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Citation: Al-Hatmi, H. & Filippopoulos, P. (2015). The relationship between time perception and emotional interference on autobiographical memories. International Journal of Emergency Mental Health, 17(03), pp. 609-616. doi: 10.4172/1522-4821.1000241

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International Journal of Emergency Mental Health and Human Resilience, Vol. 17, No.3, pp. 609-616, ISSN 1522-4821

The Relationship between Time Perception and Emotional Interference on Autobiographical Memories

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ABSTRACT: *Over the past three decades studies have investigated whether people are able to look back in time and perceive themselves from a field (first-person) or observer perspective. A major field of cognitive psychology looked at time perception and memory and depended on emotional factors. The objective of the current research was to investigate the relationship of time estimations and emotional interference on autobiographical memories and whether perception of the field/ observer is related to the emotional factor. Two studies were conducted. In study.1 (pilot), participants were asked to recall a positive, negative, or a neutral autobiographical memory dating three to six years prior to the study. In study.2, participants were exposed to all three emotional autobiographical memory conditions during the task. Finally, each participants was asked whether they could look back and choose if they could perceive themselves as first-person (field), or observer, or both in a given event. Results on both studies rejected the hypotheses and suggested no significant results. Participants showed no differences in their objective and subjective duration judgements of the original events and whether they perceive them to be first-person, observer, or even both. These findings suggests further study in this field is needed as under certain experimental methods, emotional interferences and time perception may have an impact on one's autobiographical memory.*

INTRODUCTION

When individuals encode and recall information, it enables them to record their actions in response to environmental events. "Only those animals which perceive time remember, and the organ whereby they perceive time is also that whereby they remember" said Aristotle (McKeon, 1941, pp. 607-608). From very early stages of reasoning thought time perception and memory seemed to be closely related. The present project will look at how time perception is represented in autobiographical memory. It will further explore how different emotional qualities (positive, negative and neutral) of autobiographical memories may affect time perception. The literature review that follows offers a summary of background studies and a rationale for the present studies in this project.

Duration estimations of past events can be highly subjective leading to individuals reporting accounts with variance towards the same event. For instance, one may recall and estimate the duration of an event to be shorter than it actually was, whereas, another individual when recalling the same event estimates its duration to be longer. Remarkably, research on clinical groups found that people who suffer anxiety, neurotic depressives and melancholics tend to provide relatively small verbal estimates of time during interviews and psychological tests, whereas hysterics, psychopaths, and maniacs provide relatively large estimates. This therefore suggests the fact that when a person's inner time units are relatively large, their verbal estimates of time tend to be low (Orme, 1964). Hogan (1978) proposed a theoretical model describing the relationship between personality and time perception. The theory is based on the assumption that extraverts estimate the exposure duration to be longer compared to introverts in regards to complex figures. Zakay, Lomranz, & Kaziniz (1984) were the first to test this hypothesis by assessing one hundred and thirty-two first year psychology students measuring stimuli complex levels (low, medium, and high) within a extraversion-introversion scale using the Eysenck Personality Inventory (EPI; Eysenck & Eysenck, 1964). Results were significant and consistent with Hogan's (1978) hypothesis that indicated that extraverts do estimate the exposure durations of low and medium-complexity stimuli to be longer than introverts.

There appears to be a linear relationship within judgement duration ranging from around half a second to a few minutes (Block, 1989). For example, one can report an event that took place a few years ago that took split seconds to experience, such as dislocating one's knee, however, if they were to be asked how long that experience felt to them subjectively, their estimation could range from hours to days. What is interesting is what variables this estimation is reliant on. Results of a study suggested that health is influenced by time estimation. Oyanadel and Buela-Casal (2011) assessed 50 subjects in a quasi-experiment and instructed them to complete the Zimbardo Time Perspective Inventory and the SF-36, measuring three time estimations. Authors found significant relationships between dimensions, physical and mental health, and time estimation, which thus demonstrated that health can be influenced by time perception in which one implies a positive attitude towards the past, orienting the future, and being content with pleasant experiences.

Research would suggest that developmental factors control our time perception estimations. Previous studies have shown that at early ages of 2 to 3 years old, children begin to verbalize their past, present, and future (Wallace & Rabin, 1960). Levin, Israeli, and Darom (1978) measured the time estimation among children from nursery school. The task was to judge and explain which of two partially overlapping events began first, ended first, and which lasted longer. The task also involved interfering cues with time judgement. Results supported the hypothesis which showed that performance increased with age and decreased with interference. Therefore children's duration judgements were affected by interfering cues. Similar findings were found by Levin (1977). Piaget claimed in the cognitive development stages, that during the first stage, when children compare the duration of two moving bodies, they would refer longer duration to the quicker

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body. Whereas during the second stage it switches, as children refer longer durations to the slower body (Levin, 1979). Hence, Levin examined the above claim and tested 72 children from the ages of four to seven years. Each child was examined by two experimenters, one who communicated with them and operated the equipment and the other who recorded the entire interview verbatim. Overall results indicated that there was confusion in duration due to interfering cues. Findings supported Piaget's claim of children's confusion of duration when interfered with cues such as, light intensity and speed.

