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Voluntary and Involuntary Mental Time Travel in Dysphoria and Depression - Characteristics and Mechanisms

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A thesis submitted for the degree of Doctor of Philosophy

to

School of Health in Social Science
University of Edinburgh

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Para a minha mãe e para o meu pai

DECLARATION

I hereby declare that I was the sole author of this thesis and that the work described within, except where explicitly acknowledged in the text and references, is my own and has not been submitted in any previous application for a degree.

A research assistant (fifth year psychology student) from the Instituto Superior de Psicologia Aplicada – Instituto Universitário (ISPA-IU), was involved in the recruitment and data collection of Study 1, under the supervision of both myself and the Research Collaborator, Auxiliary Professor Victor Cláudio, from ISPA-IU. The research assistant was recruited to avoid interruptions in the data collection process during the time I spent at the University of Edinburgh. Consequently, her contribution was limited to following the protocol I designed for the data collection of Study 1. She had no intellectual contribution to the hypotheses and design of Study 1, nor to the analyses/interpretation of the data collected. Her involvement in Study 1 ceased once the data collection was complete. This arrangement was approved by the first year review board in March 2012.

João Pedro Garcez Aurélio dos Santos

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Abstract

Mental time travel (MTT) refers to an individual's ability to mentally travel through subjective time, autonoetically re-experiencing past events under the form of autobiographical memories (past MTT), and pre-experiencing events as future autobiographical representations (future MTT). MTT can occur voluntarily, whereby a past/future autobiographical event is subjectively experienced as an intended occurrence, or involuntarily, wherein such an event is subjectively experienced as an unintended outcome of which the individual is aware. Studies investigating MTT's characteristics in dysphoria and depression show that dysphoric and depressed individuals produce more overgeneral and negative MTT events when compared to control groups. However, existing research has been limited to past and voluntary MTT events, with few studies investigating involuntary MTT and future MTT in dysphoria and depression.

The overarching aim of the present research was to compare the phenomenological characteristics of MTT in dysphoric individuals vs. normal mood individuals (Study 1), and in clinically depressed individuals vs. never-depressed individuals (Study 2), with the purpose of furthering existing knowledge on MTT and its relation with dysphoria and Major Depressive Disorder. This aim was addressed by conducting two studies, using a 2 x (2 x 2) mixed-factorial design, with temporality (past vs. future events) and type of retrieval (voluntary vs. involuntary events) as within-subjects independent variables, and participant group as a between-subjects variable. In Study 1, Portuguese university students were categorised into a dysphoric (n=17) or a normal mood group (n=39) depending on their score on the Beck

Depression Inventory (BDI-IA) – cutoff point (≥ 10). In Study 2, clinically diagnosed depressed patients (n=32) were recruited from a Portuguese hospital and matched for age and gender with never-depressed control participants (n=32) recruited from the community. The dependent variables tested were: level of spatiotemporal specificity, self-relevance, mood and physical impact, valence, and visual perspective of the MTT events produced. A diary methodology was used in both studies, with an open-ended time period that lasted for a minimum of two weeks, for participants to record their MTT events and grade them on the above mentioned variables using Likert-type ratings. Between seven and fourteen MTT events were produced for *each* of the four MTT conditions (past voluntary, past involuntary, future voluntary, future involuntary).

Results showed that when compared to their respective control groups, depressed, but not dysphoric participants, exhibited a clear influence of mood on several of the phenomenological characteristics of MTT. In Study 1 there were no statistically significant differences in the specificity, negative valence, and mood/physical impact of the MTT events produced by dysphoric and normal mood participants. On the contrary, in Study 2, results partially supported a lower specificity and fully supported a greater negativity and mood/physical impact of MTT events in depressed individuals compared with never-depressed participants. Both studies supported the greater self-relevance of voluntary MTT events and partially supported the hypothesised effect of type of retrieval in specificity.

These were the first studies to directly compare past and future, voluntary and involuntary MTT events in dysphoric and depressed individuals, addressing existing gaps in the literature. The key limitation is the relatively small sample size of both

studies, however each participant was comprehensively assessed for at least two weeks, providing a rich set of reliable data. Despite limitations, this thesis provides novel pilot findings that help understand the similarities and differences between involuntary and voluntary, past and future MTT, as well as providing new information regarding the possible role of MTT in dysphoria and depression.

CHAPTER ONE – THESIS OVERVIEW

The purpose of this thesis is to examine the phenomenological experience of Mental Time Travel (MTT) in normal mood, dysphoric, never-depressed and depressed individuals, so as to further existing knowledge on MTT and its interaction with dysphoric mood and Major Depressive Disorder (MDD). Throughout this thesis MTT refers to the ability to mentally travel through subjective time, which enables an individual to be "transported" into the past, re-experiencing events under the form of autobiographical memories with semantic and episodic content (past MTT), and into the future, pre-experiencing events as future autobiographical representations with semantic and episodic content (future MTT). Furthermore, the phenomenological experience of MTT consists of the subjective experience associated with remembering or pre-experiencing an event, manifest in a number of event-related factors such as specificity, self-relevance, mood and physical impact, valence and visual perspective.

The past and future MTT events assessed in this thesis are based, respectively, on veridical past experiences and realistic future occurrences. Consequently, alternative pasts and unrealistic future occurrences were not considered.

The introduction has been divided into five chapters, each attempting to provide the reader with the historical and theoretical background necessary for understanding MTT's relevant dimensions, theories and controversies, as well as the nature of its interaction with dysphoric mood and MDD. The reader is first exposed to chapters with macro-level information, wherein the foundational systems, processes, and findings contributing to the phenomena under study are described. Once the

necessary elementary knowledge has been presented, it is then supplemented by theories, constructs, and findings directly associated with the hypotheses assessed in this thesis.

Chapter 2 discusses memory systems, processing stages and processes to explain how the informational content of past and future MTT events is created and later accessed. The valuable contributions of short- and long-term memory systems towards MTT are described with a level of detail that allows the reader to understand the underlying structure and mechanisms of the working, semantic, episodic, and autobiographical memory systems. Additionally, memory processes and processing stages are described to explain how information is encoded and what factors contribute to its apprehension, the manner in which it is stored and what variables influence its consolidation and reconsolidation, and how it is retrieved and what components impact its retrieval. These memory components provide the "building blocks" of MTT, which impact the phenomenological variables studied in this thesis.

Chapter 3 capitalises on the information provided in Chapter 2 and delves directly into the two key axes of MTT explored in the thesis: temporality (past vs. future) and type of retrieval (voluntary vs. involuntary). Similarities and differences between past and future MTT are explored, and relevant neuroimaging and behavioural studies presented. The literature is reviewed, highlighting a clear predominance of studies on past MTT and, subsequently, the need to extend findings into future MTT and its relationship to past MTT – two aspects this thesis attempts to address. Furthermore, voluntary and involuntary retrieval are discussed. The differences and similarities between both types of retrieval are analysed, as is their impact on MTT. The present imbalance of research on type of retrieval is addressed,

since there are considerably more studies devoted to voluntary than involuntary MTT. This is exacerbated by scant research on the retrieval mechanisms of future MTT, assumed to be similar to those of past MTT, and the object of analysis in this thesis.

Chapter 4 focuses on depression, with a brief historical review of its classification systems, followed by its prevalence, course, and possible outcomes. The level of disability induced by depression is also described, as are its vulnerability factors and their respective impact on MTT. The need for additional research that can help improve therapeutic success is pervasive across this chapter, and the present thesis aims to contribute to this goal by addressing previously unexplored aspects of MTT in dysphoria and depression.

Chapter 5 reviews the existing literature on some of the phenomenological variables under analysis in this thesis, namely the level of spatiotemporal specificity, valence, and visual perspective associated with MTT experiences. The information presented builds on the concepts, models, and theories of previous chapters, progressively structured to enable an understanding of the similarities and differences in past and future, voluntary and involuntary MTT experiences of normal mood, dysphoric, never-depressed and depressed individuals. While providing the necessary context to interpret the hypotheses of this thesis, Chapter 5 evidences discrepancies and limitations in the MTT literature.

Chapter 6 presents the thesis' aims and hypotheses. Study 1 compared dysphoric mood individuals with normal mood individuals on a number of MTT characteristics, namely their specificity, centrality to life and identity, valence, physical and mood impact, as well as visual perspective, whereas Study 2 compared these same characteristics between depressed and never-depressed individuals.

Chapters 7-9 cover the methodology, results, and discussion of Study 1, respectively. Chapters 10-12 address Study 2, following the same structure.

Chapter 13 provides a general discussion of the results across the two studies and presents the limitations of this thesis, its conclusions and implications for future research.

CHAPTER TWO – MEMORY

The term memory is often used to describe different concepts, ranging from systems of organisation to processes and representations (Tulving, 2000). Given this heterogeneity, a universal definition of memory has proved elusive, with Klein (2015a) claiming that "memory consists in an initial act of registration (learning) which, via the continuity assumed necessary and provided by the mechanism of storage, eventuates in an act of retrieval" (p.3). In this chapter, the multiplicity of memory is accounted for, with a focus on the dimensions that are particularly relevant for the present thesis.

2.1. Memory System(s) – Origin and Rationale

For thousands of years, different theories have sought to explain how memory is represented and organised in human beings (Foster & Jelicic, 1999). From Aristotle's distinction between memory and reminiscence, dating as far back as 350 BC, to Maine de Biran's nineteenth century proposal of three different types of long-term memory, or William James' references to primary and secondary memory, there have been numerous attempts to identify and define different forms of memory (Eichenbaum, 2008a). In spite of this, unified memory theories proposing a single memory system were the dominant paradigm until the 1970s (Schacter & Tulving, 1994b; Sherry & Schacter, 1987; Tulving, 1999), paralleling unitary theories of learning (Klein, Cosmides, Tooby, & Chance, 2002; Nadel, 2008).

According to Schacter and Tulving (1994b) it was a confluence of three factors, occurring between the late 1960s and the early 1980s, that affirmed the multiple memory systems framework:

a) Findings from neuropsychological studies. Scoville and Milner's (1957) influential article alluded to the relevance of the medial temporal lobe for specific types of memory and hence acted as a catalyst to the debate that followed about the possibility of multiple memory systems (Mullally & Maguire, 2014). The interest it generated led to further attempts at replication in the animal memory literature (Schacter & Tulving, 1994b) which, having been successful, contributed to proposals of functional and neuroanatomical dissociations between different types of memory (O'Keefe & Nadel, 1978) that were later extended to human memory research (Cohen & Squire, 1980). These findings, coupled with observed memory impairment dissociations in pathological states like the Korsakoff Syndrome and Alzheimer's disease (Kopelman, Thomson, Guerrini, & Marshall, 2009; White, 2008), and with progress in cognitive neuroscience, strengthened claims of associations between specific brain regions and distinct types of memory. This convergence of manifold data has, thus, been essential to the current accord about a multiple memory systems framework (Eichenbaum, 2008a);

b) The emergence of the distinction between semantic and episodic memories (Schacter & Tulving, 1994b). Tulving's (1972) proposal that episodic and semantic memory were two distinct memory systems prompted several studies and subsequent theories, many of them supporting the independence of both

types of memory (Martin & Simmons, 2008; Nyberg, 2008; Tulving, 1985a; Tulving & Markowitsch, 1998);

c) Convergent dissociations between declarative and nondeclarative memory, meaning "dissociations of different kinds, observed with different tasks, in different populations and using different techniques" (Schacter & Tulving, 1994b, p.18). Several studies in the 1980s, inspired by the aforementioned neuropsychological findings and research about semantic and episodic memory, postulated dissociations between procedural and declarative memories (Graf, Squire, & Mandler, 1984; Schacter & Tulving, 1994b), and hence contributed to current research seeking to refine existing knowledge of such systems (Burwell & Agster, 2008; Knowlton & Moody, 2008).

The concept of memory system(s) has thus been the object of various debates (Foster & Jelicic, 1999; Roediger, Rajaram, & Srinivas, 1990; Schacter & Tulving, 1994a), having experienced considerable development since the 1970s. Throughout this time, other conceptualisations for memory structure/organisation have also been proposed. A unified memory theory has been proposed by those who oppose the multiple systems view (Gaffan, 2002; Nee, Berman, Moore, & Jonides, 2008), although a holistic description of memory does not seem viable given the data in favour of a multiple systems framework (Eichenbaum, 2008b). There has also been a proposal emphasising the role of the components involved in information processing (Cabeza & Moscovitch, 2013), which has argued for a "middle ground" between a memory systems view and the frameworks advocating an organisation couched in perceptual and conceptual forms of information processing. This proposal asserts that there are

multiple processing components that can be arranged according to numerous combinations, depending on the nature of the task. Compared to the memory systems approach, this framework is still in its early stages of development.

Finally, Klein (2015a, 2015b) also diverged from a memory systems' approach, advocating the importance of a subjective and phenomenological experience in determining whether a memory occurs. According to Klein (2015a, 2015b), information is encoded and stored in a system-neutral format, and it is the experiential process associated with retrieval that determines whether it is a memory that is experienced or some other mental state. Although Klein's ideas will be mentioned at different points in this thesis, given their relevance for several of the phenomenological aspects being discussed, a memory systems approach will often be used to frame the existing literature, due to its prominence in Mental Time Travel (MTT) research.

2.2. Different Taxonomies of Memory Systems

Whereas the adequacy of a multiple systems framework is arguably consensual among the majority of cognitive psychology and neuropsychology researchers (Eichenbaum, 2008a; Schacter & Tulving, 1994b), no similar consensus exists respecting the number and characteristics of existing memory systems (Foster & Jelicic, 1999; Schacter & Tulving, 1994a). Over the past 40 years different taxonomies have been proposed, from distinctions between and within declarative and nondeclarative memory (Squire 1992; Squire & Shrager, 2008), and between and within short-term and long-term memory (Baddeley, 2007; Buchsbaum & D'Esposito, 2008), to distinctions between episodic and semantic memory (Nyberg & Tulving

1996; Tulving, 2005). This multiplicity has fostered attempts to define stable criteria for memory systems that help establish a baseline for the analysis and comparison of possible frameworks (Foster & Jelicic, 1999; Schacter & Tulving, 1994a).

Tulving (1985a) defined memory systems as the principal subdivisions under which memory is organised. Each of these systems is composed of neural, cognitive and behavioural correlates that are combined together to provide a response to everyday tasks. Sherry and Schacter (1987) also affirmed the interactive nature of a memory system's components, considering them the result of an interaction between encoding, retention and retrieval mechanisms, framed by rules of operation. Eventually, Schacter and Tulving (1994b) and Schacter, Wagner and Buckner (2000) went further, and proposed three criteria to determine the existence of a memory system: (a) Class inclusion operations, referring to the ability of a memory system to perform several functions within a particular class/domain, such as the capacity of semantic memory to process different types of information like words or numbers within the general class/domain that is knowledge; (b) properties and relations, respecting a memory system's critical features and how these relate to other systems – e.g., the neural substrates underlying a memory system or the type of information it processes; (c) convergent dissociations, which may take the form of functional dissociations produced by experimental manipulations.

The existence of different memory systems conformant with these criteria (Nyberg & Tulving, 1996; Schacter et al., 2000) suggests that memory can be structured in different ways, depending on the functions of the brain systems involved (Eichenbaum, 2008a). If memory is conceived as a set of functions serving specific

adaptive purposes from which individuals can learn, it follows that different human experiences and needs will require different types of memory (Sun, 2012).

It is beyond the scope of this thesis to give a detailed exposition of all possible memory systems. Consequently, the focus throughout the remainder of this chapter will be on the memory systems considered important for understanding MTT processes and mechanisms. Following Roediger, Zaromb and Goode's (2008) framework, the ensuing sections and subsections describe memory systems in accordance to the timeframe of their representations.

2.3. Short-term Memory Systems

Although the construct of short-term memory dates back to the 19th century work of Willem Wundt, William James and John Mill, only in the 1950s and 1960s did it achieve prominence, via the research endeavours of Donald Broadbent, Donald Hebb and George Miller (Atkinson & Shiffrin, 1971; Miller, 1956). Since then, the considerable accumulation of knowledge and breakthroughs in this field (Buchsbaum & D'Esposito, 2008) have led to a paradigm shift, from Atkinson and Shiffrin's (1968, 1971) seminal model of short-term memory as a passive single-component system, to current conceptualisations of working memory as a multicomponent system that is actively involved in complex cognitive activities (Baddeley, 2000a, 2012; Buchsbaum & D'Esposito, 2008).

It is in this latter capacity that the working memory system – more specifically Baddeley's multicomponent working memory model (Baddeley, 2012) – is described in the ensuing subsection. Its involvement in apprehending and manipulating

information means it is indispensable to the construction of past and future MTT events. Furthermore, besides its involvement in encoding and retrieving MTT experiences (Conway, 2005), working memory also impacts several of their phenomenological aspects, such as specificity (Ros, Latorre, & Serrano, 2010), valence (Levens & Gotlib, 2009), imagery, and associated emotions (Andrade, 2014; Kavanagh, Freese, Andrade, & May, 2001; Van den Hout et al., 2010), all of which are of crucial importance to the hypotheses underlying this thesis – see Chapters 3, 5, and 6 for details.

2.3.1. Working memory system

The original conception of short-term memory systems as relatively passive single component storage structures was profoundly impacted by Baddeley's proposal of a dynamic multicomponent working memory model (Baddeley, 1986, 2000b, 2007, 2012). The term working memory, borrowed from Miller, Galanter and Pribram (1960), sought to convey the active role of short-term memory structures in capturing and manipulating information (Buchsbaum & D'Esposito, 2008). Since Baddeley's proposal, the concept of working memory has become ingrained in the short-term memory literature (Baddeley, 2003; Buchsbaum & D'Esposito, 2008) despite several alternative approaches being suggested (see Baddeley, 2012, for a review). Additionally, because most of these alternative approaches differ from the multicomponent memory model only in terms of emphasis and scope (Baddeley, 2012), it is the latter approach that is described in the following subsection.

2.3.1.1. Multicomponent working memory model

The multicomponent working memory model perceives working memory as a "complex interactive system that is able to provide an interface between cognition and action, an interface that is capable of handling information in a range of modalities and stages of processing" (p.19, Baddeley, 2012). This interface is made possible by the components of the multicomponent model, namely the phonological loop, the visuospatial sketchpad, the episodic buffer and the central executive (Baddeley, 2007).

The phonological loop is one of two domain specific mechanisms of memory maintenance, composed of a passive buffer titled phonological store, that stores speech-based information, and an articulatory rehearsal process, which refreshes and revivifies the contents of the phonological store. It is through the interaction of both components that representations of verbal material are kept active (Buchsbaum & D'Esposito, 2008).

The visuospatial sketchpad is the other domain specific mechanism of memory maintenance, and can be fractionated into two distinct but interrelated components: A visual store, named visual cache, which maintains the visual features of perceived or internally generated objects, and a spatial manipulation and rehearsal *inner scribe* system, that is believed to serve a rehearsal function (Logie, 2011). Via its involvement in visual imagery (Baddeley & Andrade, 2000), the visuospatial sketchpad not only plays an important role in the (re)construction of MTT events, but also in visual imagery's detrimental contributions towards several clinical disorders, depression included (Brewin, Gregory, Lipton, & Burgess, 2010; Holmes & Mathews, 2010).

