



# Individual differences in time perspective predict auto-noetic experience

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## ABSTRACT

Tulving (1985) posited that the capacity to remember is one facet of a more general capacity—auto-noetic (self-knowing) consciousness. Auto-noetic consciousness was proposed to underlie the ability for “mental time travel” both into the past (remembering) and into the future to envision potential future episodes (episodic future thinking). The current study examines whether individual differences can predict auto-noetic experience. Specifically, the Zimbardo Time Perspective Inventory (ZTPI, Zimbardo & Boyd, 1999) was administered to 133 undergraduate students, who also rated phenomenological experiences accompanying autobiographical remembering and episodic future thinking. Scores on two of the five subscales of the ZTPI (Future and Present-Hedonistic) predicted the degree to which people reported feelings of mentally traveling backward (or forward) in time and the degree to which they reported re- or pre-experiencing the event, but not ten other rated properties less related to auto-noetic consciousness.

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## 1. Introduction

Twenty-six years ago, Endel Tulving proposed that the human capacity for remembering could best be conceptualized as one facet of a more general capacity, which he termed auto-noetic consciousness (Tulving, 1985). A recent collection of empirical studies has brought new attention to this proposal. In essence, this work suggests that remembering is best viewed from a wide-angle perspective, such that it is conceptualized as one manifestation of auto-noetic consciousness, the other being its complementary capacity: the ability to envision potential future events. This latter capacity will be referred to here as episodic future thought (Atance & O'Neill, 2001; Szpunar, 2010), although other researchers have utilized different terms including episodic simulation (Schacter, Addis, & Buckner, 2008) and prospection (Buckner & Carroll, 2007).

Renewed interest in this broad conceptualization of episodic memory has arisen in part from the observation that groups of individuals who demonstrate episodic memory impairments tend also to demonstrate deficits in the capacity for episodic future thought. This observation, first made by Tulving (1985) in a single amnesic patient, has been extended to a second patient (Klein, Loftus, & Kihlstrom, 2002) and to a sample of five people with medial temporal lobe amnesia (Hassabis, Kumaran, Vann, & Maguire, 2007). Moreover, suicidally depressed individuals demonstrate impairments in both capacities (Williams et al., 1996), as do people with schizophrenia (D'Argembeau, Raffard, & Van der Linden, 2008), those with Alzheimer's Disease (Addis, Sacchetti, Ally, & Budson, 2009) and even healthy older adults (Addis, Wong, & Schacter, 2008). Episodic memory impairments and deficits in episodic future thought seem to go hand-in-hand across different subject populations.

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Might there exist a similar variation within the population of healthy young adults? That is, do there exist individual differences across healthy young adults that predict the phenomenological qualities accompanying remembering and episodic future thinking? In order to begin to address this important question, we examined the relation of time perspective (i.e., orientation to the personal past, present, and future, [Zimbardo & Boyd, 1999](#)) to people's reported sense of subjective experience associated with mental time travel.

To assess time perspective, we administered the Zimbardo Time Perspective Inventory (ZTPI, [Zimbardo & Boyd, 1999](#)), which contains five subscales oriented toward classifying individual people's perspective of time; specifically, the subscales related to the following five orientations: future, present-hedonistic, past-negative, past-positive, and present-fatalistic. The Future subscale measures a general concern for the future, including a focus on planning, future goals, achievement, and delay of gratification. The Present-Hedonistic subscale captures a pleasure-seeking, risk-taking orientation. The Past-Negative subscale measures degree of negative view of the past and is associated with cautiousness and conservatism. The Past-Positive subscale reflects a sentimental, positive attitude toward the past, often oriented toward family. The Present-Fatalistic subscale reflects a helpless, hopeless view of the future and life in general.

Individual differences in time perspective have been associated with behaviors such as risky driving ([Zimbardo, Keough, & Boyd, 1997](#)), tobacco, alcohol, and illegal drug use ([Keough, Zimbardo, & Boyd, 1999](#)), duration of homelessness ([Epel, Bandura, & Zimbardo, 1999](#)), and risky health behaviors ([Henson, Carey, Carey, & Maisto, 2006](#)). In general, those who are more future-oriented and less present-oriented partake in fewer risky behaviors.