ATTENTION AND TIME PERCEPTION

Zakay (1992) examined the role of attention in seven to nine year old children's duration estimation. The objective was to investigate the distinction between prospective and retrospective time estimation of children in short intervals including the role of attention in only prospective time estimation. Two experiments were conducted. There were eighty children who were exposed to two types of light bulbs; a small bulb of low intensity and a big bulb of high intensity. The first experiment revealed that prospective time estimates were significantly longer than retrospective estimations. In contrast, the results of the second experiment supported the research hypothesis indicating that when children were distracted from attending to the light bulbs, their estimations decreased. Zakay therefore suggested that these findings show that children's prospective time perception processes are attentional based, similar to adults' prospective time perception, whereas, their retrospective time perceptions are based on memory and dependent on the relative changes that occur during an estimated interval. The results of Block and Zakay (1997) provided evidence to the findings of the former study.

Driot-Volet (2003) investigated the effect of a signal warning of the arrival of a stimulus to be timed on temporal discrimination in children aged 3, 5, and 8. The procedure consisted of two successive experimental phases: training and testing. In the training phase, participants were presented with two standard durations, each presented in five alternative times. The experimenter then told them to focus on the shape of the circle and its duration during a block of 8 trials. While in the testing phase, participants received eight blocks of fourteen trials, 7 with and 7 without a click. The findings showed that there is an ability for temporal discrimination in children as young as 3 years, indicating that sensitivity to duration increases with age. Moreover, researchers have concluded that time discrimination improves during human development.

Current research investigated the relation between the attentional resources underlying time perception and temporal order memory (Brown & Smith-Petersen, 2014). Participants in this study made judgements about temporal attributes associated with a series of word lists. Results demonstrated that attention to order interfered with duration judgements, and vice versa. Another finding was that there were interferences of mental workload tasks with duration and temporal order processing which made judgements less accurate. Finally, bidirectional interference was found between the temporal and workload tasks, which therefore suggested that there is an association between workload and temporal order processing.

DURATION JUDGEMENTS AND TIME PERCEPTION

There have been numerous studies on how individuals form judgements on duration tasks. A classical research study found that older people differ significantly from younger people in duration judgements (Block, Hancock, & Zakay, 1998). This finding was the opposite of what was initially hypothesized, and therefore led authors to conclude that there are individual differences in temporal judgement. Experts with high domain knowledge have been found to report longer duration with domain-relevant information. Rhodes and McCabe (2009) examined the first ever study of individual differences in time perception as a function of expertise. Authors assessed 144 psychology students from Colorado State University. The study consisted of three phases: familiarization, practice, and a testing phase. The familiarization phase gave participants the chance to practice making duration judgements. In the practice phase, participants were told to practice their ability to judge the duration of the words presented to them. Finally, after completing the practicing, participants moved to the testing phase of actual duration judgements and were lastly required to complete the NFL (National Football League) questionnaire. Results showed that there was a difference in judgement duration between participants with high or low levels of knowledge of American football for presented words that were either related or unrelated to American football. Those with high knowledge of American football had longer duration of judgement and less duration with unrelated words. On the contrary, participants with low levels of knowledge of American football did not differ based on football related words. Authors thus concluded experts' subjective perception of time for domain-relevant information differs highly from that of non-experts. In other words, individuals are more likely to report longer duration judgements for related words than unrelated words.

There are two duration estimates that researchers today refer to as the prospective and the retrospective paradigm. The difference between the two is participants acknowledged that they are required to judge the duration of a time period prior to beginning the task. Numerous studies and experiments have shown that prospective judgements are longer and more accurate than retrospective judgements (Block & Zakay, 1997), and that females are more focused on time in the prospective paradigm and possess greater episodic memory in the retrospective paradigm (Block et al., 2000). A recent study looked at the interference between auditory and visual duration judgements using a temporal generalization paradigm (Filippopoulos, Hallworth, Lee, & Wearden, 2013). Sixty participants were divided into four groups: an auditory/auditory group, visual/visual group, visual/auditory group, and auditory/visual group. In total, half of the participants began with long interference conditions and the other half began with the short one. After a comparison stimulus was displayed participants had to judge whether it was equivalent to the standard duration of the block by pressing the 'Y' (YES) or 'N' (NO) keys to respond. Finally, they completed another interference block and repeated the procedure four more times. Filippopoulos et al. found that when test blocks were alternated with interference blocks where durations were either shorter or longer than in test blocks, interference was found. Authors therefore provided the first empirical evidence for a "common code" for time. Another recent study provided evidence that in Alzheimer's disease (AD) patients have a deficiency in time perception, which results in a failure to mentally travel back in time to recollect or relive past events. Therefore, due to the dramatic changes that occur in the frontal lobes and hippocampus, AD patients perceive time as passing more rapidly than older and younger adults. It is evident that there is a mass of research that has thoroughly explored time perception and duration estimations. Both prospective and retrospective studies have in various ways revealed a relationship between memory cognitive functions and time estimations. Very limited studies have explored the relationship of time estimations and autobiographical memory.