The central executive is a domain-general mechanism of executive control (Buchsbaum & D'Esposito, 2008) that functions as an attentional controller

(Baddeley, 2000a) and is involved in the coordination and control of working memory components (Baddeley, 2012), being responsible for the processing of information (Andrade, 2014).

The final component, the episodic buffer, was Baddeley's most recent addition to the model (Baddeley, 2000b). It was included to satisfy the need for a system that could represent and bind inputs from all the components of working memory and long-term memory systems into one multidimensional code. The episodic buffer constitutes a possible explanation as to how, having received information from different sources and in different codes, an individual is capable of integrating them into a single item/event and store it for a small period of time (Baddeley, 2000b; Gathercole, 2008).

Baddeley's multicomponent working memory model is couched in two key premises (Buchsbaum & D'Esposito, 2008) that are particularly relevant for the present thesis, namely its limited capacity for information processing, and the structural independence of its subsystems. Regarding the former, the working memory system' limited capacity implies there are limits to the amount of information it can process simultaneously. These limits have been shown to be negatively impacted by depression, as depressed individuals tend to require greater cognitive effort to be as efficient as never-depressed individuals during effortful tasks (Harvey et al., 2005). Consequently, depressed individuals often experience cognitive deficits, and given that the central executive component of the working memory system has a positive correlation with the spatiotemporal specificity levels of MTT (Birch & Davidson, 2007; Raes, Hermans, Williams, Demyttenaere et al., 2006), depressed individuals are often at a disadvantage regarding the production of specific MTT events, an aspect evaluated in Hypothesis 1 of this thesis (see Section 5.1). Furthermore, the working

memory system's limited capacity implies that stimuli from the environment and long-term memory continuously compete to be the focus of attention, placing this system in a privileged situation to impact emotional regulation. However, research suggests that when faced with competing stimuli, depressed individuals are not only impaired in their ability to select positive stimuli for working memory processing (Levens & Gotlib, 2009), but they also struggle to dismiss irrelevant negative stimuli from working memory processing (Joormann & Gotlib, 2008; Zetsche, D'Avanzato, & Joormann, 2012). Both these impairments constitute biases that can influence the valence of MTT experiences, a premise tested in Hypothesis 4 of the current thesis.

Concerning the structural independence of working memory's specialised subsystems, it implies each is responsible for representing specific types of information, ensuring there is no between-subsystems interference during information processing. As a consequence, therapeutic techniques have been developed that take advantage of the working memory system's limited processing capacity and the independence of its subsystems by overloading the visuospatial sketchpad, limiting its capacity to process involuntary traumatic MTT events (James, Zhu, Tickle, Horsch, & Holmes, 2015; Kavanagh et al., 2001; Lilley, Andrade, Turpin, Sabin-Farrell, & Holmes, 2009).

2.4. Long-term Memory Systems

The concept of long-term memory has been one of the most misunderstood constructs in psychology, often utilised to categorise whichever memory phenomena do not comply with short-term memory criteria (Roediger et al., 2008). In the present

thesis, long-term memory refers to what an individual is able to recall from the past when "the information to be learned no longer occupies the current stream of thought, either because immediate memory capacity was exceeded or because attention was diverted…" (Jeneson & Squire, 2012, p.15), meaning that it refers to information the individual can access in the absence of sensorial exposure to it, or rehearsal.

The most popular taxonomy characterising long-term memory systems is that which distinguishes between nondeclarative and declarative memory systems. It was first proposed by Ryle (1949), and later refined by Squire (1982), who suggested the integration of additional systems within these two overarching constructs. Hence, the nondeclarative memory system was considered to encompass a group of nonconscious knowledge systems, being characterised by a heterogeneous set of abilities that allowed an individual to acquire information unconsciously and express it through performance (Squire & Shrager, 2008). The declarative memory system, on the other hand, was deemed to include semantic and episodic memory systems, being characterised by a conscious knowledge of facts and events, flexibly represented in the mind, which helped model an individual's views of the world. This thesis aimed to explore the declarative memory system, in particular the role of semantic and episodic memory in MTT.

Traditionally, whereas the episodic/semantic distinction has served a useful heuristic within the neuropsychological literature, supported by several double dissociations found between both systems (Irish & Piguet, 2013), memory theorists have adopted a broader view, often focusing on the nature of these systems' interactions (Greenberg & Verfaellie, 2010). In this regard, a better understanding of the interplay between episodic and semantic elements has been provided by

autobiographical memory research, given that autobiographical memory is a result of the synergy between semantic and episodic memory components (Conway, 2009; Irish & Piguet, 2013; Markowitsch & Staniloiu, 2011), that often results in what this thesis refers to as MTT. In ensuing subsections both episodic and semantic memory systems, as well as their representations and relevance towards MTT, are described, followed by theories hypothesising their interaction within an autobiographical memory system deemed necessary for MTT to occur.

2.4.1. The origin and evolution of the episodic memory system

The episodic memory system was first proposed by Tulving in 1972 to refer to an information processing system distinct from that of semantic memory and responsible for receiving, maintaining and transmitting information to other cognitive systems. Since its inception, the episodic memory system's perceived characteristics have undergone several changes (Tulving, 1983, 2002), often predicated on its relation with the semantic memory system (Szpunar & McDermott, 2008). Initially, Tulving (1972, 1983) proposed both systems interacted frequently but were functionally independent, differing in terms of the nature of the information processed, its origin, basic units and organisation, but also in terms of associated processes, such as encoding, interference effects and retrieval. Whereas the episodic memory system's basic unit of information were personally experienced events, temporally and contextually specific, that included the what, where and when of an experience, the semantic memory system's more abstract and conceptual essence did not involve such specificity.

However, the proposal that both systems were completely independent raised several theoretical problems, among which being able to explain their alleged ability to function in complete independence of one another (Tiberghien, 1984), or the episodic memory system's acquisition of inferential capacity (McCauley, 1984). Consequently, the episodic memory system was proposed to be embedded into the semantic memory system and, later, a serial parallel independent processing model (SPI) was proposed (Tulving, 1995), stating that the relation between episodic and semantic memory systems had different levels of interdependency in accordance with different information processing stages (Greenberg & Verfaellie, 2010). Thus, encoding processes in semantic and episodic memory systems were considered to be organised serially, with semantic memory's occurring first, whereas the storage processes of both systems unfolded in parallel, and their retrieval processes were independent of one another.

Tulving's proposals stimulated further research into possible differences between both systems, leading to findings of functional (Nyberg & Tulving, 1996; Yonelinas, 2002) and neuropsychological (Balota & Coane, 2008; Nyberg, 2008; Szpunar & McDermott, 2008) dissociations, and of the indispensability of four features to the episodic memory system: The already mentioned specific spatiotemporal contextualisation, autonoetic consciousness, self-awareness/contiguity, and subjective time (chronestesia) (Nyberg, Kim, Habib, Levine, & Tulving, 2010; Tulving, 2002, 2005; Wheeler, Stuss, & Tulving, 1997).

2.4.2. Autonoetic consciousness, self-contiguity and chronestesia

Tulving (1983), when comparing the episodic and semantic memory systems, argued they exhibited different levels of consciousness, with the episodic system being defined by an enhanced and subjective state of consciousness that enabled individuals to have a phenomenological experience of memory. This phenomenological experience was argued to allow individuals to relive their past events almost as if they could mentally travel in time to the moment of their occurrence.

Tulving (1985b) further proposed that different levels of consciousness were associated with different memory systems, namely anoetic consciousness with nondeclarative memory, noetic consciousness with semantic memory, and autonoetic consciousness with the episodic memory system. It has since been shown that the three layered levels of consciousness that Tulving proposed are hierarchically structured and in continuous interaction (Vandekerckhove, Bulnes, & Panksepp, 2014). Of these, anoetic consciousness is the most basic, corresponding to a primal state of autonomic-phenomenal awareness (Vandekerckhove & Panksepp, 2009; Vandekerckhove et al., 2014) responsible for an individual's global experience of personal existence and self-continuity (Slaby & Stephan, 2008), able to impact the affect and accessibility of episodic memories (Prebble, Addis, & Tippett, 2013).

The remaining two levels of consciousness, noetic and autonoetic, are both indicative of reflective consciousness, the ability to think about experiences and the thought process itself – meta-awareness (Vandekerckhove & Panksepp, 2009; Vandekerckhove et al., 2014). Noetic consciousness has been proposed to allow the individual to act upon symbolic knowledge of the world by objectively thinking about an object, irrespective of its presence in the environment (Tulving, 1985b; Wheeler et

al., 1997). It constitutes a form of awareness of one's self in semantic ways, characterised by personality traits and factual self-knowledge, but "has no access to a fully resolved, affectively rich awareness of one's ongoing subjective experience" (p.7, Vandekerckhove et al., 2014). As for autonoetic consciousness, Tulving (1985b) deemed it to be a *sine qua non* criterion of the episodic memory system, that allowed individuals to mentally represent and become aware of their protracted existence across subjective time, by focusing their attention directly on their subjective experiences (Vandekerckhove & Panksepp, 2009; Wheeler et al., 1997), a process that has since become known as MTT. Consequently, autonoetic consciousness has "outgrown" its association with Tulving's episodic memory system, and become a widely consensual and necessary criterion for individuals to be able to re- or pre-experience an event in a phenomenological complex manner, and thus mentally travel in time (Klein, 2015a, 2015b; Renoult, Davidson, Palombo, Moscovitch, & Levine, 2012).

For autonoetic awareness to occur and MTT to unfold, individuals need to possess a sophisticated form of self-representation that includes self-awareness and contiguity, so they can examine their thoughts and feelings while being aware, spatially and temporally, of their standing in relation to the environment (Vandekerckhove & Panksepp, 2009; Wheeler et al., 1997).

Another essential component for the production of MTT experiences is an idiosyncratic relation with time, manifest through the experience of subjective time, and termed chronesthesia (Tulving, 2005; Vandekerckhove & Panksepp, 2009; Wheeler et al., 1997). According to Tulving (2005), the episodic memory system is the only memory system capable of bending the rules of physical time, whereby

individuals manipulate subjective time in order to remember and pre-experience events. Thus, according to Tulving (2005), subjective time can only exist by virtue of the interaction between physical time and episodic memory's autonoetic consciousness. Other authors, while agreeing on the importance of this interaction for MTT, do not limit autonoetic consciousness to Tulving's episodic memory system construct (Klein, 2015a, 2015b; Renoult et al., 2012).

2.4.3. Semantic memory system

The semantic memory system is a long-term memory system of great importance for human activity, as it influences numerous cognitive processes (Binder & Desai, 2011), past (Binder & Desai, 2011; Tulving, 2005) and future MTT (Buckner & Carroll, 2007; Duval et al., 2012; Irish, Addis, Hodges, & Piguet, 2012) among them. Some authors argue it functions as a multimodal input, transmodal and highly structured central knowledge store (Humphreys & Forde, 2001; Tulving, 2005), with its representations often consisting of knowledge of the world, more specifically of facts, ideas, events and concepts, abstracted from personal experiences (Balota & Coane, 2008; Binder & Desai, 2011). Although semantic memory representations have frequently been perceived as lacking self-referential, contextual and emotional components (Binder & Desai, 2011; Martin & Simmons, 2008), recent research has contested such claims (Klein, 2013d; Renoult et al., 2012; Renoult et al., 2015). In the ensuing subsections several explanatory frameworks for semantic memory are presented according to their timeline, so as to demonstrate the evolution of the construct of semantic memory, and how such evolution has impacted the perception surrounding semantic memory's contribution to MTT.

2.4.3.1. Network approaches

Network approaches state concepts are formed via a process whereby information is abstracted from personal experiences. Once this happens, connections are established with other concepts and a complex structure is formed that functions as a network of semantic knowledge/representations (Balota & Coane, 2008). Collins and Quillian (1969) were the first to propose a hierarchically arranged network composed of nodes and pathways, wherein each node directly represented a concept in the semantic memory system, which then became interconnected to other concepts via directional or property pathways (i.e., the concept bird would become interconnected to concepts such as animal and breathe). These pathways were instrumental because they described the relations between different concepts. However, problems emerged with the model's hierarchically structured network, namely its inability to explain differences in accessibility to concepts that were supposed to exist at a same hierarchical level – e.g., it could not explain why individuals took longer to connect the concept *ostrich* than the concept *robin* to the concept *bird* (Balota & Coane, 2008).

A revised version of Collins and Quillian's model (Collins & Loftus, 1975) addressed previous criticism by proposing the pathways between nodes were structured according to the strength of existing relations between concepts, which could depend on semantic similarity – items from a same category like cat and dog would be linked – or lexical level factors – concepts that occurred in the same context would be linked (Balota & Coane, 2008).

2.4.3.2. Feature analytic approaches

Feature analytic approaches, unlike network approaches, did not consider concepts to be embedded in a structure. Instead, they proposed individuals use a set of primitive features to define concepts, with different combinations of these features creating different concepts (Balota & Coane, 2008). These features are crucial, as their infinite combinations can, in theory, lead to equally numerous concepts.

The model of Smith, Shoben and Rips (1974) was one of the first to reject the existence of hierarchical network structures, focusing instead on the role that both defining and characteristic features played in the formation of concepts. Defining features describe features essential to define a concept (e.g., to fit the concept of bird, all candidate exemplars must lay eggs) whereas characteristic features are those possessed by most but not all members of a category (e.g., most birds can fly).

Some authors have questioned the need for defining characteristics in concepts and their respective class inclusion, and several questions remain as to how to define and measure the importance of different features in the formation of concepts (McCloskey & Glucksberg, 1979). Such questions have contributed to the development of theories grounding semantics in context and perceptual-motor systems, as a novel approach to the construction of meaning (Balota & Coane, 2008). Among these are embodied cognition theories.

2.4.3.3. Embodied cognition approaches

Embodied cognition theories ground semantics in perceptual-motor systems (Barsalou, 1999; Wilson, 2002) while being receptive to proposals for the contextual sensitivity of meaning (Balota & Coane, 2008; Barsalou, 1999). The construction of

meaning is perceived to be the result of the interaction between proprioceptive, motor and perceptual systems with the environment (Balota & Coane, 2008), meaning that an organism's construction and representation of concepts is both limited by its perceptual and motor systems as well as by the surrounding context.

Given these premises, representations are not all perceived to be abstract and amodal, as proposed by a network approach, but are instead defined by the systems acquiring them (Barsalou, Simmons, Barbey, & Wilson, 2003), with different modal representations being initially stored in memory and, through repetition and experience, leading to the formation of complex multimodal representations that will be the foundation for schema-like structures integrating perceptions.

The emergence of embodied cognition theories has contributed to a greater emphasis on the interactive nature of several brain functions. When describing the network of brain regions associated with semantic processing, Binder and Desai (2011) found a considerable overlap with the brain default network. This network is involved in episodic memory and several other cognitive processes (Buckner, Andrews-Hanna, & Schacter, 2008; Burianova, McIntosh, & Grady, 2010) that are fundamental for scene construction (Summerfield, Hassabis, & Maguire, 2010), a key aspect of both past and future MTT (as will be further detailed in Chapter 3). This led to Binder and Desai's (2011) proposal that conceptual knowledge, which they consider to be the basis of semantic memory, overlaps with several of these cognitive functions because it is crucial to the reconstruction of past events, eventuating in MTT into the past, and to the creation of future events, leading to future MTT. As discussed below, this proposal, together with those of Irish et al. (2012) and Renoult et al. (2012, 2015), has helped "blur" the hypothetical lines dividing episodic and semantic memory systems,

and in doing so threatens to reframe semantic memory system's role in past and future MTT.

2.4.4. The uncertain nature of the semantic-episodic relation

Multiple questions persist regarding the character and extent of existing boundaries between semantic and episodic memory systems (Balota & Coane, 2008; Klein, 2013a; McKoon, Ratcliff, & Dell, 1986; Renoult et al., 2012), which in turn impact their perceived contributions for the occurrence of MTT. These doubts have been fostered by: different proposals regarding the ontogeny of both systems (Conway, 2005, 2008; Mullally & Maguire, 2014; Tulving, 2005); multiple studies evidencing frequent interactions between both memory systems (Binder & Desai, 2011; Ryan, Hoscheidt, & Nadel, 2008; Tulving, 2001); lesion studies exploring their contribution for past and future MTT (Duval et al., 2012; Irish et al., 2012); and proposals questioning the adequacy of older, less self-referential, and decontextualized notions of semantic memory (Klein, 2013a; Renoult et al., 2012, 2015).

Respecting the ontogenesis of both systems, Tulving (2002, 2005) proposes a late-developing episodic memory system (McCormack & Hoerl, 1999), that is preceded by the acquisition of semantic memory (Wheeler et al., 1997; Wheeler, 2000) and only becomes functional when children are between three and four years of age (Bauer, 2012; Hayne & Imuta, 2011). Conway (2005, 2008, 2009) and Mullally and Maguire (2014), on the contrary, claim that the episodic memory system is an early-developing system, present in neonates under the early form of multiple sensory-perceptual features, that will constitute the basis for the development of semantic knowledge. Thus, akin to Baddeley (1988), Conway (2008, 2009) proposes that

conceptual knowledge is abstracted and generalized from individual episodic events (Conway, 2008), not the other way around. These different theorisations are relevant because the memory system perceived to have developed last is also considered to constitute an evolutionary advantage, with Tulving (2002, 2005) emphasising the episodic memory system's necessary role in the production of a MTT ability that is exclusive to humans, and Conway (2005, 2008) valuing episodic and semantic components' role in the creation of abstract and general representations.

As Chapter 3 outlines, much of the research on MTT and its processes has centred on the episodic memory system, influenced by Tulving's theory, with limited relevance attributed to the semantic memory system's contributions (Irish et al., 2012). However, recent findings have questioned the assumption that the recall of past MTT barely involves the semantic memory system, and that future MTT is exclusively contingent on the extraction of episodic details from past events. The act of mentally travelling into the past and future has been shown to involve semantic elements, from personal semantics (Renoult et al., 2012) to more general conceptual knowledge (Gilboa, 2004; Irish & Piguet, 2013), as the semantic memory system has been found to have an interdependent relation with the episodic memory system that acts on both the encoding of information and its retrieval (Greenberg & Verfaellie, 2010).

Regarding encoding, semantic knowledge aids the integration of new episodic memories via the semantic scaffolding hypothesis (Irish & Piguet, 2013), whereby a semantic scaffold serves to incorporate episodic elements, and by allowing individuals to represent time as a dynamic concept, a skill necessary for past and future to be experienced in the present moment (Greenberg & Verfaellie, 2010; Irish et al., 2012; Klein, 2013d); as for episodic memory, it promotes the encoding of new information

into the semantic memory system. While episodic elements aid in the retrieval of information from semantic memory, semantic memory functions as the very building blocks upon which the retrieval of episodic memories unfolds (Greenberg & Verfaellie, 2010).