The question here was not how time perspective affects outward behavior but whether it predicts how people experience remembering the past and imagining the future. For both remembering and episodic future thinking, an adaptation of the Memory Characteristics Questionnaire (MCQ; [Johnson, Foley, Suengas, & Raye, 1988](#)) was used to assess the degree to which people experienced the following twelve phenomenological characteristics: feelings of mentally traveling backward or forward in time; sound; effort required to bring the event to mind; feelings of re- or pre-experiencing the event; clarity of location; remembering or envisioning bodily movements; clarity of spatial arrangement of objects; clarity of spatial arrangement of people; smell/taste; degree to which the event is remembered or imagined as a coherent story; clarity of time of day; and visual details.

The MCQ questions are distinct from the ZTPI items. The MCQ questions ask participants to rate their phenomenological experience of a particular memory or future thought. For example, participants were asked to rate the degree to which they felt as though they had pre-experienced the specific future event they had just imagined. In contrast, the ZTPI asks participants to rate how well general statements relating to time characterize themselves. For example, participants rated the extent to which their own attitude about the future was characterized by the statement "You can't really plan for the future because things change so much". Because the MCQ and the ZTPI have such different focuses, any correlation between the two could not be explained by overlap in the questions.

Might individual differences in time perspective influence the phenomenological experience of episodic memories and episodic future thoughts? Other studies have shown that some individual differences can influence the phenomenological experience of remembering and episodic future thinking (e.g., [D'Argembeau, Ortoleva, Jumentier, & Van der Linden, 2010](#); [D'Argembeau and Van der Linden, 2006](#); [Quoidbach, Hansenne, & Mottet, 2008](#)). However, no study has examined how all of the time perspectives captured by the ZTPI may influence phenomenological experiences and how this influence may be similar or different when remembering past events and imagining future events. The current study aims to answer these questions. In this study, participants remembered 10 past events of their lives and imagined 10 possible future events they might experience and rated those events on the twelve dimensions listed above. They then completed the entire ZTPI. A regression analysis explored the association of time perspective and the phenomenological experiences of episodic memory and episodic future thought.

## 2. Methods

### 2.1. Participants

One hundred and forty-seven Washington University undergraduate students participated in exchange for class credit. Data from 14 participants were dropped from the analysis due to failure to follow instructions or a significant amount of missing data, and therefore data from a total of 133 participants were included in the analysis.

### 2.2. Design

A  $2 \times 5$  mixed design was used, with temporal orientation (past, future) manipulated within-participants and temporal distance [1 day ( $N = 25$ ), 1 week ( $N = 26$ ), 1 year ( $N = 24$ ), 5 years ( $N = 28$ ), 10 years ( $N = 30$ )] manipulated between-participants. Data relating to the influence of temporal distance on phenomenological characteristics (e.g., vividness of spatial location) are reported elsewhere. In the present analysis, temporal distance is statistically controlled using hierarchical multiple regression; the question addressed is how individual differences in time orientation might predict various aspects of the experience of remembering and episodic future thinking.

### 2.3. Materials

The ZTPI is an individual difference measure designed to assess a person's time perspective, (i.e., an individual's view of the psychological past, present, and future). It breaks down time perspective into five subscales: Future, Present-Hedonistic, Past-Negative, Past-Positive, and Present-Fatalistic (Zimbardo & Boyd, 1999).

The inventory consists of 56 statements relating to time perspective. For each statement, participants answered the following question: "How characteristic or true is this of you?" on a scale from 1 (very uncharacteristic) to 5 (very characteristic). Responses from each statement contribute to one of the 5 subscales. For example, responses from the statements "I am able to resist temptations when I know that there is work to be done" and "I complete projects on time by making steady progress" contribute to the future construct.

A modified version of the Crovitz–Shiffman cueing technique was used (Crovitz & Schiffman, 1974). One-word cues (e.g. mother, lake, city) were used as starting points for remembering/imagining past and future events. The same set of 20 cues (adopted from Rubin, 1980) was used in each condition. On a participant-by-participant basis, random assignment was used to pair cues to a temporal orientation and to determine the cue order.

Each memory and episodic future thought was rated by each participant on each of 12 questions designed to capture phenomenological experience. Specifically, the questions were adapted from the Memory Characteristics Questionnaire (MCQ, Johnson et al., 1988). They probed the following characteristics: feelings of mentally traveling backward or forward in time (1 = not at all, 7 = completely), sound (1 = little, 7 = a lot), effort required to bring the event to mind (1 = very easy, 7 = very effortful), feelings of re- or pre-experiencing the event (1 = not at all, 7 = completely), clarity of location (1 = vague, 7 = clear), remembering or envisioning bodily movements (1 = not at all, 7 = completely), clarity of spatial arrangement of objects (1 = vague, 7 = clear), clarity of spatial arrangement of people (1 = vague, 7 = clear), smell/taste (1 = little, 7 = a lot), degree to which the event is remembered or imagined as a coherent story (1 = not at all, 7 = completely), clarity of time of day (1 = vague, 7 = clear), and visual details (1 = little, 7 = a lot).