DEVELOPMENT OF AUTOBIOGRAPHICAL MEMORY

There are two types of long-term memory (LTM): implicit and explicit. Implicit memories are automatic and are not accessible to the conscious mind, whereas explicit memories are accessible to consciousness, however, require effort to encode, store and retrieve. A child's implicit memory develops prior to birth and is subject to rapid forgetting due to newly replaced experiences. The explicit memory develops by the first year of life. The majority of early

memories are formed at 2 years of age and earlier, and remain non-verbal even after language acquisition. Early memories are easily forgotten as they are nonetheless disorganized and fragmented. According to Howe and Courage (1997), evidence has illustrated that there is an improvement with age in children's long-term retention performance as they have been found to retain information over a continuous period of time. Likewise, there is an increase in the ability to store and maintain information for autobiographical memory (AM) during early childhood.

Present theory and research has demonstrated that autobiographical memory develops throughout life and within particular social and cultural frameworks. More specifically, children raised by mothers who elaborately recall being with their children, have more detailed autobiographical memories (Fivush, 2011). A very recent study conducted by Goddard et al. (2014) explored the general impact on autobiographical memory ability and the extent to which specific executive processes of inhibition, cognitive flexibility/shifting, planning, and verbal fluency impact on autobiographical memory ability. Authors assessed 63 children with an autism spectrum disorder (ASD) and compared them with 63 typically developing children matched for age, gender, IQ, and verbal ability. All children were between the ages of 8 to 17 years. The current study consisted of two sessions. In session 1, participants completed the Wechsler Abbreviated Scale of Intelligence (WASI), BPVS, and verbal fluency test followed by an interview. In the second session, participants were presented with stories, subsets and dot locations followed by a cueing task. Results showed that there were difficulties in retrieving specific events for children with ASD, similar to the comparison group. Authors therefore suggested that specific autobiographical memories are problematic in ASD and other psychological disorders.

THEORIES OF AUTOBIOGRAPHICAL MEMORY

Autobiographical memories are dynamic transitory mental constructions generated from an underlying multilevel knowledge base which is under control of executive processes. They are not like photographs, CDs, DVDs, videos, books, or any type of media, despite the fact that many people tend to believe that they are. Autobiographical memories are divided into two components: autobiographical knowledge and episodic memories. The former is conceptual or abstract knowledge about one's life, meaning memories of the past, present, and future. The latter refers to specific details of experienced events. Hence, autobiographical memories can be redefined as the transitory joining of conceptual autobiographical knowledge with episodic memories. The features of autobiographical memories are that they always consist of a perspective, whether it be field or observer, and they are predominantly represented in the form of visual images. The self-memory system (SMS) was first introduced by Conway and Pleydell-Pearce (2000) as a model of the relationship of AM to the self (Conway, Singer, & Tagini, 2004). This model proposed that autobiographical memories were the transitory mental constructions of a complex goal-driven set of control processes collectively referred to as the "working self". A complex goal that motivates and modulates cognition, affect, and behaviour is a key feature of the SMS model. However, there is neither detail on the nature of goals nor on their relation to memory in the SMS.

Conway et al. (2004, pp.504) stated that "a self-defining memory (SDM) is a specific type of autobiographical memory that has the following attributes: affective intensity, vividness, high levels of rehearsal, linkage to similar memories, and connection to an enduring concern or unresolved conflict". For instance, one of the authors was able to accurately recall where they were during the September 11th attack on the World Trade Centre. It could not be mentioned whether this memory was directly related to the conflicts that preoccupy the authors' sense of identity. The memory was affective and important, however, it could not be considered self-defining. Hence, some personal memories may have the qualities of vividness and affective intensity ascribed to self-defining memories and may be thought about repetitively during one's life due to external cues. Furthermore, authors have explained that these memories have an impact in mood regulation processes for non-depressed people.

The complex nature of memory accuracy is divided into two main components: coherence and correspondence. Coherence is a memory construction that is true in that it is consistent with other knowledge in memory, whereas, correspondence is a memory that is true to the extent that it corresponds with some past experiences. Moreover, all memory constructions fall on the coherence-correspondence dimension. Our episodic representations are at the correspondence end, while at the coherence end, memory content accurately represents the self, such as, a false flashbulb memory. In other words, episodic memories are associated with correspondence constructions, whereas coherence construction is associated with autobiographical knowledge (Conway et al., 2004). Therefore, just as the brain functions to make up one's daily experiences, it also makes up memories with unconscious inferences.

AUTOBIOGRAPHICAL MEMORIES, TIME ESTIMATION AND EMOTIONS

In studies of memory and time, subjects have been found to differ in estimating the actual duration of an event and reporting how they subjectively felt the event lasted for. A series of experiments in two studies investigated (a) how normative data on the organization of emotions are collected and the potential situational factors that underlie this organization, and (b) measured reaction time to test how the situational knowledge, observed in the normative studies, is represented in memory (Conway & Bekerian, 1987). The participants in these experiments were from the undergraduate population of Cambridge University between 18 to 24 years of age. Seven experiments were conducted and divided into two parts, as mentioned previously. A major finding of this study was that there was a significant association between situational knowledge with both conceptual representations of emotional words and personal memories of emotional experiences. From the many implications mentioned by the authors, they suggested that a situational knowledge base can associate with emotions, as well as with different types of knowledge. Hence, the knowledge of emotions overlaps the effectiveness of different types of knowledge for inducing moods.