These contributions of the semantic memory system have been proposed to be particularly crucial for future MTT, in light of findings in the neuropsychological literature. Research shows that semantic dementia patients, characterised by a relative preservation of their episodic memory system amidst severe dysfunction of the semantic memory system, were able to consciously retrieve a limited number of past experiences while experiencing considerable difficulties projecting themselves into the future (Duval et al., 2012; Irish et al., 2012). Irish et al. (2012) and Irish and Piguet (2013) attributed this difference to the fact that, unlike past MTT, in future MTT the creation of novel non-previously experienced events is often required. As such, when faced with the impossibility of accessing previously experienced events, individuals tend to resort to conceptual knowledge, as it will function as a scaffold for the episodic elements of their choice and enable the creation of a future MTT event. However, since this resource is unavailable to semantic dementia patients, they experience difficulties in the construction of novel future scenarios.

The interdependencies found between semantic and episodic memory systems, besides raising questions about the boundaries of both systems, have also triggered discussions about how to best consider memory representations that do not fit seamlessly into either category. Among these are what Renoult et al. (2012) classify as personal semantics, or what Conway (2005) terms general events, analysed in this thesis as categoric and extended MTT events. Greenberg and Verfaellie (2010)

addressed their relevance as intermediate forms of memory representation, "somewhere" between non-autobiographical generalised semantic knowledge and autobiographical and spatiotemporally specific episodic memory representations. This stance suggests a possible episodic-semantic continuum, whereby each memory representation may have different weightings of the same component processes. Likewise, Renoult et al. (2012, 2015) considered general events to be a form of personal semantics that, being strongly influenced by the episodic memory system, possess visual imagery, spatial and temporal features, and can involve a subjective re-experiencing of an event, meaning they can elicit a MTT experience. Markowitsch and Staniloiu (2011) adopted a similar stance when addressing the pervasiveness of general events in depressed individuals – an issue analysed in Hypothesis 1 of this thesis.

To conclude, a considerable portion of the literature on past and future MTT has focused on the episodic memory system, failing to acknowledge the crucial role that the semantic memory system assumes in MTT. This, in part, is the result of outdated conceptualisations of semantic memory, as merely general and non-autobiographical conceptual knowledge. The present subsection aimed to present evidence that the semantic memory system and its representations have a much larger and important role in past and future MTT than initially foreseen, and that in the interdependency and continuum between episodic and semantic memory systems, there are intermediate forms, such as categoric and extended representations, that themselves constitute MTT experiences.

2.4.5. Autobiographical memory system

Most of the relevant advances in understanding the interplay between episodic and semantic elements stem from the domain of autobiographical memory (Irish & Piguet, 2013). In this subsection two theoretical models of autobiographical memory are presented, the Self Memory System model (Conway, 2005; Conway & Jobson, 2012; Conway & Pleydell-Pearce, 2000) and the Social-Cultural Developmental model (Fivush, 2011; Nelson & Fivush, 2004). Each provides a unique understanding of how the interaction between episodic and semantic components leads to autobiographical representations, which are of fundamental importance for this thesis because it is when these autobiographical representations are subjectively re-experienced or pre-experienced, that MTT occurs.

2.4.5.1. Self-Memory System (SMS)

The SMS embodies a conceptual framework that considers cognition to be goal-driven and, therefore, memory to be motivated and constructive in nature (Conway, 2005). As a consequence, the SMS is couched in the dynamic balance between an individual's need for self-coherence (Conway, 2005), that permeates memory systems and processes, shaping the accessibility of memories, and a set of evolutionary demands that privilege an accurate correspondence between events and their representation in memory (Conway, Meares, & Standart, 2004; Conway, Singer, & Tagini, 2004).

With this theoretical framing in mind, the SMS can be defined as a superordinate memory system comprised of three key components, working self, conceptual self, and an autobiographical knowledge base, continuously interacting to

produce patterns of activation that materialise into autobiographical memories (Conway & Jobson, 2012) and, in case of autonoetic experience, MTT.

2.4.5.1.1. The working and conceptual selves

Within the SMS the working self is perceived as an on-line and dynamic conception of the self (Markus & Nurius, 1986), responsible for establishing and managing an individual's goals and subgoals hierarchy with the ultimate purpose of ensuring there is a correspondence with reality and that self-coherence is maintained (Conway, 2005; Conway & Pleydell-Pearce, 2000).

The SMS's high valuation of the role of the working self lies in the importance it attributes the multicomponent working memory system in the coordination and modulation of information from disparate sources, and its consequent involvement in managing the currently active goal hierarchy (Conway, 2005). Although this goal structure is perceived to be in a state of constant activation, at any given time there are subsets of goals that are predominant and, thereby, regulate cognition, affect and emotion, functioning as a set of control processes. It is through this goal hierarchy and its control processes that information must transit when entering long-term memory systems, or when accessed in the form of memory (past MTT) representations (Conway, 2005). Hence, the working self, via the working memory system and its involvement in managing an individual's goal hierarchy, influences the encoding and accessibility of knowledge in long-term memory systems, which in turn will contribute to the occurrence of MTT.

The conceptual self refers to the working self's conceptual knowledge and its inclusion into the SMS meant to integrate social-cognitive elements into the working

self (Conway, 2005). Hence, the conceptual self derives from the individual's life story (Bluck & Habermas, 2000) and other abstract knowledge structures that consist of socially constructed schemas and categories, formed from social influences, that help define the self, others, and their interactions with the world (Bluck, Alea, Habermas, & Rubin, 2005; Conway & Jobson, 2012; Conway, Singer, & Tagini, 2004). The conceptual self's role is to engage specific and temporally defined incidents, such as episodic memories or autobiographical knowledge (Conway, 2005), in a similar way to that of the working self, and therefore act as an additional source of control in the everyday regulation of past and future MTT.

2.4.5.1.2. The autobiographical knowledge base

The third central aspect of the SMS is an autobiographical knowledge base that consists of a temporally and thematically organised (Brown & Schopflocher, 1998; Lancaster & Barsalou, 1997) hierarchy of different levels of knowledge specificity, partonomically organised (Barsalou, 1988; Burt, Kemp & Conway, 2003; Conway & Jobson, 2012; Conway & Pleydell-Pearce, 2000). The proposed framework for this autobiographical knowledge base has evolved in parallel with conceptualisations of the episodic memory system (Tulving, 1983; Wheeler, 2000), and as a function of a clearer understanding of both the intricate levels of complexity that characterise highly specific representations of knowledge and of several aspects of the conceptual self (Conway, 2009; Conway & Jobson, 2012).

The most informationally abstract level of the SMS autobiographical knowledge base is the life story, which refers to general factual and evaluative knowledge about the individual that can be divided into more specific themes such as

a work theme or a personal relationships theme (Bluck & Habermas, 2000; Conway, 2005). The following level in the hierarchy, embedded into the life story, consists of lifetime periods. These have been shown, by different studies and with resource to different methodologies (Barsalou, 1988; Linton, 1986; Treadway, McCloskey, Gordon, & Cohen, 1992), to constitute a relevant form of knowledge organisation. Lifetime periods consist of both thematic (Linton, 1986) and temporal knowledge about a given period in time, usually measured in years, that is manifest under the form of abstract knowledge of locations, activities, significant others, plans and goals – e.g., "When I was a teenager" (Conway, 1996; Conway & Pleydell-Pearce, 2000). General events, compared to lifetime periods, represent a higher level of knowledge specificity, referring to shorter time periods that are usually measured in months, weeks or days, and involve fewer actors, events and locations (Anderson & Conway, 1993; Conway, 1996). These include Goddard, Dritschel and Burton's (1996) constructs of extended memories – which indicate an event, with a definite beginning and end, that lasts for more than one day, e.g., "The first weekend I spent in Glasgow" – and categoric memories, referring to a set of repeated events – e.g., "playing football every Tuesday" (Williams & Dritschel, 1988; Goddard et al., 1996).

Finally, throughout the SMS's history, different terms and frameworks have been used to account for the most specific level of the autobiographical knowledge base (Conway & Pleydell-Pearce, 2000; Conway, 2005, 2009; Conway & Jobson, 2012). In the SMS's initial version, a theory-neutral concept was chosen, event-specific knowledge, to distinguish it from Tulving's (1972) early conceptualisations of the episodic memory system (Conway & Pleydell-Pearce, 2000). Unlike lifetime periods or general events, event-specific knowledge comprised memories of specific

events, lasting less than one day and often-measured in units of seconds, minutes or hours (Conway & Pleydell-Pearce, 2000).

Tulving's proposed changes to the episodic memory system (Tulving, 1984, 1985b; Wheeler, 2000) and Conway, Pleydell-Pearce and Whitecross's (2001) review of the existing evidence led to the amelioration of the aforementioned incompatibility between models, as more similarities emerged. These acted as a catalyst for a new SMS proposal of two distinct types of representation in the autobiographical knowledge base: autobiographical knowledge, composed of the aforesaid general levels of knowledge, and episodic memories, referring to summary records of sensory-perceptual-conceptual-affective processing, that replaced the concept of event-specific knowledge (Conway, 2005).

2.4.5.1.3. Episodic memory according to the SMS

The SMS's conceptualisation of episodic memories moved away from Tulving's (2002) more definitional approach, which centred on an episodic memory system, to focus on the episodic memories themselves, as mental representations characterised by a unique and multidimensional set of features. These features differentiate episodic memories from other types of memory representations with respect to their functions, development, content, phenomenology and neural basis (Conway, 2009). According to the SMS, episodic memories are characterised by a conjugation of nine different properties:

- Episodic memories are a sensory-perceptual-conceptual-affective summary record of an episode, meaning they are experience-near but not an exact replica of the experience itself (Conway, 2009). Their features are congruent with

the goal structure active at the time of the episode, and likely represented in a way that enables future processing of the same or similar goals (Conway, 2008);

- Episodic memories possess patterns of activation/inhibition that determine the accessibility of their content (Conway, 2009). Several factors are believed to influence these patterns, amongst which the dominant goal structure at the time of encoding, given its role in the control of attentional and emotional processes (Conway, 2005; Williams, Conway, & Baddeley, 2008);

- Episodic memories represent short temporal slices of experience whose boundaries are action-determined, meaning the initial boundary of an episode likely relates to information about actions involving that episode, whereas its respective closing boundary concerns facts and details about those actions' outcomes (Conway, 2009). This enables individuals to be cognisant of the evolution of their short-term goals;

- Episodic memories are represented on a temporal dimension, roughly in order of occurrence (Conway, 2009). The ability to recall a day's events in a forward or backward sequence underlies both goal planning/pursuit and, according to the SMS, extends into the past and future, as a result of both being supported by the same remembering-imagining system (Conway, 2009; Conway & Loveday, 2015). This system, by providing a 2-3 day window of episodic consciousness for remembering-imagining, enables episodic memories for recent experiences and anticipated episodic future experiences to be accessible and thereby foster individuals' awareness of current goals and plans. This idea of a common system for past and future representations resembles Tulving's (2005) proposal, albeit

within the constraints of each theorisation, and is consistent with the concept of MTT.

- Episodic memories are often represented in the form of visual images, with the relevance of visual imagery to episodic memory being corroborated by studies showing that brain damage to the areas responsible for generating visual images may lead to retrograde amnesia (Conway, 2005; Greenberg & Rubin, 2003; Rubin, Burt, & Fifield, 2003).

- Visually represented episodic memories always have a perspective, be it a first-person (field) perspective or a third-person (observer) perspective (Conway, 2009; Nigro & Neisser, 1983). The perspective adopted has a considerable impact on the phenomenological nature of the episodic representation.

- Episodic memories are subject to rapid forgetting (Conway, 2009), with recent studies suggesting that, with an increase in retention time, episodic memories are not lost but instead become inaccessible, requiring specific cues to elicit them (Loveday & Conway, 2011).

- Episodic memories, when accessed, are recollectively experienced, meaning the individual will experience the feeling of re-living an event, even though it may never have occurred (Conway, 2005; Roediger & McDermott, 1995). The SMS hence parallels Tulving's perspective (Tulving, 2000, 2005) on the relevance of autonoetic consciousness to episodic memory, as it reflects the integration of elements of the knowledge base, sensory-perceptual experience, and working self into a dynamic act of remembering that signals to individuals their

current state – i.e., individuals will believe they are remembering instead of daydreaming or fantasising (Conway, 2005).

- Episodic memories are knowledge-specific, which allows individuals to maintain an updated record of recent goal processing. The existence of a small proportion of episodic memories in long-term memory is judged by the SMS to reflect their relevance to longer-term goals in the individual's future (Conway, 2009) and to the acquisition of knowledge (Westmacott & Moscovitch, 2003; Westmacott, Black, Freedman, & Moscovitch, 2004).

The foregoing features of episodic memory underline its importance in the SMS, and have motivated additional changes to how the model organises its most specific level of autobiographical knowledge (Conway, 2009; Conway & Loveday, 2010; Conway & Jobson, 2012). The SMS has proposed three types of representations, i.e., episodic elements, simple episodic memories, and complex episodic memories, to describe how episodic memories might be organised in long-term memory once their integration with existing knowledge structures, or contribution to new knowledge structures, has occurred (Conway, 2009).

Episodic elements represent the most event-specific and experience-near representation in long-term memory, often existing in the form of visual images (Conway, 2009; Conway & Loveday, 2010). When embedded in extremely simple conceptual and contextualising frames or when utterly deprived of their structure, episodic elements correspond to what Tulving (1983, 1984) termed free radicals (Conway, 2009). In these situations, episodic elements exist as fragments of memories, such as isolated images and extremely early childhood memories, or as

decontextualised memories, such as memories for jokes. Furthermore, when registering high levels of activation, and independently of the existence of an associated conceptual and contextualising frame, episodic elements may intrude into consciousness, a process that underlies some of the memory dysfunctions exhibited by PTSD (Brewin & Holmes, 2003) and depressed individuals (Holmes, Lang, & Deeprose, 2009; Morina, Deeprose, Pusowski, Schmid, & Holmes, 2011).

In spite of the preceding considerations, episodic elements are frequently framed by conceptual and contextualising knowledge (Conway, 2009; Conway & Loveday, 2010), constituting what the SMS terms as simple episodic memories. The components of simple episodic memories "embody" what is the SMS' delicate balance between principles of coherence and correspondence, as episodic elements are characterised by high levels of correspondence with reality, whereas their conceptual and contextual frame is responsible for fitting them into the overarching memory structure, thus abiding by the need for coherence (Conway, 2005, 2009). The conceptual and contextualising frame of simple episodic memories is thus necessary to provide interpretation and personal meaning to episodic elements. Simple episodic memories are comprised of a limited number of episodic elements, depending on multiple factors such as the nature of the experience and its self-relevance (Conway, 2009).

Due to the complex organisation of memory, simple episodic memories can be organised into complex episodic memories, the result of the association of simple episodic memories, aggregated due to a higher-order conceptual frame (Conway, 2009; Conway & Loveday, 2010). To exemplify, Christmas Eve can constitute a higher-order conceptual frame, setting the conditions for a complex episodic memory

composed of several simple episodic memories such as afternoon drinks with friends, dinner with family and opening presents after midnight. Each of these, in turn, can be composed of multiple episodic elements, such as the warm feeling of the afternoon's liqueur sliding down one's throat, or the image of the family's patriarch slipping when attempting to bring the codfish to the table, or the youngest sister's expressions when unwrapping her present.

The latest version of the SMS's organisational structure, including all of the above-mentioned components, is presented in Figure 1. As can be seen from this figure, episodic elements (EE), semantic episodic memories (EE plus the conceptual frame) and complex episodic memories (CEM) constitute the episodic memory system which itself is part of a larger autobiographical memory/knowledge base (Conway, 2009).

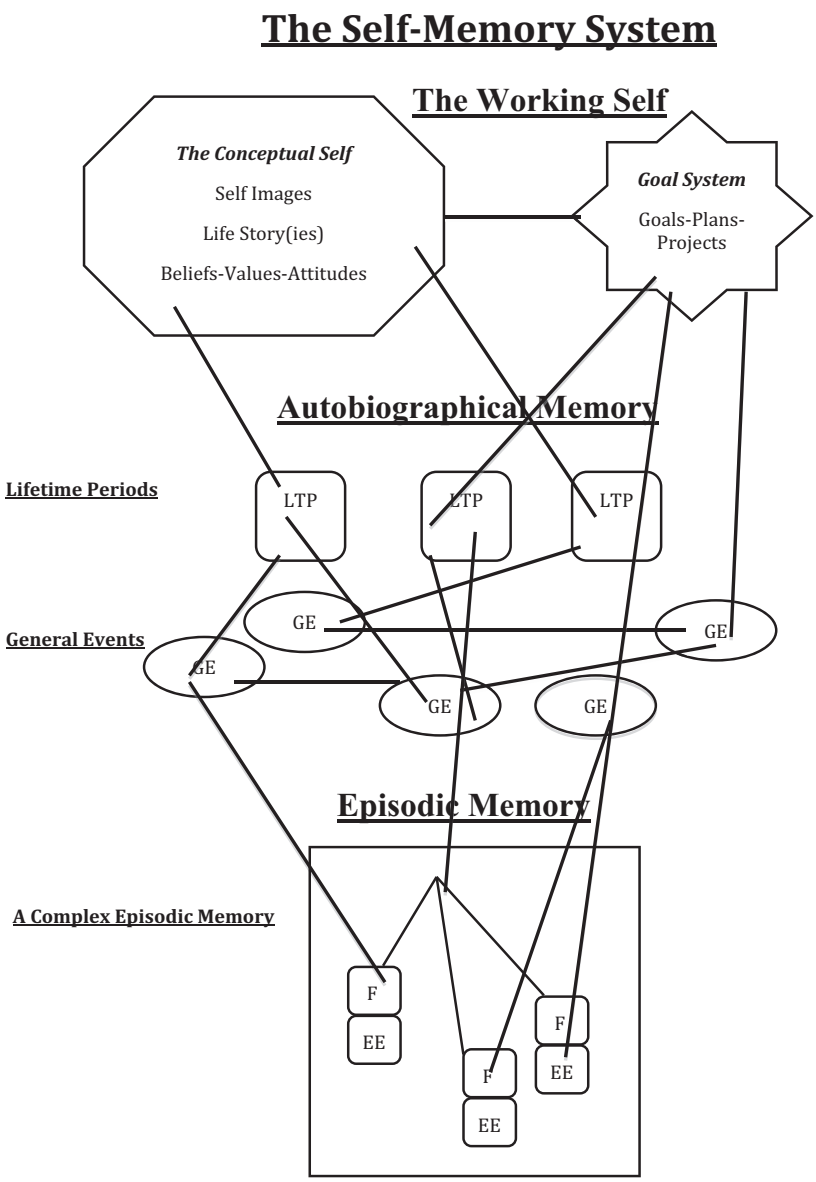


Figure 1. The SMS organisational framework. Adopted from Conway and Loveday (2015)

Superordinate elements of the autobiographical knowledge base, such as lifetime periods and general events, provide a conceptual context for the episodic memory system and its representations while, in turn, they themselves are given a conceptual context by the conceptual self (Conway, 2009). These different autobiographical knowledge base domains are, as previously stated, hierarchical and

nested within each other, forming a partonomic knowledge hierarchy (Conway, 2009; Conway & Loveday, 2010).