### 2.4. Procedure

The experimenter read detailed instruction to participants, who were told they would be remembering episodes from their past, imagining possible future episodes they might experience, and answering questions about these recollections/imaginings (for complete instructions, see Appendix 1 of Arnold, McDermott, & Szpunar, 2011). Participants were instructed to remember/ imagine events that were or will be specific and discrete in time, lasting no more than a few hours. Two examples (one past, one future) were described in detail. The example past event involved taking a test and the example future event involved a riding in a car with friends; both events included details such as the settings, other people, visual and auditory details, and emotions.

Each participant was randomly assigned to one of five temporal conditions: within 1 day, approximately 1 week, 1 year, 5 years, or at least 10 years from the present, and all events were to be remembered/imagined within that temporal distance. In the present analysis, the effect of temporal distance will not be considered. At the beginning of each trial, the word "past" or "future" was displayed on the screen to indicate whether to remember a past event or to imagine a future event. Past and future trials occurred in a random order determined on a participant-by-participant basis with no more than two of the same trial type occurring in a row. In addition to the temporal orientation instructions, a randomly paired word cue (e.g., mother) was also displayed on every trial. This word cue was to be used as a starting point to help participants think of a memory or future event. However, participants were told that their event did not have to be related to the word cue in any direct way. The temporal orientation instructions and word cue remained on the screen until after participants had finished describing the event.

Once the participants had an event in mind, they pressed the space bar. While still displaying the temporal orientation instructions and word cue, the background color of the computer screen became green for 3 min. During this time, participants wrote a description of their event in a booklet. They were told to write as many details as they could remember or imagine and to continue writing for the entire 3 min. Particular emphasis was placed on including details about the settings of the events and any other people who might have been or will be involved in the event. After 3 min, the background color changed from green to red and the temporal orientation instruction and cue were removed to signal participants to stop writing. The content of these written protocols are not characterized here, but we note that they were reviewed to confirm that participants followed the instructions (for sample protocols, see Appendix 2 in Arnold et al., 2011). Six participants were excluded because their protocols indicated they failed to follow the instructions.

Immediately after the 3 min writing period for an event, participants answered a series of 12 questions about their phenomenological experiences of the immediately preceding event. One question at a time was displayed on the screen. Responses were given via number keys on the keyboard. Responses faster than 600 ms were assumed to be invalid and were not included in the results. If more than 10% of any participant's responses were under 600 ms, that participant was excluded from the analysis ( $N = 6$ ). Two participants were excluded from the analysis because their average response times were more than 2 standard deviations below the group mean.

Prior to beginning, participants completed one past and one future practice trial. They then completed 20 experimental trials consisting of 10 past and 10 future trials. When finished with all 20 trials, participants completed the ZTPI, which was always at the end of the procedure because it was exploratory. Each of the 56 ZTPI statements appeared on the screen one at

a time. Participants indicated how characteristic each statement was of them by pressing the appropriate number key. Upon completion, subjects were debriefed and thanked for their time. The experiment lasted approximately 2 h.

### 3. Results

Cronbach's alpha was determined for each subscale as a measure of reliability. For the Future subscale, the alpha was .83; for Present-Hedonistic, .85; for Past-Positive, .79; for Past-Negative, .84; and for Present-Fatalistic, .62. Correlations between the subscales were also calculated. Almost all subscales were significantly correlated with each other. The largest correlation was between the future and present-hedonistic subscales,  $r = -.35, p < .01$ . The one exception was a non-significant correlation between past-positive and present-fatalistic,  $r = .02, p = .83$ .

Once the reliability of the subscales was established, a hierarchical multiple regression analysis was used to determine the influence of individual differences in time perspective on phenomenological ratings of episodic memories and episodic future thoughts. An alpha level of .05 was used for these analyses. The independent variables were scores on the five subscales of the ZTPI (Future, Present-Hedonistic, Past-Positive, Past-Negative, and Present-Fatalistic) and temporal distance.