Autobiographical memory has been shown to play a vital role in the recollections of personally experienced past events. Numerous studies and experiments have examined the effect of emotionally experienced events on one's autobiographical memories, and in particular, individuals experiencing mental illnesses and emotional disorders, such as major depression, anxiety, and post-traumatic stress disorder (PTSD). Williams et al., (2007) pointed out that individuals with major depression and PTSD are unable to retrieve specific memories, rather they often retrieve overgeneral memories, which occurs when memories are condensed together that seem to be frustrating, for example, if an individual often finds what they are looking for, but they retrieve solely the negative memories and squeeze them together, they would therefore perceive memories to be unspecific. A recent study supported Williams et al., (2007) assumption that patients with major depressive disorder tend to retrieve overgeneral memories when attempting to retrieve specific ones (Söderlund et al., 2014). Neuropsychological studies have provided evidence that that when the amygdala is combined with the hippocampus and the prefrontal cortex, they play a vital role together in retrieving emotionally experienced events (Buchanan, 2007; Holland & Kesinger, 2010).

Much has been mentioned of how emotional autobiographical

memories affect the mood of individuals. However, is there an association between emotional memories and time perception? Tipples (2008) used a bisection task on forty-two psychology students from the University of Hull in order to examine the influence of individual differences in self-reported negative emotional arousal on time perception, and to follow up previous research by examining the effects of fearful facial expressions on time perception (Droit-Volet, Brunot, & Niedenthal, 2004; Tipples, 2006; Effron, Niedenthal, Gil, & Droit-Volet, 2006; Thayer & Schiff, 1975). Initially, participants went through a training phase discriminating between "short" (400ms) from "long" (1,600 ms) stimulus durations followed by a test session. During the main test phase, each angry, fearful, happy, and neutral expression was presented for each of the standard (400 ms and 1,600 ms) durations. Finally they completed the EAS Temperament survey for Adults (Buss & Plomin, 1984). Results showed a significant positive correlation between negative emotionality and temporal bias due to both anger and fear, but not happiness. Thus, individual differences in negative emotionality were associated with high levels of overestimations due to both angry and fearful expressions, however, not with happy expressions. Other studies have investigated how subjective time estimation in individuals experiencing psychological disorders like generalized anxiety disorder and major depression perceive time to be slow (Bar-Haim, Kerem, Lamy, & Zakay, 2010; Gil & Droit-Volet, 2009), or depending on the individual's mind set, whether abstract or concrete, one can perceive time as passing quickly (Hansen & Trope, 2013).

A previous study by Mioni, Zakay, and Stablum (2011) investigated temporal abilities in school age children from 4 to 8 years old and how the environment acts on children's subjective perception and experience of time. Children were divided into different groups. They engaged in a time reproduction task with static or moving vehicles (car and truck) that moved from one side of the computer screen to the other in 11 or 21 seconds. Participants were given a practice trial prior to beginning the actual experiment. Finally, at the end of each video, participants were instructed to keep pressing the space bar as long as the duration of the video presented. A significant difference was found between vehicles when presented for 21 seconds, whereas for 11 seconds, there was no significant difference found. In the stimuli, the car was found to be more under-reproduced than the truck. Hence, the longer the stimuli were reproduced, the higher the under-reproduction was between the car and truck. The previously mentioned study was recently replicated, this time comparing primary school children with adults (Mioni, Zakay, Stablum, & Grondin, 2014). Similar methods were carried out, however in this study, either a motorbike or a bicycle was presented for 11, 21, and 36 seconds. Results in Experiment 1 found significant differences, where younger participants under-reproduced the duration more than the older participants did. Thus, younger participants had an effect of symbolic meaning whereas older participants did not. In Experiment 2, four images were presented: a bicycle, a motorbike, a bicycle, and a motorbike driven by a person. Participants were required to respond with their left and right index finger. Results indicated that when the symbolic meaning of fastness was recalled, temporal intervals were under-estimated, whereas, when the meaning of slowness was recalled, temporal intervals were over-estimated. Authors suggested that the appropriate selection of methodology should be taken into consideration when investigating time perception.

Research on how individuals can recall emotional autobiographical memories, either positive or negative, have looked at their ratings of emotional intensity during that event and their current mood state as well as the vividness of their memories. Rasmussen and Berntsen (2009) conducted two studies that examined the characteristics of memory associated with different functions of autobiographical memories, specifically, how emotional memories (positive and negative) serve distinctive functions. Study 1 required participants to generate memories that fit into three functions: directive memories and self and social memories. In Study 2, participants were instructed to generate their most emotional memories, including their most vivid flashbulb memories. All three memories were measured through rating-scale questions. The study found that positive memories were rated higher on the self and social functions, whereas negative memories were rated higher on the directive function, although directive functions were found to consist of the lowest ratings across both studies. Therefore, the two studies provided evidence that different types of memories are associated with different functions and that these functions can serve as cues to elicit specific autobiographical memories.