2.4.5.1.4. A brief synthesis of the SMS

To conclude, the continuous loop of interactions and influence between the working self, the conceptual self and the autobiographical knowledge base lies at the "heart" of the SMS model (Conway & Loveday, 2015). This reciprocal relation between all three components means that an individual's active goals, which are already partially determined by the interaction between working and conceptual self, are further circumscribed by the autobiographical knowledge base, via consistency and plausibility constraints (Conway, 2005; Conway & Tacchi, 1996). Moreover, the fact that the autobiographical knowledge base is, itself, encoded through the goal structure of the working self, means the latter has a considerable impact on the access to knowledge and memory/MTT construction (Conway & Pleydell-Pearce, 2000). Such impact is based on the previously mentioned principle of self-coherence, whereby the working self seeks to ensure the autobiographical knowledge and memories that are accessed and constructed support current goals and associated self-images (Conway, 2005). By contrast, autobiographical knowledge and memories/MTT experiences that are conspicuously discrepant with the operative goal structure are actively inhibited or, if accessed, edited and distorted into acceptable conformity (Conway, 2005; Conway & Pleydell-Pearce, 2000).

2.4.5.2. The Social-Cultural Developmental model

In this model the autobiographical memory system is defined as a functionally new human memory system whose development depends on the interaction between a variety of factors, namely the neurological maturation of episodic and semantic memory systems (Schacter et al., 2000), and the development of the child's social, cultural and cognitive domains (Fivush, 2008; Nelson & Fivush, 2004). Consequently, autobiographical memory representations, which in this model equate to this thesis' past MTT experiences, only begin to emerge across the preschool years, as they require basic memory, language and narrative skills, as well as an understanding of temporal relations, self and others (Nelson & Fivush, 2004).

Over time, the foregoing developmental domains are integrated by means of a collaborative process consisting of children's personal narratives, framed by a specific temporal context (Nelson & Fivush, 2004), and occurring in a social and cultural framework (Bauer, Stennes, & Haight, 2003; Nelson, 2005; Wang & Fivush, 2005) that shares particular forms and contents of experience. In light of these premises, the function of the autobiographical memory system is to define the self in time and in relation to others, so that both an independent and a shared past are created and the individual is integrated into the community (Nelson & Fivush, 2004).

This theoretical perspective (Fivush, 2011) differs from previously mentioned models (Conway, 2005, 2009; Tulving, 2002, 2005) given its developmental focus, which emphasises the relevance of social, cultural, and linguistic processes to the development and operations of the autobiographical memory system, and its conceptualisation of the episodic memory system as a system exclusively devoted to the specific aspects of an experience – the what, where and when – whose sole purpose

is guiding current and future behaviour (Fivush, 2008, 2011). By contrast, the autobiographical memory system is judged to be involved in self-functions, such as self-definition, self-in-relation, and self-regulation (Fivush, 2012; Fivush, Berlin, Sales, Mennuti-Washburn, & Cassidy, 2003), with its representations always relating to the self (Fivush, 2008, 2011). Hence, the development of self and autonoetic consciousness is viewed not as an exclusive construction of the mind/brain, but as the "result of innumerable social experiences in cultural space that provide for the developmental differentiation of the sense of a unique self from that of undifferentiated personal experience" (Nelson & Fivush, 2004, p. 507).

Since autonoetic consciousness is assumed to require access to self-functions, it is considered to be characteristic of the autobiographical memory system, instead of being associated with the episodic memory system and its representations – as suggested by Tulving's framework. According to this model, autonoetic consciousness implements a link between past and present experiences via the construction of a personal timeline of coherent and chronologically organised events (Bluck & Habermas, 2000; McLean, Pasupathi, & Pals, 2007) that are structured into an overarching life narrative (Fivush, 2012).

In synthesis, the autobiographical memory system is perceived by the social-cultural developmental model to constitute a uniquely human form of memory that necessitates the existence of social-cultural groups (Fivush, 2012) as it involves a collaborative interaction between the self and others. This interaction is guided by the short and long term goals that define an individual's identity and purpose (Fivush, 2011), and characterised by autonoetic consciousness and its ability to link specific episodic representations into meaningful sequences of events that contribute to the

development of a life story (Bluck & Habermas, 2000) and the experience of MTT, serving social and emotional functions (Fivush, Berlin, Sales, Mennuti-Washburn, & Cassidy, 2003; Pillemer 1998).

2.5. Memory Systems – A Summary

The aim of previous sections was to provide a description of the memory systems involved in the creation of a MTT experience. Although none of the theoretical frameworks presented were originally developed to describe and explain MTT, they are nonetheless fundamental for understanding its foundations.

The working memory system, in interaction with autobiographical, episodic, and semantic memory systems and components, all contribute to the content of a MTT experience, as it consists of past or future self-referential events. Additionally, memory systems are directly involved in enabling the autonoetic and phenomenological re-experience or pre-experience that is necessary for a MTT experience to occur, and which distinguishes MTT events from self-referential representations that do not involve MTT, such as autobiographical facts (e.g., "I was born in a year with 366 days") or autobiographical representations deprived of the autonoetic feeling of pre- and re-experience (Klein, 2015b).

In this thesis, no particular conceptualisation of an episodic memory system is adopted, as all the aforementioned theorisations address its self-referential capacity, and endorse its relevance to MTT. Although there are differences between the previously mentioned models of episodic memory, many of them derive from an

emphasis on different domains and the use of different terminology, both of which do not obscure the considerable points of overlap.

Consequently, a MTT experience is the result of a complex and multifarious process involving different memory systems, subsumed under an autobiographical/self-referential scaffold. Together, these systems are able construct a past or future representation that is subjectively re- or pre-experienced by the individual as a MTT event.

2.6. Memory Processing Stages and Processes

The memory processing stages of encoding, consolidation, retrieval and reconsolidation are outlined in the following chapter subsections. Their relevance to MTT is evident by their involvement in memory formation and subsequent phenomenological experience (Oitzl, Schwabe, & Aggleton, 2012). These processing stages are responsible for creating representations in memory to which an individual can mentally travel back to (past MTT) and use to create future experiences (future MTT).

As mentioned before, there are multiple definitions of autobiographical, episodic, and semantic systems. To avoid confusion, the concepts of autobiographical memory/representation are used in this thesis for self-referential representations with differing levels of spatiotemporal specificity and episodic elements, that involve autonoetic consciousness and, thus MTT. Even though there are autobiographical memories/representations that may not involve autonoetic consciousness (e.g., autobiographical facts), they are of secondary interest to this thesis. The concepts of

episodic memory/representation, on the other hand, address self-referential and spatiotemporally specific experiences that inevitably involve autonoetic consciousness (and thus MTT). Although the term MTT is often used interchangeably with that of episodic memory/representation, in the present thesis MTT is also considered to involve certain forms of personal semantics/general events, such as categoric and extended events, because these have been proposed to exhibit the necessary episodic elements and autonoetic nature (see Subsection 2.4.4).

There are two distinct views on the sequence of processing stages that leads to autobiographical memory formation (Nadel, Hupbach, Gomez, & Newman-Smith, 2012). The more traditional view states that upon experiencing an event, some of its characteristics are encoded and, subsequently, undergo a process of consolidation. Once the information becomes consolidated, a permanent memory trace is created, that is then accessible via retrieval mechanisms. The alternative view, adopted in this thesis, possesses a far less orderly arrangement of processing stages. No permanence to the memory trace is assumed, as once an autobiographical representation is retrieved, it becomes active and is susceptible to undergo a reconsolidation process, whereby it is liable to change.

In the following subsections each of the previously mentioned processing stages is described separately. It should, however, be noted that there are continuous interactions between the different processing stages (Oitzl et al., 2012).

2.6.1. Encoding

The term encoding refers to the information processing operations that transform an individual's experience into a memory representation. These perceptual

and cognitive operations, set in motion when an experience occurs, are an automatic by-product of stimulus processing. The quality of the encoding process depends on a variety of factors, including the attentional levels registered during stimulus processing, prior knowledge, type of processing, and emotional aspects.

The degree of attention devoted to information impacts the latter's encoding (Hunt, 2008; Turk-Browne, Golomb, & Chun, 2013), with higher attentional levels leading to better encoding (Iidaka, Anderson, Kapur, Cabeza, & Craik, 2000; Ziaei, Peira, & Persson, 2014). Underlying this association is an individual's limited information processing capacity, conducive to better performances in conditions of reduced interference from non-relevant information (Chun & Turk-Browne, 2007; Gazzaley, Cooney, McEvoy, Knight, & D'Esposito, 2005; Vogel, McCollough, & Machizawa, 2005).

2.6.1.1. The influence of type of processing

According to the theory of levels of processing (Craik, 2002; Craik & Lockart, 1972), information can be the target of superficial processing, amounting to a meaningless level of perceptual analysis, or the object of deep and meaning-based processing, that involves a semantic analysis of stimuli and potentiates their long-term retention (Craik & Lockart, 1972). The greater elaboration that characterises deeper levels of encoding is hypothesised to enhance stimuli distinctiveness, thereby allowing a more effective retrieval. Additionally, this superior elaboration enables encoded stimuli to be better integrated with past events and knowledge structures, which will then serve as a scaffold for reconstructive retrieval processes (Moscovitch & Craik, 1976). Prior knowledge is thus another dimension of considerable importance to

encoding, as it can enable the integration of information, by enhancing its qualitative nature, or serve as an incongruent background, by leading information to stand out in its distinctiveness and making it unique and easy to access (Brod, Werkle-Bergner, & Shing, 2013; Hemmer & Steyvers, 2009).

Despite its considerable influence and evidence-base, the theory of levels of processing has its limitations (Hunt, 2008; Watkins, 2002). Among these is the lack of an index (Craik, 2002) with which to measure depth of processing, that leads to a possible tautological scenario whereby proof of depth of processing amounts to longer-term memory retention (Baddeley, 1978). Also, additional questions respecting the limits of this explanatory framework emerged when it was found that replicating encoding conditions during retrieval better explained some of the results in the literature (but see Goh & Lu, 2012, and Poirier et al., 2012 for explanations that privilege distinctiveness as the key factor for successful retrieval).

The foregoing findings stimulated the emergence of the principles of encoding specificity and transfer appropriate processing. The former states the importance of a correspondence between encoding and retrieval conditions for the efficacy of retrieval cues (Tulving, 1984; Tulving & Thomson, 1971, 1973). It is corroborated by evidence of place- and state-dependent learning, whereby the respective matching of contextual and internal cues at encoding and retrieval leads to retrieval success (Eich & Macaulay, 2000; Kenealy, 1997; Rajaram & Barber, 2008). The latter differs from the principle of encoding specificity by emphasising the procedures of the mind, not its structural contents, when explaining the interactions between encoding and retrieval. Hence, it refers to matching the type of processing that stimuli undergo at encoding and retrieval (Barry, Naus, & Rehm, 2004; Morris, Bransford, & Franks, 1977).

Both these principles have contributed to changes in the levels of processing theory, evidenced by Craik's (2002) statement that "…any final theory must involve some account of encoding processes and the representations they create, as well as some factor capturing the relations between encoding and retrieval" (p.309). Hence, an elaborated memory trace is but a potential future memory, the extent to which this potential is realised depending on the matching of encoding and retrieval conditions, coupled with the ability of the trace, via its distinctiveness, to elicit activation (Brod et al. 2013; Goh & Lu, 2012 and Poirier et al., 2012). This clearly demonstrates the interactive character of the memory processing stages and how different processes influence the likelihood that certain MTT events will be retrieved in detriment of others.

2.6.1.2. The influence of emotion

Behavioural and neuroimaging studies have shown that emotion strongly impacts encoding and other memory processing stages (Kensinger, 2004; Labar & Cabeza, 2006; Murty, Ritchey, Adcock, & Labar, 2010). Emotion can be characterised in different ways, one of which corresponding to the circumplex model of affect (Posner, Russell, & Peterson, 2005) that proposes emotional experiences exist in a two-dimensional space of arousal and valence, whereby arousal refers to how calming or exciting an experience is, and valence concerns how negative or positive the experience is felt to be. Both dimensions influence encoding, but it has been proposed they do so via distinct mechanisms (Kensinger, 2004) and involve different brain regions (Kensinger, Corkin & Raichle, 2004).

The true nature of the impact of emotional arousal in encoding processes remains elusive due to incompatible findings (Fredrickson & Branigan, 2005; Huntsinger, 2013; Kensinger, 2009; Mather & Sutherland, 2011) and possible boundary conditions (Murty et al., 2010). On the one hand, the literature is consensual in affirming that emotionally arousing stimuli are more successfully encoded than their non-arousing counterparts, in large part due to their ability to mobilise attention (Kensinger, 2004, 2009). From an evolutionary standpoint, this is important, as emotional arousal, by capturing the individual's attention, can quickly signal stimuli or events with immediate and/or future relevance to the individual's survival (Hamann, 2001). On the other hand, questions abound regarding whether such encoding success requires specific trade-offs, such as favouring central over peripheral aspects, or an event's gist over its details (Kensinger, 2009; Kensinger, Garoff-Eaton, & Schacter, 2007; Levine & Edelstein, 2009).

An intriguing solution to this problem was advanced by Mather and Sutherland (2011), who suggested such trade-offs are but incidental patterns that demonstrate the priority levels individuals assign to the stimuli of an event. Furthermore, the privileged encoding of emotionally arousing stimuli is apparent even in situations of low attentional capacity (Dolan & Vuilleimier, 2003). This has led researchers to argue that not only are emotionally arousing stimuli prioritised by attentional and general information processing resources (Kensinger, 2004), but also that emotion can facilitate early visual processing in situations of limited attentional capacity, leading emotionally arousing stimuli to be preferentially encoded (Phelps, Ling, & Carrasco, 2006; Steinmetz, Waring, & Kensinger, 2014).

The valence dimension of emotion also affects the encoding process, although not as strongly as arousal (Kensinger & Corkin, 2003) and via different means (Kensinger, 2004; Kensinger & Corkin, 2004). Contrasting with the relatively automatic attentional modulation that emotionally arousing stimuli elicit, nonarousing valenced stimuli benefit from conscious encoding strategies, such as elaboration. Though this elaboration is presumed to assume different forms, autobiographical and semantic elaboration are among the most prominent (Kensinger, 2004).

Autobiographical elaboration refers to the establishment of a link between the information being processed and the self (Macrae, Moran, Heatherton, Banfield, & Kelley, 2004), whereas semantic elaboration consists of thinking about items' meanings and linking them to other items, often via their semantic cohesiveness (Talmi & Moscovitch, 2004). However, and as previously mentioned, the influence of emotionally valenced stimuli is often weaker than that of emotionally arousing stimuli, a situation made evident by the considerable impact that limited attentional resources can have in the encoding of the former (Kensinger & Corkin, 2004).

Overall, the literature clearly demonstrates that certain aspects of emotionally salient information are better encoded than their neutral counterparts. Additionally, emotional memories often exhibit greater vividness, which may lead individuals to erroneous judgements of memory accuracy (Phelps & Sharot, 2008). These enhancements and biases, which arise from the influence of emotion on the encoding stage of memory formation, are frequently exacerbated by processes occurring in other memory processing stages, such as memory consolidation. Moreover, as they impact which information is retained, they influence the information available to serve as

content for past and future MTT experiences, and are of particular relevance for MTT in individuals with mood disorders (see Chapter 5).

2.6.2. Consolidation

This stage of memory processing refers to the continuous post-acquisition stabilisation of a memory trace into long-term memory (Dudai, 2012; Walker, 2005), and is made possible by two key mechanisms: the reactivation and the reorganisation of memory traces (Frankland & Bontempi, 2005). Memory reactivation, by enabling the reinstatement of experience-dependent patterns of neural activity, proves itself essential in promoting the gradual remodelling of the hippocampal-cortical circuits that support memory formation, leading to a memory reorganisation manifest in long-term consolidation (Frankland & Bontempi, 2005; Lewis & Durrant, 2011).

There are two types of consolidation: cellular/synaptic consolidation is the post-encoding transformation of information into a long-term form. It occurs in the local nodes of the neural circuits responsible for encoding the memory, and is assumed to take between minutes and hours (Dudai, 2004, 2012); systems consolidation is the post-encoding reorganisation of the distributed brain circuits responsible for long-term memory, and can last between days and years, depending on the memory systems and tasks involved (Dudai, 1996, 2012; Frankland & Bontempi, 2005).

During the time window of consolidation, after a stimulus has been encoded, the information received is particularly malleable and can be readily integrated with other information, forming meaningful narratives. This means consolidation is more than a simple cognitive operation involving the retention of individual memory items,

as it is also engaged in associating and integrating them into pre-existing networks of knowledge (Dudai, 2004).

Different theories have been proposed to explain memory consolidation, namely the standard model of consolidation, the multiple trace theory and the transformation hypothesis (Winocur, Moscovitch, & Bontempi, 2010). Although it is beyond the purpose of this thesis to detail these theories, it bears mentioning there are obvious evolutionary benefits to consolidation that make it essential for MTT to occur. Without consolidation, an individual's ability to develop long-term memories/knowledge and to establish intricate and associative patterns of reasoning would be nonexistent, forcing human beings to live perpetually in the present moment. As a consequence, there would be no past or future to mentally travel to.

2.6.3. Retrieval

Retrieval concerns the processing stage wherein previously encoded and consolidated information is brought to awareness. When information is encoded and consolidated it becomes available for retrieval, but this availability should not to be mistaken for accessibility, as not all information that is available can be accessed (Tulving & Pearlstone, 1966). Because successful access to available information depends on several component processes of the retrieval stage, considerable research has been devoted to understanding their nature and subsequent ability to enable or undermine access to available information in the brain (Rajaram & Barber, 2008). Among these component processes, the type of retrieval, the essence and role of retrieval cues, and the relevance of encoding and retrieval interactions are now briefly addressed before their more detailed exploration in Chapter 3.

The concept of type of retrieval is not uniformly used within the field of memory research. It has been used to reference distinctions between the processes of recollection and familiarity, as they are considered to be different types of retrieval (Yonelinas, 2002), but also to reference differences in the intent associated with the act of retrieval, meaning whether it was voluntary and intentional or involuntary and non-intentional (Berntsen, 2009; Mace 2010a). Due to this thesis' exclusive focus on recollection via MTT processes, what is meant by type of retrieval is solely whether the retrieval is voluntary or involuntary. Type of retrieval is hence equated with intent, or lack thereof, to retrieve a past/future MTT event. This motivational component of retrieval has been a defining characteristic of retrieval processes since Ebbinghaus (1885) first established a distinction between spontaneous and deliberately evoked memories, leading to the proposal of voluntary and involuntary memories. Voluntary retrieval is the process whereby events are retrieved through a deliberate, goal-directed search process, in response either to an external or an internal query, whereas involuntary retrieval represents a form of retrieval in which events are subjectively experienced to come to mind spontaneously and automatically, without a conscious attempt by the individual to elicit them (Koriat, Goldsmith, & Halamish, 2008). Type of retrieval is one of two key dimensions (the other being temporality) evaluated in all the hypotheses of this thesis, as it considerably influences the content and phenomenological characteristics of MTT.