**Table 1**

Hierarchical multiple regression analysis with Model 1 (temporal distance) and Model 2 (temporal distance and ZTPI subscales) for phenomenological qualities of remembering.

Phenomenological Qualities	$R^2_1$	$R^2_2$	$\Delta R^2$	Standardized $\beta$ ZTPI subscales					
				Future	Hedonistic Present	Positive Past	Negative Past	Fatalistic Present	Temporal Distance
<i>Past</i>									
Clarity of Location	.05	.12	.06	.02	.20*	.04	-.03	-.16	-.23**
Time of Day	.08	.11	.03	.12	.11	-.04	-.11	.04	-.28**
Objects	.03	.09	.06	.02	.10	-.04	-.21*	-.01	-.17
Movements	.05	.08	.02	.05	.10	.08	.05	.05	-.23**
Mental Time Travel	.00	.10	.10*	.28**	.25*	.01	-.01	.06	.06
Re-experience	.00	.12	.12**	.27**	.27**	-.10	-.15	.02	-.04
People	.02	.09	.07	.05	.18	.07	-.13	.04	-.14
Coherent Story	.01	.07	.06	-.04	.10	.08	-.09	.15	-.08
Visual Details	.00	.03	.03	-.06	.10	.01	-.08	-.04	.02
Effort	.01	.05	.05	.12	-.12	.01	.05	.13	.09
Smell/Taste	.01	.05	.04	-.04	-.10	.15	-.09	.11	-.08
Sound	.01	.06	.05	.03	.06	.17	.03	.12	-.08
(Auto-noetic Consciousness)	.00	.12	.12**	.30**	.28**	-.04	-.08	.05	.02

\*  $p < .05$ .

\*\*  $p < .01$ .

**Table 2**

Hierarchical multiple regression analysis with Model 1 (temporal distance) and Model 2 (temporal distance and ZTPI subscales) for phenomenological qualities of episodic future thought.

Phenomenological Qualities	$R^2_1$	$R^2_2$	$\Delta R^2$	Standardized $\beta$ ZTPI subscales					
				Future	Hedonistic Present	Positive Past	Negative Past	Fatalistic Present	Temporal Distance
<i>Future</i>									
Clarity of Location	.17	.21	.05	-.08	.13	.05	-.07	-.09	-.41**
Time of Day	.01	.02	.01	-.01	.04	.01	-.07	.03	-.10
Objects	.02	.06	.04	-.12	.01	.11	-.13	-.04	-.13
Movements	.02	.07	.05	-.08	.08	.18	-.03	.00	-.12
Mental Time Travel	.00	.09	.09*	.19	.23*	.06	-.07	.03	.02
Pre-experience	.01	.13	.12**	.25*	.27**	.05	-.02	-.09	-.11
People	.00	.05	.05	-.02	.17	.11	-.03	-.01	-.02
Coherent Story	.03	.08	.04	-.12	.07	.09	-.09	.02	-.19*
Visual Details	.00	.03	.02	-.11	.03	.11	-.05	-.04	.02
Effort	.02	.10	.09*	.16	-.18	-.06	.06	.14	.12
Smell/Taste	.00	.06	.06	.06	.02	.21*	.02	.08	.03
Sound	.00	.06	.06	.01	.01	.22*	-.03	.06	.03
(Auto-noetic Consciousness)	.00	.12	.11**	.23*	.27**	.06	-.05	-.02	-.04

\*  $p < .05$ .

\*\*  $p < .01$ .

The dependent variables were the ratings on each phenomenological characteristic. In order to control for the influence of temporal distance on the phenomenological ratings, temporal distance was entered into the analysis first (model 1). Next, the five ZTPI subscales were simultaneously entered into the analysis (model 2). Standardized betas reported for temporal distance are from model 1, and standardized betas reported for the ZTPI subscales are from model 2. These results can be seen in Tables 1 (episodic memory) and 2 (episodic future thought).

### 3.1. Overall regression analysis

A significant  $\Delta R^2$  from model 1 to model 2 indicates the ZTPI subscales explain a significant amount of the variance after accounting for the effect of temporal distance. For remembering,  $\Delta R^2$  was significant for two dependent variables: feelings of mentally traveling backward through time,  $\Delta R^2 = .10$ ,  $p = .02$ , and feelings of re-experiencing events,  $\Delta R^2 = .12$ ,  $p = .006$  (see Table 1). For episodic future thoughts,  $\Delta R^2$  was significant for 3 dependent variables: feelings of mentally traveling forward through time,  $\Delta R^2 = .09$ ,  $p = .04$ , feelings of pre-experiencing events,  $\Delta R^2 = .12$ ,  $p = .007$ , and effort to bring an event to mind,  $\Delta R^2 = .09$ ,  $p = .04$  (see Table 2).