Interestingly, over the past three decades studies have gradually investigated whether people are able to look back in time and perceive themselves from a field (first-person) or observer perspective. However, further research in this field of study is gradually developing. One study that examined the process of field and observer perspectives during recall of one's autobiographical memory replicated a classical study by Nigro and Neisser (1983) where they argued that many subjects claim they are able to alternate between field and observer perspectives at any moment when recalling past events (Robinson & Swanson, 1993). Authors found that recent experiences were likely to recall a field perspective, whereas older experiences are more likely to be recalled at an observer perspective. People can thus alternate between the ways they perceive their memories from any time in their lives. Recently, clinical research has tested how patients with depression tend to have an impairment of field perspective when recalling positive events (Bergouignan et al., 2008), rather they are more likely to retrieve memories from an observer perspective (Kuyken & Howell, 2000). Furthermore, the question arises as to whether it is possible that individuals can perceive both field and observer perspectives in emotional autobiographical memories, including neutral memories. It would be very interesting to investigate if positive or negative memories would produce overestimation or underestimation of the duration of the event described in the memory and whether there would be a difference in the perceived field/ observer variant when recalling these memories.

The aim of the present study was to investigate whether participants could (a) recall three of their top autobiographical memories (positive, negative, and neutral) and offer a duration estimation of the event that the memory described and an estimation of the felt duration of the same event and (b) perceive their memories either as first-person (field), observer, or both. This study was a follow up of the two previously mentioned studies Nigro and Neisser's (1983) and Robinson and Swanson's (1993) studies. In Robinson and Swanson's (1993) experiment, they asked participants to select either a field, observer perspective or none. The present study was highly interested in looking at whether they are able to see themselves as both first person and as an observer on all three conditions. The experimenter conducted this by asking them to recall three emotional autobiographical memories ranging from 3 to 6 years prior to the current study. Two research hypotheses were proposed:

- There would be a significant correlation between over and under-estimated judgements of time estimation within all three emotional autobiographical memories.
- Whether emotional autobiographical memories (positive, negative, and neutral) would predict a difference in field and observer perspective.

METHODS

STUDY-1

The pilot study was carried out to ascertain whether participants

would be able to recall either a positive, negative, or a neutral autobiographical memory dating back three to six years prior to the study. This study used an independent measure so that each participant would be asked to recall only one of the three emotional autobiographical memories.

Participants

Twenty one undergraduate students at City University London were randomly selected to participate in the study in exchange for either assessment credits or chocolate. There were 11 males and 10 females who participated. The average age was 28 years.

Stimuli

A Dell OPTIPLEX 9010 computer was used. The screen would display three Microsoft Word documents: the debriefing form, briefing form, and question form. A consent form was initially presented to them which each participant was required to complete. A notebook, pen, and ruler that were used by the researcher to record the answers.

Design

The current study carried a 3x2 between subjects design. The independent variable was autobiographical memories which were looked at on three levels of emotion: positive, negative, and neutral. The dependent variables measured were the responses to scales and reported time estimations. Conditions were counterbalanced by neutral memories. The experimental hypothesis was two-pronged, predicting whether there will be a significant correlation between overestimation and underestimation of time of the memories held in past events.

Procedure

Initially, participants were told to fill in a consent form. After briefing they were individually asked open-ended questions by the researcher. Each participant was asked to recollect one of their top autobiographical memories (positive, negative, or neutral) between 3 to 6 years ago. They then had to estimate the timing of that event, provide both subjective and objective estimates including how old they were during that event. The next two questions required participants to rate their emotional intensity and vividness during recollection, using a 1 to 5 Likert scale. Finally, the last question asked to choose whether they were able to perceive themselves in that memory or event from a (a) first-person perspective, (b) observer perspective, or (c) both. The task took approximately 10 minutes to complete. All data were written down and then recorded on an Excel spread sheet.

STUDY-2

The second study was similar to the pilot; however, in this study participants were a completely different group and were instructed to recall all three emotional autobiographical memories during the task. Therefore a repeated measure was taken to examine whether there would be a significant difference between the field, observer perspective and both on all three emotional autobiographical memories.

Participants

Thirty nine undergraduate students at City University London were randomly selected to participate in the study in exchange for either assessment credits or chocolate. There were 23 males and 16 females who participated. The average age was 22 years.

Stimuli

The same as the pilot study.

Procedure

Firstly, participants filled in the consent form. The researcher then handed out the briefing form and carefully explained the instructions for the task. Participants were presented with the questions form on the computer screen. Contrary to the pilot study, participants on this study had to recollect or recall all three emotional autobiographical memories that occurred 3- to 6 years prior to the current study. For each event or memory, both subjective and objective time estimations were reported. Participants then rated their emotional intensity and vividness when recalling the past event, using the Likert scale from 1 to 5. They were finally asked to picture or imagine themselves back in time during all three autobiographical events and choose whether they see themselves from a first person perspective, observer perspective, or both. In Study 2 the task took longer than the pilot (roughly 10-16 minutes for each participant) as participants were required to report two more emotional autobiographical memories. Similarly to Study 1, all data were written down and then recorded on an Excel sheet. (See all three forms in Appendices 1, 2, & 3)

