.60	-0.03	0.05	0.13
2(60%)	1.88	0.04	0.15	0.09
3(50%)	0.60	0.05	0.10	0.15
4(40%)	-0.64	0.07	0.10	0.17
5(20%)	-4.46	0.01	0.17	0.14

*Note:* RP-AP = reported percentage of positive event - actual percentage of positive event; PRP-AP = percentage of recalled positive event - actual percentage of positive event; P-Error: Error rate in recognition of positive events; N-Error: Error rate in recognition of negative

3.2.2 Subjective well-being and ratio report

It was predicted that participants with high subjective well-being would report larger portion of positive events than low subjective well-being participants for the same event list. SWB was measured by life satisfaction, positive emotional experience, and negative emotional experience. Mean rating was calculated for life satisfaction variable and sum score was computed for each positive and negative emotional experience variable. The difference between reported portion of positive events and actual portion (positive percent difference) was calculated as a dependent variable. Positive value of the difference indicates the extent to which participants overestimate the positive portion of the events. While negative value of the difference indicates the extent to which participants underestimate the positive portion of the events.

Using t-test, mean difference of positive percent difference between participants of high and low subjective well-being was analyzed. Table 2 presents mean scores of reported positive percent and differences between reported portion and actual portion of positive event for low and high groups of life satisfaction scores. As seen in Table 2, happy people reported higher ratio of positive events versus negative events in condition 1,

$t(15) = -2.474, p < .05$ , and in condition 3,  $t(14) = -2.650, p < .05$ . Also, there were significant mean differences between reported ratio and actual ratio in condition 1 and condition 3 as a function of life satisfaction. Specifically, in condition 1, participants with high life satisfaction reported more positive ratio than low satisfaction participants,  $t(15) = -2.474, p < .05$ , and high life satisfaction people reported more positive ratio than actual positive percent while low life satisfaction person reported less positive ratio in condition3,  $t(14) = -2.650, p < .05$  (see Figure 1). However, there was no significance difference in the other three conditions.

In addition, no significant mean difference was found as a function of both positive and negative emotional experience across all five conditions. Thus, Hypothesis 1 was partially supported.

**Table 2.** Mean scores of reported ratio of positive event and difference between response and actual ratio of positive event for low and high life satisfaction groups.

Condition	SWLS Low		SWLS High	
	RP	RP-AP	RP	RP-AP
1 (80%)	.665*	-.135*	.764*	-.036*
2 (60%)	.660	.060	.579	-.021
3 (50%)	.433*	-.068*	.576*	.076*
4 (40%)	.470	.051	.534	.099
5 (20%)	.361	.244	.319	.186

Note: RP = mean score of reported percentage of positive event; RP-AP = reported percentage of positive event - actual percentage of positive event; \*p < .05.

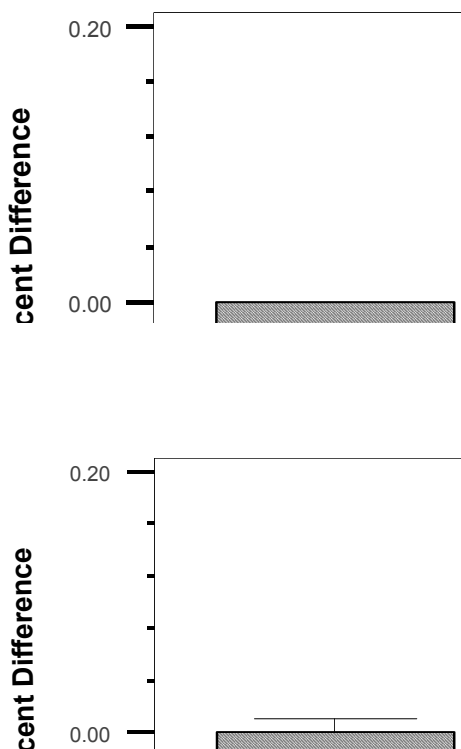


Figure 1. The difference of reported percent of positive events versus actual percent of positive events for low and high life satisfaction groups in condition 1 and condition 3