Below, these characteristics are explored more fully. Specifically, only dependent variables involving a significant  $\Delta R^2$  are discussed. That is, the following question is addressed below: If we restrict our focus to phenomenological characteristics that are predicted by the ZTPI, which subscales predict which aspects of the phenomenological experience?

#### 3.1.1. Feeling of re- and pre-experiencing the event

As can be seen in Tables 1 and 2, scores on the Future subscale predicted the degree to which people reported re-experiencing remembered events ( $\beta = .27$ ,  $p = .008$ ) and pre-experiencing future events ( $\beta = .25$ ,  $p = .01$ ).

A second subscale also predicted the degree of re- and pre-experiencing an event. Specifically, people with higher scores on the Present-Hedonistic subscale reported stronger feelings of re-experiencing the past while remembering ( $\beta = .27$ ,  $p = .007$ ) and pre-experiencing potential future episodes ( $\beta = .27$ ,  $p = .008$ ).

#### 3.1.2. Mental time travel

For remembering, scores on the Future subscale of the ZTPI predicted the experience that one was traveling through time ( $\beta = .28$ ,  $p = .006$ ). More future-oriented people tended to report greater experiences of traveling back in time to remember.

Further, the Present-Hedonistic subscale reported stronger feelings of mentally traveling backward ( $\beta = .25$ ,  $p = .01$ ) and forward ( $\beta = .23$ ,  $p = .03$ ) through time.

#### 3.1.3. Effort

Although the ZTPI as a whole predicted the amount of mental effort exerted while performing the task, this phenomenological experience was not captured by any of the specific subscales (smallest  $p = .07$ ).

### 3.2. Auto-noetic experience: A derived measure

In an analysis of individual differences in emotion regulation strategies on the phenomenological experience underlying remembering and episodic future thinking, D'Argembeau and Van der Linden (2006) examined several derived dependent measures, one of which was an "auto-noetic consciousness" index. Specifically, they combined responses from feelings of re-/pre-experiencing the event and feelings of mentally traveling backward/forward in time to create two "auto-noetic consciousness" indices – one past and one future.

Against this backdrop, it is particularly noteworthy that two of the phenomenological qualities that were predicted by the ZTPI were the two that went into this index (i.e., re- or pre-experiencing the event and feelings of mentally traveling backward or forward in time).

We therefore examined this derived measure in our own data; for the ZTPI,  $\Delta R^2$  was significant for both past and future auto-noetic consciousness indices,  $\Delta R^2 = .12$ ,  $p = .007$  and  $\Delta R^2 = .11$ ,  $p = .009$ , for past and future, respectively (see Tables 1 and 2). Further, the Future subscale significantly predicted both past and future auto-noetic consciousness indices,  $\beta = .30$ ,  $p = .003$  and  $\beta = .23$ ,  $p = .02$ , respectively. People with greater degrees of future orientation reported more vivid auto-noetic consciousness experiences during remembering and episodic future thinking.

In addition, the Present-Hedonistic subscale predicted scores on both the past and future auto-noetic consciousness indices ( $\beta = .28$ ,  $p = .006$  and  $\beta = .27$ ,  $p = .009$ , respectively). People who are more pleasure-seeking reported greater degrees of subjective re- and pre-experiencing events and greater feelings of traveling through time.

## 4. Discussion

Within a healthy young adult sample, individual differences in time perspective predicted differences in the phenomenological experience underlying remembering and episodic future thinking. Feelings of re-experiencing (and pre-experiencing) an event and feelings of mentally traveling backward and forward through time were captured by this inventory. Taken

together, these measures can be considered as capturing the essence of the auto-noetic experience (cf. D'Argembeau and Van der Linden, 2006).

The relation between scores on the Future subscale and the index of auto-noetic consciousness appears robust: higher scores on the Future subscale predicted significantly higher ratings for 3 out of the 4 auto-noetic questions and both derived measures of auto-noetic consciousness. Further, the one auto-noetic question for which the Future subscale did not predict significantly higher ratings (feelings of mentally time traveling forward to future events) did show a marginally significant relationship ( $\beta = .19, p = .07$ ) such that higher scores on the Future subscale tended to correspond to greater feelings of mentally time traveling forward to a future event.