Cues are another key component of retrieval, playing a critical role in the access to representations (Rajaram & Barber, 2008; Tulving & Pearlstone, 1966) and, thus, MTT content. Their importance was asserted in Tulving's (1983) proposal that the combination between a memory trace and available cues determines what

memories are recalled. Retrieval cues can be internal or external and, given their nature, will differ considerably in their effectiveness to trigger retrieval, influencing what MTT experiences are elicited. Moreover, the linear importance of retrieval cues to memory accessibility, manifest in the premise that the more retrieval cues the more accurate and detailed recall is, requires encoding conditions to be kept constant, which, although possible in laboratory settings, rarely happens in real life situations. The principle of levels of processing (see Subsection 2.6.1.1) is an example of a situation whereby encoding conditions can vary and thus override the premise of more retrieval cues leading to better recall. In such situations, what becomes fundamental is the replication of encoding conditions at retrieval.

These constraints underscore the importance of ensuring that retrieval conditions maximally exploit the features of encoding conditions, particularly in complex real life scenarios that are impacted by multiple variables at both encoding and retrieval (Rajaram & Barber, 2008). Retrieval is a context and state-dependent processing stage (Koriat et al., 2008), whose direct implications to MTT and depression are discussed in Chapters 3 and 5, respectively.

2.6.4. Reconsolidation

Research evidencing reconsolidation began to emerge in the late 1960s (Misanin, Miller, & Lewis, 1968), but the concept itself only gained relevance in the 1990s (Przybyslawski & Sara, 1997), having since raised important questions regarding the constructive nature of memory. Reconsolidation is the process whereby a previously consolidated memory, made unstable upon retrieval, is re-stabilised (Nader, 2013). In essence, it implies that even after memories are consolidated, they

can be made labile upon trace reactivation (Diekelmann, Buchel, Born, & Rasch, 2011).

There are doubts about the universality of reconsolidation (Diekelmann et al., 2011; Lee, 2009; McKenzie & Eichenbaum, 2011; Nader & Einarsson, 2010; Nader & Hardt, 2009; Nader, Hardt, Einarsson, & Finnie, 2013), with several authors proposing the existence of boundary conditions such as the age of the memory to be retrieved (Alberini, 2011; Milekic & Alberini, 2002; Wichert, Wolf, & Schwabe, 2011), the type and duration of the reminder (Forcato, Argibay, Pedreira, & Maldonado, 2009), the potential of the memory trace to generate new learning and update existing information (Lee, 2009), and the replication of the context wherein the original memory took place (Hupbach, Gomez, & Nadel, 2013; Hupbach, Hardt, Gomez, & Nadel, 2008).

Besides questions about universality, reconsolidation has been shown to have a differential effect on different memory systems, with lesser impact in episodic memories compared to fear conditioning learning (Phelps & Schiller, 2013; Schiller & Phelps, 2011). Furthermore, findings demonstrate that memory reconsolidation is more likely to occur when reactivation of the memory trace is followed by the learning of new information that is somehow similar to the original information (retroactive interference), often leading to the incorporation of new information into older material (Lee, 2009; McKenzie & Eichenbaum, 2011).

There are several other lingering questions involving memory reconsolidation, namely its function and relation to consolidation. In this regard, two different perspectives stand out. Some researchers advocate reconsolidation serves an evolutionary purpose (Forcato et al., 2009; Lee, 2013) by allowing existing memory

representations to be updated with new information (Forcato, Rodriguez, Pedreira, & Maldonado, 2010). As such, they consider reconsolidation to be distinct from consolidation, a claim somewhat strengthened by existing differences at the molecular level (Lee, Everitt, & Thomas, 2004; Nader, 2013).

An alternative view is that reconsolidation is the continuous action of consolidation processes with the purpose of stabilising memory, with differences at the molecular level not warranting claims of different processing stages (Alberini, 2011; Dudai, 2012; Dudai & Eisenberg, 2004; McKenzie & Eichenbaum, 2011). Both perspectives evidence the fluidity of memory and portray the dynamic nature of the process by which memories are formed, updated and maintained (Hupbach et al., 2013).

The fact that previously stable memory traces can be subject to restructuring is relevant, on account of the possible repercussions to how MTT experiences are perceived and dealt with in clinical scenarios (Alberini, Ansermet, & Magistretti, 2013; Corlett & Taylor, 2013). Several studies have addressed the benefits of using reconsolidation processes in therapeutic settings to improve the mental health of individuals (Ecker, 2015; Lane, Ryan, Nadel, & Greenberg, 2015). These studies propose that through reconsolidation it is possible to destabilise existing representations and form new semantic structures/schemas that will interact with past, present, and future events to improve well-being. Thus, besides emphasising the importance of reconsolidation processes in therapeutic settings, these studies evidence the importance of MTT and its malleability to clinical research.

2.7. Memory Processing Stages and Processes – A Summary

Throughout this section, the different stages of memory processing and their respective processes were described. As the central focus of this thesis is MTT, which requires access to autobiographical (semantic and episodic) content, it is important to provide a general notion of how that informational content can be formed, consolidated, and accessed, as it is necessary for a MTT experience to unfold. Moreover, the factors affecting each memory processing stage are also relevant to the MTT literature, as they impact the likelihood of informational content being experienced as a MTT event.

To conclude, this chapter aimed to provide the reader with the necessary information to understand the systems and processes underlying the experience of MTT.

CHAPTER THREE – MENTAL TIME TRAVEL (MTT)

In this thesis MTT refers to the ability to re- or pre-experience autobiographical events by mentally travelling through subjective time, as a result of autonoetic consciousness. This allows individuals to be mentally "transported" into their past, re-experiencing a past event (past MTT), and to be mentally "transported" into their future, pre-experiencing a future event (future MTT). In this thesis only real past experiences and plausible future occurrences are considered as MTT events. As a consequence, the literature presented throughout this chapter abides by these "reality/plausibility" constraints. Alternative past events, that never happened, and unrealistic future occurrences, defying reality or unlikely to occur, are not elaborated upon, as they were not considered in Studies 1 and 2 of this thesis.

There are multiple definitions of MTT in the literature. Some are more overarching, encompassing purely semantic representations and dismissing the need for autonoetic consciousness (Stocker, 2012). According to these, simply thinking about the past or the future can constitute a MTT experience, irrespective of spatiotemporal specificity or autonoetic consciousness. Other definitions are more restrictive, stating MTT requires spatiotemporally specific autobiographical events (unique occurrences lasting less than a day) that need to be autonoetically experienced. This thesis adopts an intermediate approach, reflecting recent evidence suggesting general autobiographical events (categoric and extended) involve both episodic elements and autonoetic consciousness (Markowitsch & Staniloiu, 2011; Renoult et al., 2012, 2015). As such, the concept of MTT is not limited to autobiographical and spatiotemporally specific (episodic) events, but expanded to include general

autobiographical events, provided these exhibit episodicity and autonoetic consciousness.

This chapter aims to familiarise the reader with the construct of MTT and with two of its key orthogonal dimensions: temporality (past vs. future) and type of retrieval (voluntary vs. involuntary). A brief historical background of existing research on temporality is provided, followed by a description of the cognitive faculties necessary to both past and future MTT, and an analysis of the similarities and differences between these two temporal dimensions. A historical perspective of retrieval will then be outlined, followed by explanatory frameworks for both voluntary and involuntary retrieval and an analysis of their respective behavioural and phenomenological similitudes and differences. The chapter concludes with a description of the functions attributed to MTT, as these are indicative of its relevance to everyday life.

3.1. Connection Between Past and Future MTT

MTT is the process whereby autobiographical events from the past are reconstructed and autonoetically re-experienced in the form of memories with semantic and episodic content, but also whereby possible future events, of an autobiographical nature, are pre-experienced via contributions from semantic and episodic components. Being so, the characteristics of the memory systems and processes revised in Chapter 2 are important not only for the recall of detailed and phenomenologically rich past MTT experiences, but also for the construction of future MTT events (Conway, 2008; Corballis, 2009; Suddendorf & Corballis, 2007; Wheeler et al., 1997).

As discussed, past MTT is characterised by the encoding, consolidation, and retrieval of an event's multiple aspects, embedded in the autonoetic, affective, and environmental contexts of their occurrence (Vandekerckhove et al., 2014). Consequently, when mentally travelling into their past, individuals experience feelings of selfhood and agency that reflect an understanding that the current mental state is a valid, non-fictive, representation of a past personal experience (Conway, 2008), the result of autobiographical memory's association with autonoetic consciousness. This form of consciousness, which was described exclusively through the "lens" of past temporality (Subsection 2.4.2), is also responsible for allowing individuals to project themselves "in the context of future opportunities and possibilities, within the context of retrospective memories and prospective plans" (Vandekerckhove et al., 2014, p.5).

According to Klein (2013b), Bradley (1887) was the first to claim a parallelism existed between remembering the past and anticipating the future. This possibility resurfaced when Köhler (1927) proposed that the ability to reference past and future events was a hypothetical source of discontinuity between human and nonhuman species. This eventually led to a proposal for a distinct and uniquely human autonoetic episodic memory system (Tulving, 1983). This proposal proved even more relevant to MTT once it was suggested that the autonoetic episodic memory system was not only essential to past MTT, but also to future MTT, through the creation of episodic representations of the future (Tulving, 1985b, 1993). This insight was obtained when, during the course of his research, Tulving (1985b) discovered a brain-injured patient who not only exhibited severe anterograde and retrograde episodic amnesia, but also showed considerable limitations in his ability to anticipate his future.

Tulving's (1985b) findings served as a precursor to research on parallelisms between past and future MTT. Researchers have demonstrated that patients who exhibit episodic impairments do so for past and future situations (Barba, Cappelletti, Signorini, & Denes, 1997; Williams et al., 1996), as a consequence of the episodic system's involvement in both (Suddendorf & Corballis, 1997; Wheeler et al., 1997).

Overall, a considerable interest has developed concerning how past MTT relates to, and impacts, future MTT (Klein, 2013b, 2015b). A significant amount of research has recently been conducted on future MTT, including its neural (Addis, Wong, & Schacter, 2007; Buckner & Carroll, 2007; D'Argembeau, Jeunehomme, Majerus, Bastin, & Salmon, 2015) and developmental correlates (Busby & Suddendorf, 2005; Klein, Robertson, & Delton, 2010), as well as its level of specificity (Addis, Cheng, Roberts, & Schacter, 2011). However, at this point in time, much remains unknown about the relation between past and future MTT and about how type of retrieval impacts both MTT outcomes. This thesis attempts to answer some of these questions by focusing on the differences and similarities of phenomenological characteristics of past and future MTT, as elicited by voluntary and involuntary retrieval processes.

3.2. Temporality in MTT – Past and Future

Up to this point of the introduction, memory systems, processes, and processing stages have been described with an almost exclusive focus on past MTT. This is partly due to the fact that there is a substantially greater volume of research on past MTT. Throughout this section, findings regarding future MTT will be discussed

in conjunction with research on past MTT. The ensuing subsections, by exploring the characteristics of future MTT and its similarities and differences with regard to past MTT, provide a necessary theoretical scaffold for the hypotheses of Studies 1 and 2 (see Chapter 6), all of which assess phenomenological variables across past and future MTT events.

3.2.1. MTT into the future: One of many and one of a kind

There are several lines of research devoted to an individual's ability to think about the future. Prospection is the comprehensive term used to refer to the variety of future-oriented cognitions that share the ability to represent what may happen in the future (Gilbert & Wilson, 2007; Seligman, Railton, Baumeister, & Sripada, 2013; Szpunar, Spreng, & Schacter, 2014). Among these are: (a) future MTT, also referred to as episodic future thinking (Atance & O'Neill, 2001), episodic foresight (Suddendorf & Moore, 2011) and episodic future simulation (Schacter et al., 2012; Szpunar, 2010). These terms have been used interchangeably to refer to the construction of detailed mental representations of specific episodic events that allow an individual to pre-experience an event; (b) predictions, often manifest under the form of affective forecasting (Miloyan & Suddendorf, 2015; Wilson & Gilbert, 2005), and referring to how well individuals are able to predict their emotional reactions to possible future events; (c) intention formation (Gollwitzer, 1999), concerning the setting of goals in relation to future events; (d) autobiographical planning (Spreng, Stevens, Chamberlain, Gilmore, & Schacter, 2010), consisting of the identification and organisation of the steps necessary to achieve a future outcome.

The existence of several future-oriented cognitive processes and the limited knowledge of their characteristics and interactions (Szpunar et al., 2014) have reinforced the need for a taxonomy of prospection that helps reduce concept overlap and enables a more rigorous study of prospection (Atance & O'Neill, 2001; Suddendorf & Corballis, 2007). Until recently, it was proposed that different future-oriented processes should be separated according to their underlying memory system (Suddendorf & Corballis, 2007). However, this has been questioned by Szpunar et al. (2014), who have devised a taxonomy of prospection that considers the aforementioned four types of future thinking (MTT/simulation, prediction, intention, and planning) to be interactive, building on one another at different levels of abstraction and complexity (Szpunar et al. 2014; Szpunar & Tulving, 2011). Moreover, they propose that these different forms of future thinking can all be differentially impacted by both the semantic and episodic memory systems, with the outcome of this impact being manifest in a predominance of semantic or episodic traits (Szpunar et al., 2014). The fact that this episodic-semantic dimension is deemed to be continuous leads to the possibility of hybrid future-oriented processes, which benefit from the input of both the semantic and episodic memory systems. This proposed continuity is congruent with that suggested for past MTT, in the form of categoric and extended memories – see Subsection 2.4.4 – and with the possibility that categoric and extended future representations themselves constitute a MTT experience into the future (Barsics, Van der Linden & D'Argembeau, 2016). This parallelism between past and future MTT is one of the several similarities to be explored in this chapter.

Klein (2013b, 2013c) has also been a proponent of a taxonomy of prospection, one that takes into consideration the important role of semantic processing in several

forms of future thinking and subjective temporality. The construction of future MTT experiences is among these, as evidenced by multiple brain injury studies (Duval et al., 2012; Hurley, Maguire, & Vargha-Khadem, 2011; Irish et al., 2012) that demonstrate the considerable impact the semantic memory system has over internally driven complex cognitive functions (Binder, Desai, Graves, & Conant, 2009). D'Argembeau and Demblon (2012) further confirmed that future MTT involves higher-order knowledge structures, as future episodic representations are frequently embedded into event clusters, being aggregated in accordance to causal and thematic relations. This embedding, which also occurs in past MTT (see Subsection 2.4.4), is referred to as the semantic scaffolding hypothesis (Irish & Piguet, 2013) and derives from the involvement of pre-existing autobiographical knowledge structures in the construction of future MTT events (D'Argembeau & Mathy, 2011).

To summarise, recent theoretical proposals have emphasised the contributions of both episodic and semantic memory systems to the construction of future MTT events. This perspective of complementarity is congruent with the stance of previously discussed models of episodic memory, which also valued the interactions between episodic and semantic systems in the generation of past MTT experiences (Conway, 2009; Fivush, 2011; Tulving, 1995). Such parallelisms suggest the existence of common underlying memory systems in past and future MTT (Atance & O'Neill, 2001; Irish & Piguet, 2013; Klein, 2013b, 2013c).

In spite of the multiple categories of future-oriented cognition, the focus of this thesis lies entirely on MTT. Only MTT is not exclusively future-oriented, as it is able to extend into the past (Schacter et al., 2012; Suddendorf & Corballis, 2007, 2008; Szpunar et al., 2014). This temporal flexibility proves invaluable, as it permits the

study of interactions between past and future oriented processes, and contributes to augment existing knowledge on either temporal dimension of MTT, and on the relation between both. Additionally, the contribution of MTT to the remaining categories of future thinking (Szpunar et al., 2014) strengthens the pertinence of the current study's attempt to further existing knowledge on MTT.

3.2.2. Cognitive faculties necessary for MTT

To understand MTT and the differences and similarities shared by its past and future temporality, it is important to know the cognitive faculties that make MTT viable. The fact that similar cognitive faculties are involved in recollecting one's past and projecting one's future is part of the reason why researchers proposed the concept of MTT, as it strengthens the perceived relation between individuals' experiences of past and future events. Nevertheless, this parallelism between past and future MTT does not preclude the existence of important differences.

The cognitive faculties contributing to MTT, despite idiosyncratic developmental timelines, eventually overlap, creating a point in time where all the necessary components for MTT are operational and able to interact (Prabhakar & Hudson, 2014; Suddendorf & Corballis, 2007; Suddendorf & Redshaw, 2013). These faculties are now described.

3.2.2.1. Self-awareness, meta-representations and attributions

The fact that MTT requires autonoetic consciousness evidences the importance of the self to MTT, in what can be considered a bidirectional relation (Suddendorf & Corballis, 1997): MTT, by allowing access to past and future autobiographical

representations, contributes to the development of a self-concept pervasive in time (Suddendorf & Corballis, 1997); the self, in turn, is responsible for creating a sense of momentary integrity or wholeness which allows individuals to associate their past memories with past experiences (Howe & Courage, 1993), and to organise future MTT events (Grysman, Prabhakar, Anglin, & Hudson, 2013; Rathbone, Conway, & Moulin, 2011). Although self-awareness can exist independently of the ability to MTT (Klein, 2012; Rosenbaum et al., 2005), the latter provides valuable contributions to the self.

The awareness that a representation constitutes a past or future MTT event requires individuals to be able to meta-represent their knowledge, to represent a representation as a representation (Perner, 1993) and be able to attribute it to a past or future self. Such attributions require the aforementioned self-awareness (Suddendorf & Redshaw, 2013) and, possibly, the capacity for theory of mind (Atance, 2008; Atance & Meltzoff, 2005; but see Hanson, Atance, & Paluck, 2014 for different view). This interconnection between MTT and theory of mind has long been advocated (Suddendorf & Corballis, 1997), as both processes seem to draw on similar cognitive resources, including meta-representations. The fact that, among other possible functions, MTT may have evolved to predict and aid or thwart the behaviour of others, has made it necessary for individuals to be able to represent themselves and others, so as to engage in complex forms of social competition and cooperation (Suddendorf & Redshaw, 2013). However, while these meta-representations are believed to emerge around the same time as those typical of theory of mind, there is no incontrovertible evidence of their interconnection (Atance, 2015).

3.2.2.2. The concept of time

The concept of time and, particularly, specific moments in time, is a key characteristic of the episodic memory system and, subsequently, MTT (McCormack & Hoerl, 1999). Because there is no natural temporal code in human memory (Suddendorf & Corballis, 1997, 2007), individuals resort to different timing mechanisms in the human brain to obtain information about temporal distance and distribution (Friedman, 2005). These two factors have an impact on the phenomenological quality of MTT events, making them relevant to the present thesis' hypotheses (see Subsection 3.3.1.1).