RESULTS

STUDY-1

Descriptive results

In the pilot study each participant was allocated to one emotional memory condition (positive, negative, and neutral). Emotional intensity and vividness ratings were taken. Table 1 shows the mean and standard deviations for emotional intensity and vividness on all three conditions. The means demonstrate that emotional intensity in positive events were quite intense (M = 3.43, SD = 1.51), whereas in the negative condition, events were reported to be highly intense (M = 4.14, SD = 1.21), compared to neutral events which were surprisingly intense (marginally) (M = 3.57, SD = 1.27). The ratings of vividness were all above the scale of three, indicating that memories of experienced events were very clear (Positive (M = 3.57, SD = 1.39), Negative (M = 4.00, SD = 1.00), and Neutral (M = 3.57, SD = 1.27)).

Over and under-estimated judgements of time

There is not a statistically significant correlation between estimation of felt duration versus duration (over estimation or underestimation) and emotional level of autobiographical memory: for positive emotional memory ($r = 0.471$, $p = 0.286$), for negative emotional memory ($r = 0.167$, $p = 0.465$) and for neutral ($r = 0.341$, $p = 0.202$). An independent measure two-way ANOVA was carried out. The mean numbers of observer/participant/both experiences in the positive condition, negative condition and neutral condition did not differ significantly ($t = 2.23$, $df = 20$, $p = 0.114$). Figure 1 shows overestimation and underestimation in the three emotional level conditions. (See Appendix 4. for correlations).

Memory perspectives within emotional autobiographical memories

Most participants in this study found it difficult to immediately report memories that were 3 years earlier, rather they found it easier to recall memories that were either 4, 5, or 6 years prior to the study. It was shown that (4/21) students reported viewing their memories from a first-person perspective, (8/21) reported being an observer in

Table 1.
Means and Standard Deviations for Emotional Intensity and Vividness on each condition in Study 1.

Conditions	Positive		Negative		Neutral	
	Mean	SD	Mean	SD	Mean	SD
Emotional Intensity	3.43	1.51	4.14	1.21	3.28	1.25
Vividness	3.57	1.39	4.00	1.00	3.57	1.27

their memories, and finally, (7/21) reported seeing themselves as both on each condition of emotional autobiographical memories. Table 2 illustrates the number of memory perspectives reported on each condition. An independent samples t-test was taken to see whether there was a significant difference between memory perspectives (first person, observer, or both) in all three conditions. Analysis showed that t-test was found to be insignificant, t (13) = 0.746, p >0.05. Memory perspectives were shown to have no significant differences within emotional memories. Figure 2 shows observer, field, and both levels of perspective in recalling autobiographical memories of the three emotional level conditions. (See Appendix 4. for Independent Samples T-test)

STUDY-2

Descriptive results

In the main study a new group of participants were allocated to all three emotional memory conditions (positive, negative, and neutral). Emotional intensity and vividness ratings were taken. Table 3 shows the mean and standard deviations for emotional intensity and vividness on all three conditions. The means demonstrate that emotional intensity in positive and negative events were reported to be highly intense (Positive (M = 4.04, SD = 0.88) and Negative (M = 4.30, SD = 0.95)), compared to neutral events which were not intense (M = 2.49, SD = 1.14). The ratings of vividness were all above the scale of 3, except for neutral memories, contrary to Study 1 (Positive (M = 3.95, SD = 0.88), Negative (M = 4.71, SD = 1.23), and Neutral (M = 2.71, SD = 1.19).

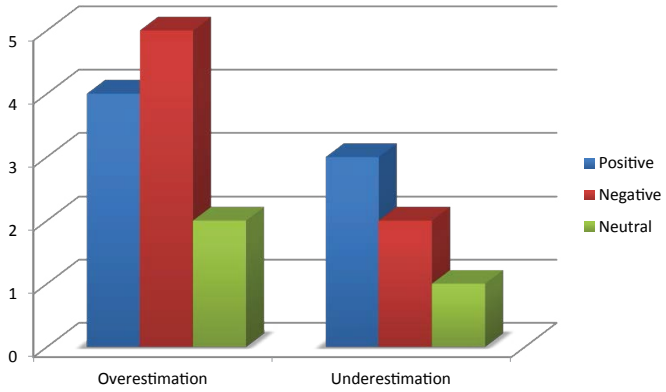

Figure 1. Overestimation and underestimation in the three emotional level conditions.

Table 2.
Number of Memory Perspectives reported on each condition in Study 1.

Conditions	Positive	Negative	Neutral
	N = 7	N = 7	N = 7
Field/First-person	1	2	3
Observer	3	3	2
Both	3	2	2

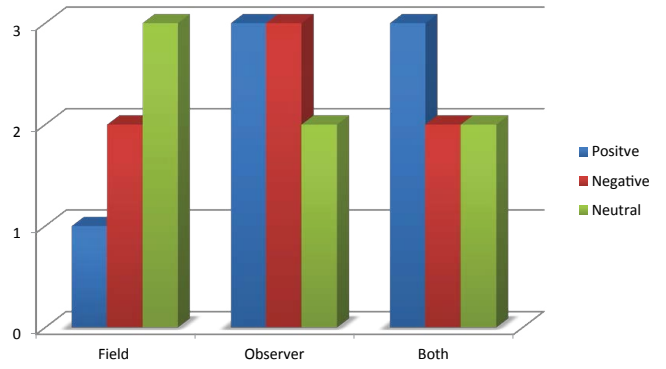

Figure 2. Observer/Field/Both levels of perspective in recalling autobiographical memories the three emotional level conditions.