An additional level of complexity emerges, however, when one considers the Present-Hedonistic subscale, a measure of the degree of hedonistic attitude toward life with little concern for the future. Scores on this subscale also predict vivid auto-noetic consciousness experiences such that higher scores on the subscale predict more vivid auto-noetic experiences during both remembering and episodic future thinking. This relation also appears robust; higher scores on the Present-Hedonistic subscale predicted significantly higher ratings for all 4 auto-noetic questions and both derived measures of auto-noetic consciousness.

Understanding how higher scores on both the Future and the Present-Hedonistic subscales predict more vivid auto-noetic experiences is challenging, considering that the Future and Present-Hedonistic subscales are negatively correlated ( $r = -.35$ ). The Future and Present-Hedonistic subscales act as suppressor variables to each other as indicated by the negative correlation between the Future and Present-Hedonistic subscales and the positive correlations between both of these subscales and the measures of auto-noetic consciousness. For example, the Future and Present-Hedonistic subscales are both positively correlated with the measure of pre-experiencing future events ( $r = .20$  and  $r = .18$ , respectively). Because the Future and Present-Hedonistic subscales are negatively correlated with each other, each subscale suppresses the relationship between the measure of pre-experiencing future events and the other subscale. Variance on the Present-Hedonistic subscale suppresses the correlation between the Future subscale and pre-experiencing; variance on the Future subscale suppresses the correlation between the Present-Hedonistic subscale and pre-experiencing. This pattern replicates for all six measures of auto-noetic consciousness (past and future: re/pre-experience, mental time travel, and auto-noetic consciousness).

We now consider these results in the context of several recent studies examining the influence of personality on remembering and episodic future thinking. We restrict discussion here to those results relevant to our own findings (i.e., to the auto-noetic experience) but note that each study was much broader in scope than is discussed here.

D'Argembeau and Van der Linden (2006) examined the influence of individual differences in emotion regulation strategies on the phenomenological experience underlying remembering and episodic future thinking. Expressive suppression (a dimension they refer to as akin to the opposite of openness to feelings) was negatively related to auto-noetic consciousness: People who suppress emotions reported less vivid auto-noetic experiences. Conversely, people open to experiencing feelings tended to report greater feelings of auto-noetic consciousness (i.e., mental time travel and re- and pre-experiencing event; see also Rubin & Siegler, 2004). Scales of vividness of imagery and the tendency to reappraise emotions did not exert any influence on this measure.

Quoidbach et al. (2008) asked (among many other questions) whether scores on the Temperament Character Inventory-Revised (TCI-R; Cloninger, 1999) and the Revised NEO Personality Inventory (NEO PI-R; Costa & McCrae, 1992) predicted quality of re- and pre-experiencing an event. They asked 35 subjects to rate their subjective experiences for 3 past and 3 future events. For the TCI-R, they found more cooperative participants reported more vivid auto-noetic experiences. In addition, participants who scored lower on a novelty seeking scale also reported more vivid auto-noetic experiences but only for positive future events. For the NEO PI-R, they found no significant predictive effects of auto-noetic experiences. We posit that a more robust sample size (and more observations/subject) might reveal a predictive effect of personality measures on auto-noetic experience, however. In line with this suggestion, Rubin and Siegler (2004) reported a relation between scores on NEO PI-R facets related to emotional components of personality and auto-noetic experiences during remembering.

The third relevant study of individual differences was reported by D'Argembeau, Ortoleva, Jumentier, and Van der Linden (2010), who examined a large set of future-oriented tasks (including one involving episodic future thought). That is, they examined relations among measures of autobiographical memory and episodic future thought (e.g., fluency, specificity, details, phenomenological ratings), working memory tasks, visual-spatial tasks, planning, relational memory, executive functioning, self-consciousness, and future time perspective (i.e., the Future subscale of the ZTPI). Mental time travel was not examined, but the degree of pre-experiencing future events was found to be predicted by a measure of self-consciousness, defined as the tendency to focus on and think about oneself and one's inner experience (Scheier & Carver, 1985). Pre-experiencing future events was not, however, related to measures of visual-spatial processing abilities, executive processes, verbal relational memory, or future orientation.