### 3.2.3 Subjective well-being and recall difference

It was predicted that participants with high subjective well-being would recall more positive events than low subjective well-being participants. Again, life satisfaction, positive emotional experience, and negative emotional experience were used as variables measuring subjective well-being. The difference between percentage of reported positive events and actual portion of positive event was

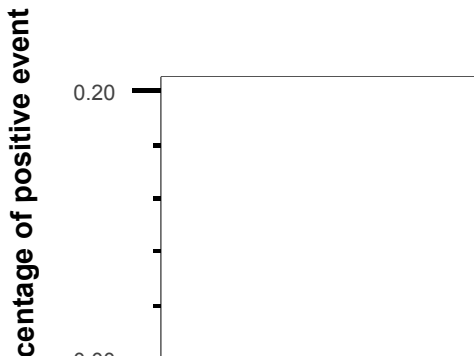
calculated as a dependent variable. Positive value of the difference indicates the extent to which participants recalled more positive events than actual ratio of positive events based on given list.

Table 3 shows average percentage of recalled positive events and difference between percentage of recalled positive events and its actual portion for low and high and low groups of life satisfaction. There was a significant difference in percentage of recalled positive events between high ( $M = .835$ ) and low ( $M = -.697$ ) groups of life satisfaction in condition 1,  $t(15) = -3.075, p < .01$ . Also, a significant mean difference was found in recalled versus actual portion of positive events between high ( $M = .036$ ) and low ( $M = -.103$ ) groups of life satisfaction in condition 1,  $t(15) = -3.108, p < .01$ . Specifically, as seen in Figure 2, people with high life satisfaction reported higher percentage of recalled positive events than actual percentage while low life satisfaction people recalled more negative events than percentage in the list. However, there was no significance difference in the other four conditions.

**Table 3.** Ratio of recalled positive event and difference between response and actual ratio of recalled positive event for low and high life satisfaction groups.

Condition	SWLS Low		SWLS High	
	PRP	PRP-AP	PRP	PRP-AP
1(80%)	.697**	-.103**	.835**	.036**
2(60%)	.633	.034	.616	.016
3(50%)	.576	.076	.542	.043
4(40%)	.455	.054	.557	.157
5(20%)	.251	.050	.217	.019

Note: PRP = mean score of percentage of recalled positive event; PRP-AP = percentage of recalled positive event - actual percentage of positive event; \*\*p < .01.



**Figure 2.** The differences between percentage of recalled positive events and actual percentage of positive events for low and highlife satisfaction groups in condition 1.

In addition, t-test examined the percentage of recalled positive events as a function of positive and negative emotional experience. Table 4 shows the mean score of difference between percentage of recalled positive events and actual percentage. The pattern is very similar to t-test results of life

satisfaction. There were marginally significant differences in condition 1. People with more positive emotional experience recalled positive events higher than actual percentage while people with less positive emotional experience recalled less positive events,  $t(19) = -1.973, p < .1$ . People with less negative emotional experience recalled more positive events than people with more negative emotional experience in condition 1,  $t(16) = 2.572, p < .05$  (See Figure 3).

**Table 4.** Differences between response and actual ratio of recalled positive event for low and high groups of emotional experience.

Condition	Positive Experience		Negative Experience	
	Low	High	Low	High
1(80%)	-.078*	.026*	.010*	-.108*
2(60%)	.055	-.010	.097	.049
3(50%)	.029	.042	.090	.071
4(40%)	.028	.051	.059	.001
5(20%)	.049	.049	-.027	.001

Note: DV = percentage of recalled positive event - actual percentage of positive event; \*p < .1.