Temporal distribution is the frequency distribution of MTT events across an individual's lifespan. Because in a MTT task participants often privilege events from a certain age-period (e.g., events that occurred when the participant was between 5 and 10 years old) in detriment of another (e.g., events that will occur when the participant is between 80 and 85 years old), temporal distribution is useful in that it allows an assessment of how the retrieved events are distributed across the individual's life. Temporal distance, on the other hand, assesses the distance, in years, between the present time and the moment the event occurred/will occur (e.g., "It has been 30 years since I first cliff-dived" or "In two years I will be on a plane to Cuba").

Beyond the use of biological timing mechanisms to assess temporal distribution and distance, humans have developed a socio-cultural resource that consists of semantic representations of temporal patterns, manifest in the concepts of hours, days, weeks, etc. (Friedman, 1993). These temporal concepts constitute a "cultural heritage that helps in the conceptualization of the time dimension and in the coordination of future-directed activities" (Suddendorf & Redshaw, 2013, p.138).

They have become the common human approach to timing (Suddendorf & Corballis, 2007) but, by themselves, are insufficient to create one's sense of past and future. As such, three kinds of processes are considered vital to the ability to perceive oneself in time (Friedman, 2005): Location-based processes, which are used in both past and future MTT, are closely linked to the temporal concepts and consist of assigning an event to a location within a time pattern (e.g., a memory of having visited a football stadium in the past summer); distance-based processes, exclusive to past MTT, refer to remembrance of events via analysis of their distances in the past (e.g., an impression that an event occurred a month ago); and order-based processes, equally exclusive to past MTT, and characterised by a remembrance process that is based on the order of past events (e.g., the notion that one went through childhood before reaching adulthood). Furthermore, research has surmised individuals use verbal and image-based processes to represent the occurrence of days, weeks, and months, which are also vital in assessing the temporal distance of events (Friedman, 2005).

3.2.2.3. Generativity and representational space

Generativity promotes a rapid adaptation to complex physical and social environments by means of the informational flexibility it entails. Although it is often associated with language, generativity manifests itself in MTT by allowing individuals to re- or pre-construct past and future events through the combination and recombination of objects, subjects and acts (Suddendorf & Busby, 2005) that helps create the phenomenological experience of MTT (Schacter & Addis, 2007; Suddendorf & Corballis, 2008; Tulving, 2005). This flexibility, evident in the lability of information subjected to consolidation and reconsolidation processes (see

Subsections 2.6.2 and 2.6.4), is particularly strong in future MTT, where the uncertainty surrounding what is yet to happen implies individuals need to construct and entertain several prospective scenarios, that are then evaluated and selected in accordance to their likelihood and desirability (Suddendorf & Corballis, 2007; Suddendorf & Redshaw, 2013).

Such plasticity in MTT requires the recursive application of rules to semantic and episodic information, so that unlimited sets of potential but realistic scenarios can be created (Suddendorf & Corballis, 1997). Recursion, which lies at the heart of several aspects of human thought (Hauser, Chomsky, & Fitch, 2002), thus enables open-ended generativity in MTT under the form of flexible combinations and recombinations of information (Suddendorf & Redshaw, 2013).

These multiple combinations require a representational space coupled with the ability for executive control (Suddendorf & Corballis, 2007; Suddendorf & Redshaw, 2013). This mental "workspace", often associated with the working memory system (see Subsection 2.3.1.1), enables an offline manipulation of temporal and spatial information, and is responsible for an individual's ability to go beyond current perceptions and entertain secondary representations (Perner, 1993; Whiten & Suddendorf, 2001), which then enable meta-representations. Executive control may be required to regulate the range of psychological mechanisms that allow for the implementation of strategic action plans, and to manage the goal system itself (Baird, Smallwood, & Schooler, 2011; Conway, Meares, & Standart, 2004; D'Argembeau et al., 2015; Suddendorf & Busby 2005).

When considered together, although some of these cognitive abilities develop as early as age two, it is only between their third and fifth year that children start to

exhibit all the components necessary to construct spatiotemporally specific past and future MTT experiences. Moreover, some of these components, such as working memory and executive functioning, undergo a developmental process that spans from early childhood into young adulthood, only then enabling a fully developed and functional MTT (Abram, Picard, Navarro & Piolino, 2014; Suddendorf & Redshaw, 2013). Nevertheless, these different timelines are shown to overlap for both past and future MTT, and thus constitute developmental evidence of their correspondence.

3.2.3. Similarities between past and future MTT

In spite of the aforementioned findings regarding the cognitive faculties involved in MTT, questions abound respecting the extent of the similarities and differences between past and future MTT (Zheng, Luo, & Yu, 2014). In this subsection and in Subsection 3.2.4, a detailed exposition of findings from neuroimaging, lesion, and behavioural studies, comparing past and future MTT events, is presented. These were accounted for when formulating the hypotheses of Studies 1 and 2, and may prove relevant to interpret the results of the present thesis, wherein past and future MTT were subjectively appraised with regard to multiple phenomenological aspects.

When Suddendorf and Corballis (1997) first proposed the concept of MTT, they considered that the generative nature of the episodic memory system (Tulving, 1993) would imply the mechanisms involved in the continuous construction of the past would also be involved in constructing one's future, thereby making obvious the connection between both. This proposal, heavily influenced by Tulving's work (1985b), found support in behavioural studies (Atance & O'Neill, 2001; D'Argembeau & Van der Linden, 2004, 2006; Spreng & Levine, 2006), but it were the following

neuroimaging studies that raised awareness, within the scientific community, for possible similarities between past and future MTT (Schacter et al., 2012).

3.2.3.1. Neuroimaging and lesion studies

Okuda et al. (2003), Addis et al. (2007) and Szpunar, Watson, and McDermott (2007) all found that, during past and future MTT, a common "core" brain network, composed of several brain structures and overlapping with the default network[1] was activated, which suggested similar neural processes were used for past and future MTT. Despite the initial impact of these neuroimaging studies, doubts arose concerning whether the aforesaid overlap in brain activity was truly a consequence of the temporal processes of past and future MTT (Schacter et al., 2012). These questions were fuelled by studies showing that atemporal processes such as self-projection (Buckner & Carroll, 2007), referring to the ability to shift perspective from the immediate environment to an alternative one, and scene construction (Hassabis & Maguire, 2007, 2009), concerning the mental generation and maintenance of a complex and coherent scene or event, also consistently activated the brain default network while being involved in forms of cognition other than past and future MTT.

As a consequence, several additional neuroimaging (Addis, Pan, Vu, Laiser, & Schacter, 2009; Addis & Schacter, 2008; Addis et al., 2007), behavioural (de Vito, Gamboz, & Bradimonte, 2012; de Vito, Gamboz, Bradimonte, Barone, et al., 2012) and lesion studies (Hassabis, Kumaran, Vann, & Maguire, 2007; Rasmussen & Berntsen, 2014) have examined the possible overlap between past and future MTT.

[1] The default network corresponds to a set of midline and lateral cortical brain regions whose activity is increased during an individual's idle moments, being linked to internally focused thought and attention (Andrews-Hanna, 2012).

Although lesion studies based on amnesic patients suggest an overlap between past and future MTT, there are contradictory findings regarding the brain areas involved, in particular the role of the hippocampus and medial temporal lobe structures (Kwan, Carson, Addis, & Rosenbaum, 2010; Maguire, Vargha-Khadem, & Hassabis, 2010; Rosenbaum, Gilboa, Levine, Winocur, & Moscovitch, 2009; see Zheng et al., 2014, for a synthesis). These divergent results may be due to methodological differences across studies (Viard, Desgranges, Eustache, & Piolino, 2012).

3.2.3.2. Behavioural studies

Behavioural studies have also provided evidence of similarities in the organisational structure/processes of past and future MTT (D'Argembeau & Demblon, 2012; D'Argembeau & Mathy, 2011; Demblon & D'Argembeau, 2014, 2016; Rubin, 2014). Research demonstrates that general personal knowledge (i.e., personal semantic information and/or general events), and in particular knowledge about personal goals, play an important role in the construction of future MTT events (D'Argembeau & Demblon, 2012; D'Argembeau & Mathy, 2011). Their construction often consists of a protracted generative process during which general personal knowledge, after being accessed, will guide the use of subsequent episodic details in the formation of a future MTT experience (see Subsection 3.3.5). These results provided initial support for the thesis that, similarly to past MTT, future MTT consists of transitory patterns of activation over knowledge structures that possess different levels of specificity, the more general of which provide a context for retrieving, integrating, and interpreting episodic details. These findings are consistent with the premises of the SMS (Conway, 2005, 2009), the Social Cultural Developmental model (Nelson & Fivush, 2004) and

Tulving's (2005) proposed interactions between the episodic and semantic memory systems.

Multiple studies have also found similarities involving certain phenomenological characteristics of past and future MTT events, such as self-relevance and associated mood and physical impact. Such research findings are addressed in Chapters 5 and 6.

3.2.3.3. Explanatory frameworks for past and future MTT similarities

Given the interest that the possible continuity between past and future MTT has generated, it is not surprising that different theoretical frameworks have been developed to explain such results. From scene construction theory (Hassabis & Maguire, 2007, 2009), that emphasises atemporal scene construction as the core process common to both past and future MTT, to the constructive episodic simulation hypothesis (Addis et al., 2009; Schacter & Addis, 2007, 2009), that states the commonalities between past and future MTT derive from the temporal flexibility of the episodic system, a shared focus has been placed on the constructive nature of MTT. This general idea of memory as a constructive process that integrates bits and pieces of information, instead of being a literal replay of the past, dates back to the original work of Bartlett (1932), and has since become the dominant paradigm of memory and MTT research.

Scene construction theory adopts an atemporal perspective (Schacter et al., 2012), proposing the elements underlying scene construction are not forcefully fragments of past events, but can constitute more abstract and semantic elements bound into a coherent spatial context (Hassabis & Maguire, 2007, 2009). By contrast,

the constructive episodic simulation hypothesis proposes that simulation-related processes, such as past and future MTT, require the flexible extraction, recombination and reassembly of past information into episodically pre-experienced future events (Painter & Kring, 2015). Although this hypothesis does not attribute the relevance to subjective temporality that Suddendorf and Corballis (1997, 2007) and Tulving, (2002, 2005) do, it values the direct use of past episodic information in the construction of future events (Addis & Schacter, 2008; Eichenbaum & Cohen, 2004).

Overall, the studies and theories described have informed current conceptualisations of the similarities between past and future MTT. Their relevance is manifest in the hypotheses being tested in this thesis (see Chapters 5 and 6 for details).

3.2.4. Differences between past and future MTT

In spite of their similarities, past and future MTT are different processes (Berntsen & Bohn, 2010; Schacter et al., 2012; Zheng et al., 2014). Past MTT is grounded in contextually situated episodic and historical information while future MTT is often couched in the creative reconstruction of prototypical information (Kane, Boven, & McGraw, 2012). Their differences, substantiated by neuroimaging (Addis & Schacter, 2008; Addis et al., 2007) and behavioural studies (Berntsen & Jacobsen, 2008; Rasmussen & Berntsen, 2013; Storm & Jobe, 2012), are now described.

3.2.4.1. Neuroimaging studies

Neuroimaging studies have documented several differences in the brain activation patterns of past and future MTT events. Higher levels of hippocampal activation have been found in the latter (Addis & Schacter, 2008; Addis et al., 2007),

believed to be a consequence of future MTT often involving an original recombination of multiple fragments of information, with more detailed and temporally distant future events requiring greater information binding efforts and respective superior brain activation (Addis & Schacter, 2008; Schacter & Addis, 2009; but see Anderson, Dewhurst, & Peters, 2015, for a different perspective). Another possible explanation is that they are the result of the encoding process that an original future experience must undergo if it is to be used in future situations (Martin, Schacter, Corballis, & Addis, 2011).

3.2.4.2. Behavioural studies

Behavioural studies have also affirmed the existence of differences between past and future MTT. It has been suggested that increased levels of brain activity in future MTT are a consequence of superior cognitive demands, such as schema-driven construction processes (Berntsen & Bohn, 2010; Berntsen & Rubin, 2004), that lead to a greater involvement of working memory processes (Smallwood, Nind, & O'Connor, 2009). In past MTT, the fact that individuals access episodic representations of events they have experienced and encoded means such representations have already been subject to encoding and consolidation factors such as emotional arousal (McGaugh, 2004) or perceived importance (Pillemer, 1998). By contrast, in future MTT one often creates episodic representations of novel events that have not yet been encoded, and thus require a greater contribution from schemas and their informational regularities (Martin et al., 2011; Schacter & Addis, 2009). The so called "memories of the future" are an exception to this, as they consist of future MTT

events often rehearsed by individuals, and thereby previously subjected to encoding – see Subsection 3.3.4 for further details).

The influence of schemas, coupled with a more positive view of the self in the future (Wilson, Gunn, & Ross, 2009; Wilson & Ross, 2003) and uncorrected positive illusions of the future (Taylor & Brown, 1988), increase individuals' susceptibility to a positivity bias (Berntsen & Jacobsen, 2008; Grysman et al., 2013). Such a bias translates a superior recall of positive compared to negatively valenced events and, despite being manifest in individuals' past MTT, is stronger in future MTT, as demonstrated by multiple studies using different methodologies (Berntsen & Bohn, 2010; Berntsen & Jacobsen, 2008; Finnbogadóttir & Berntsen, 2013; Gallo, Korthauer, McDonough, Tesdale, & Johnson, 2011; Newby-Clark & Ross, 2003).

Further phenomenological differences exist between past and future MTT, several of them the result of the aforementioned privileged association between future MTT and schema construction processes and knowledge structures (Rasmussen & Berntsen, 2013). This association is evident in the greater difficulties that individuals experience in projecting themselves into a specific time and place in the future (Anderson & Dewhurst, 2009; Berntsen & Jacobsen, 2008) when compared to the past, with frameworks of temporally closer (Berntsen & Jacobsen, 2008; Spreng & Levine, 2006), routine, and repetitive events being more easily constructed (Spreng & Levine, 2013). By virtue of future MTT's more schematic nature, it often exhibits fewer sensory details (Berntsen & Jacobsen, 2008) and vividness (Rasmussen & Berntsen, 2013), given the gist-like nature of schematic events, with a predominance of third-person perspective and greater percentage of personally significant events

(D'Argembeau & Mathy, 2011; D'Argembeau & Van der Linden, 2004, 2006; Miles & Berntsen, 2011; Newby-Clark & Ross, 2003).

Besides phenomenological differences, future MTT is believed to involve greater goal-directed processing and creative thinking (Zheng et al., 2014). Regarding goal-directed processing, personal goals have been shown to contribute to the generation and organisation of specific future MTT (Christian, Miles, Fung, Best, & Macrae, 2013; D'Argembeau & Demblon, 2012; D'Argembeau & Mathy, 2011; Demblon & D'Argembeau, 2014). Goal-processing directly influences both perception (Bar, 2009) and mental imagery (Christian et al., 2013), the latter serving as the primary medium through which goals impact representations of the future (Moulton & Kosslyn, 2009), with the purpose of enhancing prospective acuity and, consequently, promoting adequate behaviour (Gollwitzer, 1999; Taylor, Pham, Rivkin, & Armor, 1998). This impact is influenced by temporal distance, as the further individuals project themselves in time, the less detailed the future MTT experiences tend to be (Christian et al., 2013; Trope & Liberman, 2003).

Creativity, as the sequence of thoughts and actions that enable innovative generation and adaptive productions (Lubart, 2001), is another fundamental aspect of future MTT. Its value lies in the construction of future MTT experiences, wherein a vast array of past episodic and semantic information can be combined in infinite and creative ways (Ellamil, Dobson, Beeman, & Christoff, 2012). However, the influence of creative processing upon future MTT varies, being modulated by temporal distance. The further an event is in time, the likelier the individual is to resort to abstract thinking (Chiu, 2012), and to engage in creative thinking (Förster, Friedman, & Liberman, 2004).

3.2.5. Past and future MTT – A brief summary

To conclude, evidence from neuroimaging and behavioural studies clearly indicates a close relationship between past and future MTT that is constrained by the differences between both processes. However, questions still abound regarding the nature of the similarities and differences between past and future MTT. One of the aims of this thesis was to address this by directly comparing the phenomenological characteristics of past and future MTT in individuals with or without dysphoria/depression.

3.3. Voluntary and Involuntary MTT

Past and future MTT can occur in one of two ways: Voluntarily, whereby a MTT event is subjectively experienced as an intended occurrence, or involuntarily, wherein it is subjectively experienced as an unintended outcome (Berntsen, 2009). In this thesis, involuntary retrieval refers to involuntary conscious retrieval, whereby the individual is aware of the event retrieved.

The nature of the subjective experience of MTT is largely attributed to the different retrieval mechanisms involved in voluntary and involuntary MTT (Berntsen, 2009; Hall et al., 2014; Mace, 2010a), as encoding and consolidation stages are characterised by greater similarity, irrespective of MTT's temporality (Berntsen & Jacobsen, 2008; Finnbogadottir & Berntsen, 2013; Berntsen, 2009).

The following subsections outline evidence in favour of these similarities between voluntary and involuntary MTT's encoding and consolidation processes, followed by theoretical frameworks explaining the processes involved in voluntary

and involuntary retrieval of MTT experiences. Much of the literature on the effects of type of retrieval on MTT has focused on past MTT, but the findings presented in Section 3.2 demonstrated that "substantial evidence – from cognitive, neuroimaging, developmental, and lesion studies – has accumulated to show that future scenarios are founded on information stored in episodic and semantic memory" (Jeunehomme & D'Argembeau, 2016, p.254), which suggests the ensuing theoretical frameworks can be, at least partially, extrapolated to future MTT retrieval.

One aim of this thesis is to examine the processes of voluntary and involuntary retrieval, an under researched topic in existing literature on MTT (Mace, 2010a). This is done by directly comparing the phenomenological characteristics of voluntary and involuntary MTT events across different participants, while controlling for temporality. Because type of retrieval is hypothesised to impact several of the phenomenological characteristics under analysis in this thesis (see Chapter 6), it is relevant to understand the theoretical premises that led to such hypotheses.

3.3.1. Encoding and consolidation-related factors – temporal distribution

When individuals mentally travel in time they often access events from distinct periods of their lives, some closer to the present, others from their distant past/future. Several studies have shown an uneven temporal distribution of events across the life span, for both past (Berntsen, 2009) and future (Bohn & Berntsen, 2011; Spreng & Levine, 2006) MTT. The following subsections present evidence of a correspondence between the temporal distribution of past and future MTT events, and between voluntary and involuntary MTT events. These parallelisms are meaningful because the fact that individuals exhibit similar temporal distributions for voluntary and

involuntary events suggests both types of events undergo similar encoding and consolidation processes. This is important because it implies that phenomenological differences between voluntary and involuntary MTT events, as assessed in this thesis, should be interpreted in light of the retrieval mechanisms involved. Consequently, understanding the different theories and processes underlying voluntary and involuntary retrieval will facilitate interpretation of the findings of this thesis.