How might we reconcile their null effect (i.e., the Future subscale of the ZTPI not predicting reported degree of pre-experiencing) with our own finding (of a relation between the two)? One hint might lie in the design of the studies. Because D'Argembeau et al. had a larger scope to their study, their subjects participated in a wide variety of tasks, each pared down in the interest of time. As a result, each of their subjects participated in only one past and one future trial; further, their sample size was approximately 2/3 the size of ours. Hence, our power was greater for answering the question of how time perspective influences auto-noetic experience. The auto-noetic consciousness index was presumably more robust (more subjects, more observations/subject). In addition, we administered the full ZTPI, including the Present-Hedonistic subscale, which was found to be a suppressor variable for the relationship between the Future subscale and auto-noetic consciousness.

By including the Present-Hedonistic subscale in our regression equation, we were able to remove unwanted variance in the Future subscale, and therefore enhance the relationship between the Future subscale and auto-noetic consciousness. These observations are not intended to be critical of their study; they examined many variables and individual difference measures, so by necessity each individual one was less extensive than would have been possible with a more focused study. The basic point is that our study was more focused on a single question and shows convincingly that auto-noetic consciousness is well predicted by individual differences in time perspective.

These results indicate a complex relationship between time perspective and auto-noetic experience. Future and present-hedonistic orientations exerted separate influences on auto-noetic experiences; however, past orientations (whether positive or negative), exerted no influence on auto-noetic experiences. Interestingly, the pattern seemed to be very similar for both memories and future events; being more future oriented and being more present-hedonistic oriented predicted more vivid auto-noetic experiences during both remembering and episodic future thinking. This similarity supports the hypothesis that one general capacity of auto-noetic consciousness underlies both remembering and episodic future thinking.

Although the existence of a relation is clear, further research will be necessary to clarify exactly how future and present-hedonistic orientations relate to auto-noetic consciousness. Perhaps those who are future oriented have more experience imagining the future and therefore have more vivid auto-noetic experiences, although the same logic would suggest a similar pattern might have appeared for past-oriented people. Perhaps thinking about the future frequently enhances one's capacity for auto-noetic consciousness (although, again, one might expect that remembering might exert the same influence). Another possibility is that having a greater capacity for auto-noetic consciousness causes people to be more future oriented or more present-hedonistic oriented, depending on the way they experience the future events. Those who are more future oriented may be more likely to vividly imagine events that are farther in the future and the past than those who are more present-hedonistic. Those who are more present-hedonistic may more vividly imagine events in the immediate future and past. After all, the temporal present is an ill-defined and constantly moving target. Because of this ambiguity, those who focus mainly on the present may be said to be focused on the immediate future. At this point, the existence of a relation between time perspective and auto-noetic consciousness is quite clear; however, understanding of exactly how these patterns emerge awaits further work.

One clear implication of these results is that administration of the entire ZTPI is useful in seeking a full understanding of how time perspective affects episodic memory and episodic future thought; using only the Future subscale would have given an incomplete understanding of the effect of time perspective. Although the impact of future orientation on the phenomenology of episodic future thought is important, research on time perspective's effect on behavior has shown the significance of dimensions beyond the Future subscale (Epel et al., 1999; Henson et al., 2006; Keough et al., 1999; Zimbardo & Boyd, 1999; Zimbardo et al., 1997). Zimbardo and Boyd (1999) argued for the importance of considering all temporal orientations and that orientations should be considered independent from each other. That is, being highly future-oriented does not automatically imply not being present-oriented and vice versa. They suggested that individual differences in reliance on past, present, and future orientations have separate influences on behavior. By extension, different temporal orientations may also have separate influences on the phenomenology of episodic memory and episodic future thought.

The observation that the auto-noetic experience accompanying remembering and episodic future thinking is similarly predicted by certain individual differences (but not others) adds to the growing literature documenting the similarities in remembering and episodic future thinking. Not only do parallel deficits occur in situations of memory impairment, but also within a nonclinical sample, degree of auto-noetic experience during remembering and episodic future thinking is predicted by the same factors.

In summary, the data shown here demonstrate that key aspects of auto-noetic consciousness can be predicted by general proclivities in time perspective. That is, feelings of mentally re- and pre-experiencing events and feelings of mentally traveling in time to remember or envision future events are strongly related to a person's time perspective. Further, these data demonstrate that variation in auto-noetic experiences within healthy young adult samples can be predicted by individual difference measures.

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