Over and under-estimated judgements of time

There is not a statistically significant correlation between the estimation of felt duration versus durations (over estimation or underestimation) and emotional level of autobiographical memory: for positive emotional memory (r = 0.225, p = 0.168), for negative emotional memory (r = 0.208, p = 0.157) and for neutral (r = 0.431, p = 0.197). (See Appendix 4. for correlations)

Memory perspectives within emotional autobiographical memories

Table 4 illustrates the number of memory perspectives reported on each condition. A repeated measure two-way ANOVA was carried out. The mean number of observer/participant/both experiences in the positive condition, negative condition and neutral condition did not differ significantly (t = 22.462, df = 38, p = 0.193). Figure 3 shows observer, field, and both levels of participation in recalling autobiographical memories in the three emotional level conditions. (See Appendix 4. for ONE-WAY ANOVA).

DISCUSSION

STUDY-1

The objective was to examine whether there would be significant correlations between over and under-estimated judgements of time within emotional autobiographical memories as well as whether there would be a significant difference between the levels of memory perspective on all conditions using independent measures. However, findings of this study were found to be insignificant and thus the hypotheses proposed were rejected. This therefore indicated that there were no significant correlation between over and under-estimated judgements of time and no significant differences between field and observer perspective found. It was shown that the gap between over and underestimated judgements reported by participants was not as a high as expected, although more than half of participants provided over-estimations of time compared to

Table 3.
Means and Standard Deviations for Emotional Intensity and Vividness on each condition in Study 2.

Conditions	Positive		Negative		Neutral	
	Mean	SD	Mean	SD	Mean	SD
Emotional Intensity	4.05	0.88	4.30	0.95	2.49	1.14
Vividness	3.95	0.88	3.71	1.23	2.71	1.19

Table 4.
Number of Memory Perspectives reported on each condition in Study 2.

Conditions	Positive	Negative	Neutral
	N = 39	N = 39	N = 39
Field/First-person	13	9	17
Observer	20	11	8
Both	16	12	11

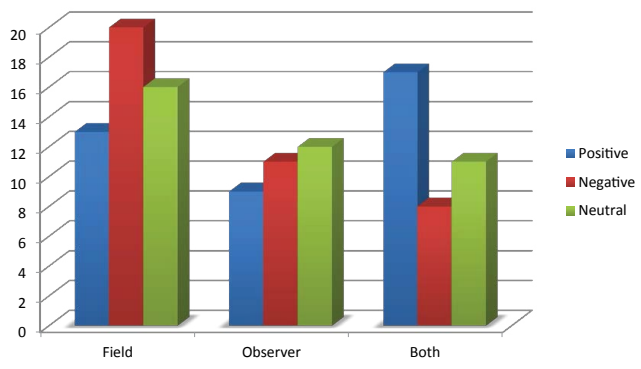

Figure 3. Observer/Field/Both level of participation in recalling autobiographical memories in the three emotional level conditions.

under-estimations. There were individual differences in how they looked back in time and perceived themselves; nevertheless, in all three emotional conditions participants were able report a memory perspective of seeing themselves during retrieval. Moreover, each condition in this study illustrated that participants were emotionally intense and that their memories were vivid so they did what they were asked.

STUDY-2

This study predicted the same hypotheses and was in fact the actual experiment itself, using repeated measures. Similarly to Study 1, results of this study were found to be marginally insignificant. Therefore, even with a larger group of participants where each participant undertook all three conditions, no significant correlations were found and neither were there any significant differences between memory perspectives found within emotional memories. Furthermore, within all three conditions, participants showed no differences in their objective and subjective duration judgements of the original events and whether they perceived them to be first-person, observer, or even both. Nonetheless, during the negative condition, a large amount of participants reported looking back at their memory and seeing themselves in a first person or field perspective, compared to observer perspective or both. In addition, positive and negative conditions indicated that participants were highly emotionally intense and that their memories were exceedingly clear, compared to the control condition (neutral).

GENERAL DISCUSSION

Summary of findings

Overall, the sole aim of the research was to investigate the relationship between time perception and emotional interference on autobiographical memories. Two studies were conducted, one pilot, the other was the actual experiment. The pilot used an independent measure whereas the second study used repeated measures. Both studies were found to be insignificant. Therefore, (a) there were no significant correlation between over and under-estimated judgements of time estimations within emotional autobiographical memories and (b) no significant difference was found between memory perspectives in all three conditions. There were individual differences with regards to memory perspectives as many participants seemed to be able to perceive both field and observer perspectives in one recollected memory. However, some were only able to view themselves from a field and others only from an observer perspective in all three conditions. In short, despite insignificant results, participants in both studies were able to provide evidence to some extent that emotional autobiographical memories can interfere with the perception of time.