3.3.1.1. Temporal distribution and temporal distance in past MTT

The temporal distribution of past MTT events is believed to be influenced by three aspects (Berntsen, 2009): Childhood amnesia, a reminiscence bump, and a retention function. Childhood amnesia consists of a "relative paucity among adults for autobiographical or personal memories from the first three to four years of life, and from the first seven years, a smaller number of memories than would be expected based on normal forgetting" (Bauer & Larkina, 2014, p. 597) that is equally manifest in voluntary (Rubin, 2000) and involuntary (Berntsen, 1998; Berntsen & Hall, 2004) autobiographical memories. The reasons underlying this paucity of childhood memories are beyond the purpose of this thesis, but the similarities across voluntary and involuntary retrieval are relevant in that they suggest a likeness between both types of retrieval that can be tested (see Sections 8.4 and 11.4) and should be considered when comparing the phenomenological characteristics of voluntary and involuntary MTT.

The reminiscence bump refers to an increase in the recall of autobiographical memories of events that occurred during adolescence and young adulthood compared to other periods of life (Rubin, Wetzler, & Nebes, 1986), and it too has been found for

voluntary (Janssen, Chessa, & Murre, 2005) and involuntary (Berntsen & Rubin, 2002; Schlagman, Kliegel, Schulz, & Kvavilashvili, 2009) memories, reinforcing the parallelism between voluntary and involuntary past MTT.

The retention function consists of a mathematical formula that successfully predicts the temporal distribution of reported autobiographical memories (Rubin & Schulkind, 1997). It explains the systematic decrease of an individual's ability to report memories, characterised by a pronounced decline at the beginning of the retention period that levels off as the time elapsed increases. Similar retention functions have been shown to exist in both voluntary and involuntary memories, consistent with evidence of strong similarities between the encoding and consolidation processes of both types of past MTT (Berntsen, 1998; Berntsen & Hall, 2004).

In summary, the literature shows considerable similarities in the temporal distribution of voluntary and involuntary autobiographical memories as both are similarly impacted by childhood amnesia, evidence a predominance of recent events, and exhibit analogous retention functions. All these aspects suggest that similar encoding and consolidation processes are involved in voluntary and involuntary past MTT (Berntsen, 2009), a premise tested in the present thesis (see Sections 8.4 and 11.4) to assess if the phenomenological differences between voluntary and involuntary past events can be interpreted by focusing on their underlying retrieval processes.

Temporal distance was also analysed in the aforementioned sections, as it has been shown to influence several of the MTT characteristics being analysed in this thesis, from spatiotemporal specificity (Falco, Peynircioglu, & Hohman, 2014) to visual perspective (D'Argembeau & Van der Linden, 2012) or self-relevance (Berntsen & Bohn, 2010). Together with temporal distribution, temporal distance

analyses can play an important role in controlling extraneous variables associated with encoding and time-related factors.

3.3.1.2. Temporal distribution and temporal distance in future MTT

Spreng and Levine (2006) suggested there is a correspondence between the temporal distributions of past and future MTT events. Additional studies corroborated their claims by demonstrating that similar changes were produced in several phenomenological characteristics of past and future MTT as the temporal distance of MTT events increased (Berntsen & Bohn, 2010; Berntsen & Jacobsen, 2008; D'Argembeau, Renaud, & Van der Linden, 2011). These similarities were also attributed to future MTT resorting to components (e.g., the context, the people, the objects) obtained from memory, meaning the phenomenological quality of future MTT experiences became directly associated with the quality of memorial information (D'Argembeau, 2015; D'Argembeau & Van der Linden, 2012). Such past/future symmetry is congruent with the temporal construal theory, which states that individuals tend to form more abstract representations of temporally distant events by comparison to the more concrete representations of temporally close events (Trope & Liberman, 2003).

3.3.2. Encoding and consolidation-related factors – frequency, rehearsal, emotional content and biases

Beyond the similarities of their temporal distributions, voluntary and involuntary MTT (Rasmussen & Berntsen, 2011; Rubin & Berntsen, 2009) occur frequently in everyday life, often being the subject of rehearsal (Rubin & Berntsen,

2009; Walker, Skowronski, Gibbons, Vogl, & Ritchie, 2009). Furthermore, the same factors have been shown to predict the frequency of voluntary and involuntary MTT, namely emotional intensity and how central to an individual's life story an event is perceived to be (Rubin & Berntsen, 2009; see Berntsen, 2009, for a review).

The positive correlation between the frequency of voluntary and involuntary autobiographical memories and their emotional intensity demonstrates that memory accessibility is often enhanced by emotional arousal (McGaugh, 2004; Talmi, 2013) and emotional valence (Kensinger, 2004, 2009). This is manifest in voluntary (Talarico, Labar, & Rubin, 2004) and involuntary autobiographical memories (Berntsen & Hall, 2004; Berntsen & Rubin, 2008), with those with an emotional content being often more accessible than those deprived of it, a phenomenon known as intensity bias (McGaugh, 2004). Additionally, emotionally positive autobiographical memories are often more accessible when compared to negatively valenced autobiographical memories (Berntsen, 1998; Berntsen & Hall, 2004; Schlagman, Schulz, & Kvavilashvili, 2006; Walker, Skowronski, & Thompson, 2003), a phenomenon termed positivity bias. These findings, overall, seem to further illustrate the similarities between voluntary and involuntary autobiographical memories and go against Brewin, Dalgleish, and Joseph's (1996) and Brewin's (2014) claims that involuntary episodic memories may derive from a memory system different from that underlying voluntary episodic memories, as it is devoted to information not verbally accessible.

The above mentioned parallelisms between voluntary and involuntary past MTT have been proposed to extend to future MTT. Studies have demonstrated that voluntary and involuntary future MTT events are both frequently elicited, and exhibit

intensity and positivity biases (D'Argembeau & Van der Linden, 2006; Finnbogadottir & Berntsen, 2013) similar to those of past MTT events.

Exceptions to the positivity bias have been found for dysphoric individuals' voluntary autobiographical memories (Joormann & Siemer, 2004; Pyszczynski, Holt, & Greenberg, 1987; Walker, Skowronski, Gibbons, Vogl, & Thompson, 2003) and for depressed individuals' voluntary and involuntary autobiographical memories (Watson, Berntsen, Kuyken, & Watkins, 2012). These exceptions have been explained as the result of mood state dependence effects and/or a diminished fading affect bias, the latter responsible for a faster fading of the negative compared to the positive affect associated with an experience. The present study, given its methodology, allows for a further analysis of such biases in past and future, voluntary and involuntary MTT events, in individuals with or without dysphoria or depression.

3.3.3. The history of research on type of retrieval

As most research focused on past rather than future MTT, much of the current knowledge about type of retrieval derives from autobiographical memory studies. Only recently have researchers begun to investigate how type of retrieval impacts and is impacted by future MTT (Berntsen & Jacobsen, 2008; Finnbogadottir & Berntsen, 2011, 2013; Jeunehomme & D'Argembeau, 2016; Watson, Berntsen, Kuyken, & Watkins, 2013), which reiterates the appropriateness of the current thesis.

Ebbinghaus' (1885) original proposal for different types of memory retrieval claimed that there were three basic modes of remembering, voluntary, involuntary, and non-conscious. In this theorisation, voluntary memories appeared in consciousness by exertion of one's will, involuntary memories emerged spontaneously, and non-

conscious memories did not emerge at all. This implied a distinction between intentional and unintentional retrieval, and between conscious and non-conscious awareness, suggesting that involuntary memories are the product of mechanisms of association, unintentionally retrieved and consciously recollected.

At the time of Ebbinghaus' (1885) proposal, involuntary memories fit the dominant paradigm of cognition. However, with the cognitive revolution of the 1960s and its valuation of feedback models (Berntsen, 2009), involuntary memory research became neglected (Berntsen & Watson, 2014). This happened because feedback models argue that an organism controls its behaviour by comparing current and desired states with existing discrepancies, motivating actions that seek to set the organism closer to its desired goal state. As such, they imply a view of cognition as a deliberate and goal-oriented process, attributing little value to non-deliberate passive processes like involuntary retrieval, in detriment of voluntary memory retrieval (Berntsen, 2009).

With cognitive psychology's relative disregard for involuntary memories, two important factors helped sustain interest in non deliberate cognitive processes: First, in the 1960s interest began to develop concerning the phenomenon of daydreaming (Berntsen, 2009). Unlike mainstream cognitive psychology research at the time, this interest was strongly influenced by William James' (1892) view of consciousness as a stream, and led to attempts to study the flow of mental life in an everyday context, involuntary memories included; Secondly, clinical psychology also played an important role in sustaining involuntary memory research. Since intrusive trauma memories were observed to be characteristic of individuals who had experienced traumatic events, a greater interest materialised in research analysing their content,

phenomenology and frequency, having since been extrapolated from trauma situations to everyday life (Rubin, Boals, & Berntsen, 2008).

At present, both voluntary and involuntary MTT are the subject of considerable scientific interest. This, coupled with recent and widespread studies about the differences and similarities between past and future MTT, has helped generate interest in how these two dimensions (temporality and type of retrieval) influence one another.

3.3.4. Retrieval in past and future MTT – similarities and differences

A crucial premise to proposing similarities across past and future MTT for voluntary and involuntary retrieval is the idea that past experiences provide the building blocks (e.g., details about previously encountered contexts, persons, and objects) from which future MTT experiences are "built". This premise derives from previously described theoretical proposals emphasising the role of episodic and semantic memory systems in the construction of future MTT experiences (D'Argembeau, 2012), from Tulving's (2002, 2005) and Suddendorf and Corballis' (2007) valuation of the episodic memory system in past and future MTT, to Schacter and Addis' (2007) constructive episodic simulation hypothesis and Hassabis and Maguire's (2007) scene construction theorisations.

The discussion of types of retrieval and their associated stages and processes may seem better suited for past MTT, whereby previously lived events can be re-experienced, comparatively to future MTT, where the events created are yet to occur. However, two sets of findings evidence the involvement of retrieval processes in future MTT: (a) Anderson (2012) showed that 90% of the details reported in a future MTT experience are associated with at least one memory, with 52% of these details being

intentionally used by individuals to construct a future MTT experience (Anderson, 2012). Extended and categoric memories are among the memories used to construct future MTT events, the latter as frequently as (and sometimes even more frequently than) specific episodic memories themselves (Anderson, 2012); (b) not all future MTT events are novel events, being generated for the first time as the individual is pre-experiencing them. Instead, some constitute "memories of the future" (Ingvar, 1985; Szpunar, Addis, McLelland, & Schacter, 2013), which are previously generated, encoded, and subsequently rehearsed future MTT experiences that can then be retrieved and pre-experienced by individuals at any point in time. In everyday life, because individuals frequently and repeatedly project themselves into the future (D'Argembeau et al., 2011; Finnbogadottir & Berntsen, 2013), it is possible to have "memories of the future" consisting of yet to occur future MTT events that have, nonetheless, been previously and repeatedly pre-experienced. Research by Jeunehomme and D'Argembeau (2016) suggests that these "memories of the future" are a common phenomenon.

Hence, although the role of constructive and generative processes in novel future MTT events is evident and has been clearly emphasized in the relevant literature (D'Argembeau & Mathy, 2011; Schacter, Addis, & Buckner, 2008; Schacter et al., 2012), both original and non-original future MTT experiences involve important retrieval aspects, that can be of a voluntary or involuntary nature. Respecting the former, the selection of specific episodic details for the generation of future MTT events is believed not to be random, but instead guided by a more general knowledge structure (D'Argembeau & Mathy, 2011), as often occurs with past MTT, and as proposed in the SMS (Conway, 2005, 2009). This implies that higher-knowledge

structures, referring to one's future and including personal goals and possible selves, likely provide an essential contextual frame (D'Argembeau & Mathy, 2011) that links and organises future MTT events into broader themes and causal sequences (D'Argembeau, 2015; D'Argembeau & Demblon, 2012).

In what concerns involuntary future MTT, provided the events produced are not novel (i.e., "memories of the future"), it seems likely they will be impacted by the same factors that influence involuntary past MTT, namely cues and associative processes (see Subsection 3.3.6). As for novel future MTT events, it is possible they become associated with personal goals or concerns of such importance to the individual that the anticipation and plans related to these goals are formed rapidly and automatically (Klinger, 2013), thus leading to their involuntary emergence.

The next Subsections (3.3.5 and 3.3.6) outline further details of the processes and processing stages underlying voluntary and involuntary retrieval. Whilst these were originally devised to address memory representations and, subsequently, past MTT, their eligibility for future MTT should be considered.

3.3.5. Voluntary retrieval

Subsections 3.3.1 and 3.3.2 presented evidence that voluntary and involuntary MTT exhibit similar encoding and consolidation processes, suggesting that it is the retrieval stage that characterises and differentiates both these types of MTT. Hence, when studying the impact of type of retrieval (voluntary vs. involuntary) on the phenomenological characteristics of MTT events, it is fundamental to understand how voluntary and involuntary retrieval develop, what processes are involved, and how these processes may affect the phenomenological quality of the MTT events produced.

This knowledge, in turn, can then inform the hypotheses being tested here, and enable an adequate interpretation of the results obtained. Whereas this subsection provides a rationale and describes the processes involved in voluntary retrieval, Subsection 3.3.6 aims to present the current theoretical understanding of involuntary retrieval (3.3.6.1) and its associated processes (3.3.6.2). All of these subsections set the stage for Subsection 3.3.7, where direct comparisons between both types of retrieval are established concerning some of the phenomenological variables under study in this thesis.

In voluntary retrieval the emphasis is placed on individuals' active role in the strategic regulation of their MTT experiences, with retrieval being perceived as a goal-directed search process that functions as a form of problem-solving in which one attempts to reduce the discrepancies between the ideal target event and those available for retrieval. Several monitoring and control processes contribute to the different phases of voluntary retrieval, from the decision on whether to initiate a memory search, to what type of search and retrieval process will be used, where the information will be searched, when to terminate the search, and whether or not to report the information retrieved (Koriat et al., 2008). Thus, all of these different control processes can influence an individual's ability to retrieve past MTT events (Ghetti, Lyons, & DeMaster, 2012), as well as their associated quality.

Norman and Bobrow's (1979) iterative model of memory construction was one of the first models to explore the role of control processes in voluntary retrieval, and has since been adopted by the SMS model (Conway & Pleydell-Pearce, 2000), and improved by Burgess and Shallice (1996) and Koriat et al. (2008), with these authors presenting slightly modified versions. Despite some differences, the core structure of

the more recent iterative models is similar and, as their designation indicates, relies on multiple and repetitive cycles of a progressively narrowed search for the desired MTT experience, that depends on supervisory executive processes. The following subsection addresses, in detail, the schematic framework of voluntary retrieval proposed by Koriat et al. (2008), and complemented by the SMS's (Conway & Pleydell-Pearce, 2000) and Burgess and Shallice's (1996) views on the unfolding of voluntary retrieval.

3.3.5.1. Iterative search and retrieval in voluntary MTT into the past

Koriat et al. (2008) proposed an iterative schematic framework of search and retrieval processes that is open to the possibility of overlap between search and retrieval processes, a stance shared by the SMS's (Conway, 2005) and Burgess and Shallice's (1996) intellection of voluntary retrieval as an iterative multi-stage process. This framework adopts Tulving's (1983) concept of ecphory, whereby the encoding of information leads to the formation of a memory trace that consists of the encoded item and the cognitive context in which it was encoded. Under this framework, the ecphoric process is perceived to be automatic, but the rememberer has an active role in pre-retrieval processes that set the parameters that define the target of the search process and the number and nature of the operations required to successfully complete it (Koriat et al., 2008). Thus, the model resembles a features or components approach, like that of Burgess and Shallice (1996) and Conway and Pleydell-Pearce (2000) wherein the constructive nature of the multi-stage retrieval process is emphasised in detriment of a record-access approach, such as that of Norman and Bobrow (1979), wherein retrieval entails access to predefined and inflexible memory records.

Koriat et al.'s (2008) framework, shown in Figure 2 below, divides the retrieval processing stage into four different phases, namely controlled preretrieval, retrieval, controlled postretrieval and the report stage. These, together with the more automatic retrieval phase and the post retrieval processes that help evaluate the memories obtained, are considered to constitute the entirety of the search stage, completed only when a decision to report the achieved memory or to terminate all further efforts is reached. There are, thus, multiple layers of control involved in the retrieval process (Burgess & Shallice, 1996), some of which will now be described as they affect which MTT event is retrieved.

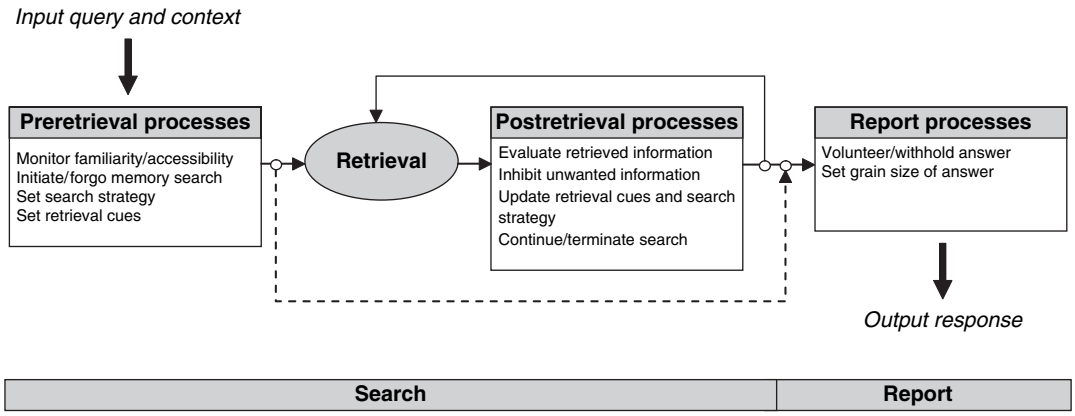


Figure 2. Schematic framework for memory and metamemory processes involved in retrieval. Adopted from Koriat et al. (2008)

3.3.5.1.1. The controlled prereetrieval phase

In the beginning of the controlled preretrieval phase, after exposure to a query, the individual sets in motion a preliminary monitoring stage to evaluate the accessibility of the intended memory and effort required to access it (Koriat et al., 2008). This monitoring equates to a feeling of knowing, that presumably relies on the overall familiarity of the query (Nhouyvanisvong & Reder, 1998) and its ability to

bring to mind fragmentary clues (Koriat, 1995), the failure of which may considerably reduce the chances of a memory search being initiated. In Burgess and Shallice's model (1996) this phase equates with the all-important access to an input template, an amalgam of representations of similar events that enables individuals to have a starting point from which to initiate a more deliberate search process.

If a search process is initiated, a decision needs to be made regarding which search strategy to adopt. Koriat et al. (2008) propose the existence of four general search strategies: (a) the generate and recognise model (Higham & Tam, 2006), which comprises two stages, the first consisting of general descriptors, generated to provide possible memory targets, and a second, during which the targets found are analysed in an attempt to recognise a memory that fits the search criteria; (b) source-constrained retrieval (Jacoby, Shimizu, Daniels, & Rhodes, 2005). Compared to the generate and recognise model this is a more precise search strategy, with a higher degree of retrieval constraints deriving from the use of target-source material, that lead it to function more as a direct-retrieval strategy (Higham & Tam, 2005); (c) reconstructive inferences. Unlike the two previous strategies this proposes the use of reconstructive search processes in detriment of a reproductive retrieval of stored information; (d) mediated retrieval (Reiser, Black, & Abelson, 1985; Williams & Hollan, 1981). In this search strategy individuals first seek to obtain contextual information that enables them to further generate cues that lead to a more direct retrieval.