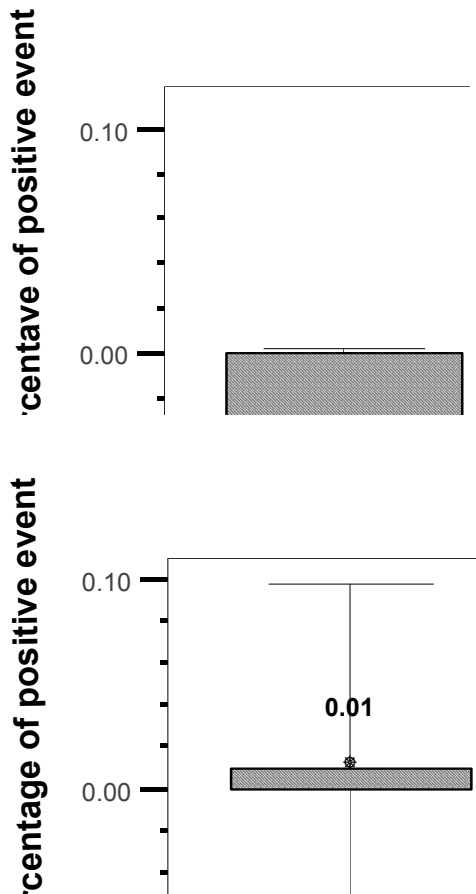


Figure 3. The difference between percentage of recalled positive events and actual percentage of positive events for low and high groups of emotional experience in condition 1.

### 3.2.4 Subjective well-being and the relationship between perceived ratio and recalled ratio

The predicted different ratio in perception of valenced events may influence memory difference between happy and unhappy people. In particular, more positive event recall of happy people might be influenced by the fact that they perceive the ratio of positive

events larger than unhappy people. To examine the predicted association between perceived ratio of valenced event and event recall, correlations between perceived ratio of positive events and recalled ratio of positive events were examined. The result shows that perceived ratio of positive events was correlated positively with recalled ratio of positive events,  $r = .548, p < .01$ . This indicates that recall difference between high and low of subjective well-being level is related with difference in event perception.

### 3.2.5 Subjective well-being and error rate in recognition task

Overall, there was no significant difference in recognition error across five conditions as a function of life satisfaction, positive emotional experience, and negative emotional experience. Error rate was calculated by the number of error over total number of sentences. However, there were marginally significant results. Participants who experienced more positive emotional experience showed more positive error at marginally significant level in condition 2,  $t(18) = -1.945, p < .1$ . Also, participants who experienced more negative emotional experience, showed more negative error in condition 3,  $t(16) = -2.025, p < .1$ .

### 3.2.6 Summary of results

The present experiment using provided event list showed that individual subjective well-being level tends to differ in perceived ratio of positive versus negative event, recalled percentage of positive events, and recognition error in positive event-superior conditions, especially in condition 1. An equivalent pattern of results was found in condition 3 where ratio of positive versus negative events was the same. These results partially support the idea that happy people perceive more positive stimulus in a given situation than less happy people. Also, happy people showed more positive percentage in recalled events than actual ratio while unhappy people reported less positive recall percentage than actual ratio. These findings indicate the existence of cognitive process that enhances positive or negative memory related to subjective well-being. Significant correlation between perceived ratio and recalled ratio also supports this proposition. Difference in error rate as a function of emotional experience at a marginal level also supports the role of cognitive process in positive or negative memory of events.

## 4. Discussion

This study is meaningful in that the study tried to explain the revealed recall difference in terms of perceived difference and associated difference with memory bias by assessing recall difference and recognition bias following construal approach. Although it was partially supported, the perceived ratio difference indicates that people perceive same information differently based on their long-term subjective well-being level. Also, increased ratio of positive events in recall task for happy people indicates that cognitive process enhancing memory bias that is consistent with SWB level may exist. Positive correlation between perceived ratio and recalled ratio supports the idea of construal approach as well. The study also has a meaning in the use of controlled stimulus for recall task. By providing event lists, the participants are free from the influence of actual experience, and thus make it easy to infer the result with SWB-recall relationship.