Reference to previous research

The results of this research showed no distinction between over and under-estimated judgements of time in all levels of emotional autobiographical memories. However, as Tipples (2008) found increased levels of over-estimation due to negative emotionality expressions but not with happy expressions, the current research showed consistency in that during both studies, when participants recalled negative emotional autobiographical memories there were also high levels of over-estimated judgements of time. This finding supported recent studies in the pattern of overestimated judgements due to emotional personal memories (Droit-Volet et al., 2004; Effron et al., 2006). Emotional interference was shown to have an impact on experienced and recalled time estimation of autobiographical events which were parallel to Block and Zakay's (1997) finding that several variables can influence experience duration and remembered duration.

Robin and Swanson (1993) reported that the experienced intensity of memories tended to decrease when retrieving memories that were more of an observer perspective, whereas, there were no changes of experienced intensity during the converse shift. In the second study of the current research, participants were vastly subjective when reporting emotional intensity and from what type of perspective they viewed themselves which led to individual differences, as many were highly intense during both positive and negative conditions and in memory perspectives. It was demonstrated in this research that memory perspectives between first person, observer, or both perspectives did not differ within emotional autobiographical memories. Memories of events that focused on feelings and negative emotions led to a field perspective of the memory (Nigro & Neisser, 1983). More than half of the participants during the negative autobiographical memory condition reported looking back at the event in a first-person perspective. This finding, however, contradicted the findings of Kuyken & Howell (2000) who reported that adolescents with depression were likely to retrieve memories from an observer point of view. In both studies, the likelihood of participants retrieving positive memories in a field or first-person point of view was quite low, particularly in the pilot study, which proved as evidence to Bergouignan et al., 2008 in that field perspectives impair retrieving positive memories.

An important finding was that the majority of participants were able to view themselves from both a field and an observer perspective during recall of a positive autobiographical memory. Studies that sought to investigate the point of view that participants would report during the retrieval of personal memories gave the selection of either observer, field perspective, or neither of the two (Nigro & Neisser, 1983; Robinson & Swanson, 1993). Interestingly, the current research was the first to look if participants were able to perceive themselves as both in a particular event on each condition. In other words, participants were asked in the final question to select, when looking back at that emotional memory, whether they see themselves in a (a) first-person (field) perspective or (b) observer perspective, or (c) as both. There were a group of participants in the second study who were able to select both on all three conditions, as well as there were high reports of both during the positive condition. This significant finding indicates that individuals are able to alternate their memory perspectives in a single recollected event.

Limitations

One of the main limitations of the study was the lack of control on the subjective and objective judgements of time estimations on all levels of emotional autobiographical memories as the differences between them varied widely and caused confusion. The use of a PC to display the questions, briefing, and debriefing forms helped, however, this limited the research to only a computer lab rather than using forms to conduct studies outside as this research was not computer-based.

Suggestions and implications for future study

As mentioned earlier both hypotheses in both studies were found to be insignificant which led to the suggestion that individuals slightly differ in over and under-estimating judgements of time during the retrieval of emotional events and that when retrieving positive memories, individuals view them from an observer point of view, whereas, individuals report seeing their negative memories in a field perspective during retrieval. For future study, it would be highly crucial that participants are clear about the type of emotional memory sought prior and during the study and that subjective and objective judgement of time estimations are as accurate as possible and controlled in order to avoid confusion and errors in data analysis, although subjectivity can be difficult to control. Finally, as this research used PC screens in computer labs to display the forms, it would be preferable that replicated or follow-up research used forms

for the questions, briefing, and debriefing rather than computers as this would be easier to conduct. In addition, an important implication would be either to use repeated measures where all participants undergo all conditions of the study or use the same methods to conduct further research on prospective and retrospective duration paradigms as prospective judgements were found to be longer than retrospective judgements (Block & Zakay, 1997), as well as using a larger number of participants.

CONCLUSIONS

To summarise, findings failed to prove both hypotheses in the two conducted studies. There were no major gaps between over and under-estimation of duration judgements. In each condition, all three levels of memory perspective that were selected demonstrated the ability for mental time travel and to look at one's self in either a field, observer perspective or both in a single retrieved event. For future study, an important recommendation would be the control of time estimations between the objective (actual) duration of the event and, in particular, the subjective duration judgements made by participants. Furthermore, regardless of the insignificant findings, this research to some extent suggests that emotional interferences and time perception, under specific experimental methods may have an influence on one's autobiographical memory suggesting a great demand for further study on the topic of time perception.

ACKNOWLEDGEMENTS

First of all, I would like thank and praise Almighty God for giving the power, strength, knowledge and skills to carry out this research project and for giving me patience and faith in myself. I thank my family and friends for their support and encouragement. I thank my personal tutor Dr. Dermot Bowler for his advice prior to beginning this project. Finally, I am extremely grateful and blessed to have Dr. Pavlos Fillippopoulos as my supervisor and I truly thank him for all that he has done to help and support me, for verily, I have been motivated and encouraged from day one about the research topic and he has managed to keep me motivated throughout the year.

"Time shapes human life and behaviour." (Zakay, 2012, pp. 578)

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