However, unsymmetrical pattern was found in the present study. While positivity superior or similar conditions were partially supported as predicted, the result did not support the hypothesis in condition 4 and 5 where negativity is superior. This result pattern could be explained by different function of positive and negative events.



Research on the mood and the emotion has suggested that positive and negative affect should be considered as qualitatively different phenomena [14]. Specifically, many studies in psychology provided the evidence that negative events appear to prompt more cognitive analysis than neutral or positive events, when holding other variables constant. For example, negative aspects of event and choice are weighted more heavily than positive aspects in judgment [29]. Also Peeters and Czapinski [42] concluded that negative stimuli lead to more cognitive work and more complex cognitive representations than do positive stimuli. These points suggests the possibility that in condition 4 and condition 5, where negative events were superior, participants in both groups heavily processed for most of events. Thus, no differences in the dependent variables were found between two groups of participants. In contrast, condition 1 through 3, where negativity bias were small, participants' judgment of ratio and retrospective task were influenced by their subjective well-being level. More specifically, in condition 1, where positive events were superior to negative events, participants with high SWB tended to overestimate the positivity and in condition 2 and 3, where positivity-superior was relatively ambiguous, participants tended to infer the information along with individual

SWB level. Similar patterns were found in recall and recognition results.

Unlike the previous studies, recall differences were not fully replicated in the present study. Happy people did not significantly recall more positive events versus negative events than unhappy people across all five conditions. An alternative concern indicates the possibility that experience recall and sentence recall from provided list might be processed in different dimension. According to the previous study, people tend to use heuristics such as self-belief to estimate the past [43]. Also it was found that people tend to incorporate one's overall self-beliefs or self-concept into recalled reports [22]. Recall difference of positive versus negative life events found in the previous research could be explained with this explanation. Since retrospect memory is vulnerable to memory bias, happy people tend to recall more positive events while unhappy people tend to recall more negative event, when representing one's self-belief. However, recall task of sentences that were provided minutes before could have been processed differently. Even though sentences described possible positive or negative real life situations, they could be perceived only as sentences rather than individual real life events. So, participants might not have cognitively processed each sentence as they would do for individual experience,

and thus memory bias might not be significant when recalling the events.

Low error rates in both high and low SWB groups could be explained as a ceiling effect. Participants in present study are a group with high cognitive ability. Across conditions, participants show relatively low error rate in both positive and negative events ( $M = .14$ ,  $SD = .09$  for positive error,  $M = .11$ ,  $SD = .09$  for negative error). For participants in the study, recognition task that required them to determine whether they saw the sentence in the previous session could be easy to remember. Also, the number of sentences or the length of sentences was not difficult enough to consume cognitive resource and to cause memory bias. 8 minutes of cognitive task on average might not long enough to disturb previous memory. In sum, the study has a limitation in experimental design to manage task difficulties to investigate the influence of subjective well-being beyond cognitive ability.

In addition, one remaining issue in the current study is the number of participants. After selecting the top and the low 25% of the participants, each condition contained about 8 participants for the analysis. Since small number of participants was analyzed, it caused large standard deviation, and might have caused marginal effects in the results. Thus, further study needs to redesign experiment with more difficult

sentences to remember, longer disturbance task, and more participants to investigate SWB-memory relationship more clearly.

To conclude, the current study examined the hypotheses that happy people perceive the valenced event differently and this difference might influence the memory bias. In accordance of these hypotheses, happy people tend to judge positive ratio among the provided event list higher than unhappy people in condition 1 and condition 3. Happy people also recalled more positive events than unhappy people, and those recalled positive percentage was higher than actual ratio in condition 1. This provides partial support for the content that people perceived the same valenced information differently when positivity is higher than negativity, and this tendency is associated with the memory bias related with individual SWB level.

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