The choice of a specific search strategy can be influenced by several factors, including the level of detail at encoding, the familiarity the query induces, and the encoding-retrieval match; moreover, the diversity of possible search strategies demonstrates how differently a retrieval process can unfold (Unsworth, Brewer, &

Spillers, 2014). Once a search strategy is implemented, further cues may be recruited as part of the reiterative process of pre-retrieval, some of which deriving from automatic activation processes. This means that the voluntary retrieval of MTT events is subject to possible involuntary contributions in the form of spontaneous ideas and associations (Koriat et al., 2008; Unsworth et al., 2014).

In the SMS model, the focus on the searching stage of retrieval is based on the contribution of personally meaningful and self-relevant themes (Conway, 1996). At any given time, there are active sets of goals and plans that reflect the current themes of the self, with the latter corresponding to discrepancies between the working self and desired/non-desired possible selves (Conway, 1996). The individual's network of active themes influences the encoding of specific events, leading to the creation of indices that form the structure of the autobiographical knowledge base. These indices are later targeted by search processes upon the retrieval of episodic information.

3.3.5.1.2. The retrieval, post-controlled retrieval, and report phases

The following stage of the retrieval process is titled retrieval and, according to Koriat et al. (2008), eludes the individual's control, being automatic. The individual's active influence, according to this model, can only be manifest in the controlled pre-retrieval phase or in the controlled post-retrieval phase. This latter phase consists of the processes occurring after the search strategy has led to the retrieval of an autobiographical memory as a candidate solution to the initial query. It is during this stage that Burgess and Shallice's (1996) editor and mediator mechanisms, responsible for editing and verifying whether the information obtained satisfies the premise of the search, act.

In the schematic framework of Koriat et al. (2008), the post-controlled retrieval phase can be subdivided into four different stages: (a) update and refinement of the search strategy and internal retrieval cues. This stage further reinforces the reiterative-cyclic nature of the search process because it concerns the refinement and reformulation of the search parameters in response to incoming information; (b) evaluation of the correctness of the retrieved representation. This stage involves post-retrieval monitoring processes, either information-based or experience-based (Koriat & Levi-Sadot, 1999), that are responsible for determining the course of the search process in that they evaluate the adequacy of the candidate representation; (c) inhibition of wrong and irrelevant information. Such controlled inhibition is crucial to prevent inadequate representations from systematically emerging and hindering the continuous search for valid information; (d) continuation or termination of the search processes. The search for an event can terminate with individuals reaching what they consider a satisfactory representation in answer to the query, or in response to their inability to find said representation. Several aspects contribute to this decision, among which the individuals' confidence in the result of their search, in their ability to answer the query, the amount of time and effort invested and incentives towards success (Koriat et al., 2008).

This controlled post-retrieval phase is also discussed in the SMS model (Conway & Pleydell-Pearce, 2000) but a greater emphasis is placed in the role of the individual's goals in the creation of a retrieval model against which retrieved representations are compared. This retrieval model is composed of goal-derived criteria, based on working self goals and general criteria, referring to what the individual accepts as a memory representation.

The final stage of voluntary retrieval, the report stage, refers to whether individuals opt to make their retrieval known to others, usually pending on the degree of confidence they have on the adequacy of the chosen representation to answer the query (Koriat et al., 2008).

Koriat et al's. (2008) schematic framework of voluntary retrieval asserts that a multiplicity of processes can influence the selection and retrieval of an event in detriment of its possible alternatives, and is thus useful to understand the relevance of the different stages involved in the voluntary retrieval of a past MTT experience, with its components arguably being applicable to the voluntary retrieval of future MTT events.

3.3.6. Involuntary retrieval

Throughout this document, the involuntary retrieval of MTT experiences is considered not as a sporadic occurrence or mere exception to the more standard voluntary retrieval mode, but as a basic mode of retrieval (Berntsen, 2010, 2012), that occurs frequently in everyday life (Brewin, Christodoulides, & Hutchinson, 1996; Finnbogadottir & Berntsen, 2013; Rasmussen & Berntsen, 2011; Rubin & Berntsen, 2009; see Kamiya, 2014; Verwoerd & Wessel, 2007, for aspects of individual variability), encompasses traumatic as well as non-traumatic events, (Berntsen & Hall, 2004) and serves multiple purposes (Berntsen, 2009; Kamiya, 2014; Pillemer & Kuwabara, 2012; Schlagman & Kvavilashvili, 2008).

3.3.6.1. Cognitive models of involuntary retrieval

Contemporary theories devoted to mental processes underlying spontaneous thought (Smallwood & Schooler, 2006) have proposed that two sources of stimulation, internal and external, compete for an individual's limited attentional capacity. Whereas internal sources amount to one's continuous and private stream of thought, often motivated by personal goals, external sources consist of sensory inputs and demands from the external environment (Johannessen & Berntsen, 2010).

Under standard conditions of information processing, external sources of stimulation will have supremacy over internal sources, with the latter gaining preponderance in situations of diffuse attention (Berntsen, 1998; Jacobsen & Berntsen, 2008; Johannessen & Berntsen, 2010; Heeren, Van Broeck, & Philippot, 2009; Schlagman, Kvavilashvili, & Schulz, 2006). Consequently, the frequency of involuntary MTT is often influenced by the demands of external inputs and their respective impact on one's attentional capacity, whereas involuntary MTT's content is often affected by an individual's internal inputs, namely current personal goals/concerns. These personal goals/concerns impact the self-relevance that representations have to one's identity and life story, and in doing so modulate the likelihood of their retrieval (Johannessen & Berntsen, 2009).

In the recent past several authors have addressed the involuntary retrieval of MTT experiences, but with limited success (Berntsen, 2009; Schlagman et al., 2009). Schank (1999) and Ehlers and Clark (2000) emphasised the importance of an encoding-retrieval match, with the former underscoring the importance of overlapping abstract cues, such as plans and goals, at both processing stages, and the latter asserting the relevance of perceptual-sensory cuing overlap for recurrent involuntary memories.

However, although both of these cognitive theories highlighted the relevance of an encoding-retrieval match to explain involuntary episodic retrieval, they also struggled to provide a rationale for why a particular episodic representation is chosen when several fit the encoding-retrieval match criterion, or for why individuals are not overwhelmed by continuous involuntary episodic representations (Berntsen, 2009).

The SMS model, which presents a detailed account of the processes underlying voluntary retrieval, was succinct in its analysis of involuntary retrieval (Conway & Pleydell-Pearce, 2000), essentially equating it with encoding specificity processes and proposing involuntary autobiographical memories are directly retrieved from a separate pool of very recent memories, yet to been consolidated (Conway, 2005; but see Schlagmann et al., 2009, and Schlagman & Kvavilahsvili, 2008, for contradictory results supporting access to a similar knowledge base). Given the model's premises (see Subsection 2.4.5.1), a possible explanation for the retrieval of a given autobiographical representation from a set of eligible encoding-specificity abiding episodes lies in the degree to which each eligible representation is congruent with working self-goals. Conway and Pleydell-Pearce (2000) state that both voluntary and involuntary recall are shaped by current goals of the self and, as such, the episodic representation to be involuntarily retrieved would be that which further potentiates self-coherence (Conway, 2005). By contrast, task/goal-irrelevant or task/goal-neutral activated representations are kept from consciousness by control processes that are responsible for controlling the accessibility of existing representations (Racsmany & Conway, 2006).

Despite these considerations, and similarly to the previously mentioned theories, Berntsen (2009) considers the SMS's theorisation of involuntary retrieval to

be insufficient, particularly the rationale proposed to explain why individuals are not continuously overwhelmed by involuntary MTT events. In attempting to provide answers to the questions on the involuntary retrieval of autobiographical memories, Berntsen (2009) developed a theoretical framework in which involuntary and voluntary MTT experiences are proposed to be a manifestation of the same episodic memory system, similarly impacted by encoding and consolidation processes (Berntsen, 2010; Clark, Mackay, & Holmes, 2013), but differing in terms of the respective retrieval mechanisms. It is hypothesised that voluntary retrieval comprises a top-down, schema-driven reiterative search and retrieval process, which is initiated and modelled by a search description/retrieval model/input template. This search description derives from a combination of an individual's autobiographical knowledge, self-schemas, life story, and task constraints. As for involuntary retrieval, it does not require an initial archetype representation nor a subsequent deliberate conscious search, being instead the result of a conjugation of processes that influence and are influenced by external and internal sources of stimulation (Berntsen, 2009).

3.3.6.2. Associative processes in involuntary retrieval

There are several elements to consider when discussing how associative processes work in involuntary retrieval, from the nature of the cues triggering these processes, to encoding and consolidation constraints in the access to MTT experiences, and the attentional and motivational biases characteristic of the retrieval processing stage. All of these factors play an important role in comprehending how involuntary MTT experiences are selected and in understanding why, despite the abundance of

possible cues in everyday life, individuals are not continuously flooded by involuntary MTT. These issues are now addressed.

3.3.6.2.1. The importance of cues to involuntary retrieval

The majority of involuntary autobiographical memories have "identifiable cues in terms of some fairly distinctive similarity between the memory and the situation in which it comes to mind" (Berntsen, 2009, p. 86). This fits the encoding specificity principle (Tulving & Thomson, 1973), according to which an episodic memory cue will only be effective if it was encoded with the information that is to be remembered; and with the results of Kvavilashvili and Mandler (2004), which demonstrated that a distinctive characteristic of involuntary semantic memories is their dependency on concrete cues that match particular parts of the memory content. Although this matching alone does not explain the emergence of certain past MTT events in detriment of others, cue characteristics are an important contributor to involuntary retrieval and, therefore should be accounted for. Nevertheless, before doing so, it is important to dispel the notion that involuntary retrieval derives, in its entirety, from bottom-up processes (Mace, 2010a). Top-down processes are also involved, though of a different nature from those acting in voluntary retrieval (Mace, 2010a)

Depending on their characteristics, cues can be classified as external, internal or mixed. Whereas external cues consist of specific features of the environment, often pertaining to categories of objects, activities, people, and themes, internal cues correspond to the features of thoughts and emotions generated by the organism – hence their internal aspect. Mixed cues, on the other hand, convey a collaboration between internal and external cues in triggering a MTT experience. Additionally, cues can also

be termed central or peripheral, the former assuming an important and central role in the event's unfolding.

In studies analysing cue-contribution to the generation of involuntary MTT experiences, external cues are more frequently experienced as triggers when compared to internal or mixed cues in past (Berntsen 1996; Berntsen & Hall, 2004; Schlagman, Kvavilashvili, & Schulz, 2006) and future (Berntsen & Jacobsen, 2008) MTT, and central cues' higher discriminability contributes to their predominance over peripheral cues as triggers of involuntary memory (Berntsen, 1998; Schlagman, Kvavilashvili, & Schulz, 2006).

The fact that involuntary memories are triggered by cues consisting of features of information to which individuals have been exposed in their lives, may not only allow these memories to imbue individuals with a sense of continuity across time, but also serve directive functions, by helping individuals take into consideration past reactions, while suggesting present and future actions.

3.3.6.2.2. The importance of attentional and motivational constraints in involuntary retrieval

Cues are important for enabling the involuntary retrieval of MTT experiences, but there are also attentional and motivational biases that, via associative processes, interact with cuing to help influence spontaneous retrieval processes (Berntsen, 2009).

As previously mentioned, the involuntary retrieval of MTT experiences, past and future, arises more frequently in situations of low attentional demands, when the individual is in a state of non-focused awareness (Berntsen, 1998; Berntsen & Jacobsen, 2008; Schlagmann, Kvavilashvili, & Schulz, 2006). This suggests the

involvement of the brain default network and the possibility that the mechanisms required for monitoring cognitive-demanding activities are involved in either generating or inhibiting involuntary episodic representations (Berntsen, 2009).

Once the individual is in a diffuse state of attention, features that are surprising and/or schema-deviant (Litman, 2005), together with those that possess personal relevance, will be more likely to mobilise the involuntary allocation of attention, leading to the activation of autobiographical memories. Berntsen (2009) proposes three concepts are relevant to understand the link between personal significance and cuing via association: current concerns, which are inner states of the organism that increase its sensitivity to concern-related cues (Klinger, Barta, & Maxeiner, 1980); unfinished personal businesses, that influence a person's life in the present moment (Klos & Singer, 1981); and stirring events, recent personal events that substantially impact one's life (Berntsen, 2009). The three concepts all constitute motivational factors that can bias associative mechanisms into making certain subclasses of MTT experiences, related to current goals or events, more accessible and easier to activate than others.

These motivational factors impact associative processes (Berntsen, 2009) and exist in two temporally distinct psychological levels: the individual's immediate situation, which provides the necessary cues for the involuntary retrieval of an event and can be related with associative mechanisms; and the individual's current life situation, a personal construct consisting of the individual's appraisal of recent past and close future which includes the aforementioned three motivational constructs.

An individual's life situation primes representations thematically associated with it by increasing the sensitivity to cues that relate to said life situation.

Consequently, if there is a cue or set of cues in the immediate situation that overlap with the representations that have been primed by the life situation, and if this overlap is strong enough to activate one of the primed representations (cue-item discriminability), an involuntary MTT experience is triggered. If there are no cues, then the priming, alone, of a set of thematically related episodic representations, will have to be sufficient to trigger an involuntary MTT experience.

Hence, the process of involuntary retrieval is not only constrained by encoding and consolidation factors (see Subsections 2.6.1 and 2.6.2) but also by an individual's immediate situation and more temporally extended life situation, their respective contributions varying in accordance with situational demands and individual characteristics (Kamiya, 2014). In periods characterised by a stable and fulfilling life situation, a higher cue-dependency and superior thematic diversity of involuntary episodes is to be expected, given the greater weight of the immediate situation. By contrast, in conditions of considerable concern and relevant goal-threatening/goal-achieving conditions, an increase in involuntary episodes thematically related to one another and to the current life situation is to be expected.

3.3.6.2.3. Cue-item discriminability

Having discussed the different factors contributing to the process of involuntary retrieval, it bears mentioning they are likewise involved, albeit under different circumstances, in an individual's ability to avoid a perpetual involuntary retrieval experience. To understand how this reprieve is possible, one must consider under which circumstances cue-item discriminability, which describes how well an item is isolated by a cue (Rubin, 1995), thrives, and those under which it fails

(Berntsen, 2009). Such knowledge is important when accounting for possible factors affecting the involuntary MTT events of Studies 1 and 2 of this thesis, and their ensuing differences with regard to voluntary MTT events:

- Cue underload and overload. Cue underload is characterised by a high level of cue-item discriminability, as it refers to a hypothetical situation whereby a given cue matches only one event, thereby increasing the odds of its recall; cue overload, on the other hand, is defined by lower levels of efficiency in recall as the result of one cue fitting multiple events. Hence, it is associated with low levels of cue-item discriminability (Watkins & Watkins, 1975);

- Multiple cues. When, in the present moment, multiple cues match those of a past event, this event becomes more likely to be retrieved, as the conglomerate of cues will imbue the event with a high level of cue-item discriminability. By comparison, all other conditions being the same, the fewer the number of cues the lower the level of cue-item discriminability;

- Distinctiveness. In this context distinctiveness is meant to refer to the "processing of difference in the context of similarity" (Hunt, 2006, p.12). In a situation of cue overload, the more distinct of the multiple events associated with a cue will be the one to possess higher cue-item discriminability, and subsequently will be likelier to be retrieved in detriment of the others. The opposite occurs for non-distinctive events;

- Rehearsal, emotion, and recency. In situations of cue overload, and besides the influence of distinctiveness, an event's odds of being retrieved can be impacted by its associated emotionality, temporal distribution, and amount of rehearsal.

The greater the amount of rehearsal the stronger the network of connections contributing to the activation of that event in present and future situations. Likewise, an event's closer temporal proximity to the present moment and stronger emotional content, manifest under the form of emotional arousal and/or valence, will also constitute conditions that favour higher cue-item discriminability;

- Motivational biases. The previously discussed interaction between associative mechanisms and motivational factors can prime for activation a set of thematically related events. A particular event may then be retrieved depending on its degree of overlap with a given cue, and on the pervasiveness of the motivational factors involved in the individual's functioning.

To conclude, involuntary retrieval can be characterised as a complex and dynamic interaction between different factors, each with its own idiosyncratic contributions that will vary across time, individuals, and situations, impacting the MTT events selected. The way it differs from voluntary retrieval is now addressed, as type of retrieval is a key dimension of analysis in this thesis's hypotheses.

3.3.7. Differences between voluntary and involuntary retrieval processes

The conceptual overlap of involuntary and voluntary MTT with involuntary and voluntary retrieval processes is couched in the premise that the differences exhibited by both types of MTT are predominantly caused by their retrieval type (Berntsen, 2009). Claims of retrieval-related differences are corroborated by neuroimaging (Hall et al., 2014) and behavioural studies (Berntsen & Jacobsen, 2008;

Watson et al., 2012), the latter similar to the current thesis, that have consistently found differences at the content and phenomenological levels between both types of retrieval.

The differences between voluntary and involuntary retrieval begin with access to the knowledge base (Berntsen, 2009). Although there are multiple models of autobiographical memory organisation, several agree in proposing the existence of different levels of abstraction that form a hierarchy of autobiographical knowledge couched in a dimension of spatiotemporal specificity (Bluck & Habermas, 2000; Conway, 2005; see Subsection 2.4.5). In voluntary retrieval, once the retrieval process is prompted by a verbal request or thought, it leads to a search process that uses the cue as a descriptor that often engages the knowledge base at the general events' level (Haque & Conway, 2001 – see Figure 1 in Subsection 2.4.5.1.3). This means that the process of voluntary retrieval is likely to begin by accessing information consistent with an individual's schematic models, given that general events are abstractions of multiple episodes that have undergone schematic influence.

By contrast, in involuntary retrieval, cues are "unselected situational features present either in the environment or in thoughts" (Berntsen, 2009, p.114), that help discriminate between events through a process of spreading activation. This process of spreading activation, according to Mace (2010b), occurs when certain representations become active and subsequently promote the activation of additional representations to which they are associated. These activations can happen with or without conscious awareness by the individual.

Paramount to this spreading activation are the aforementioned dimensions of cue-item discriminability, some of which are likely to privilege the recall of MTT experiences overlooked by a voluntary retrieval process. Whereas temporal

distribution, emotion, rehearsal and motivational factors are involved in both types of retrieval, thus privileging the recall of similar MTT events, dimensions such as cue underload, distinctiveness, and the existence of multiple cues, predominate in involuntary retrieval, allowing access to events often neglected in voluntary retrieval. The reason for this difference lies in the fact that the three latter dimensions favour the emergence, through involuntary retrieval, of unusual and non-schematic MTT experiences, with cue underload privileging infrequent events, distinctiveness promoting novel and/or distinctive events, and multiples cues benefitting less frequent combinations of cues (Berntsen, 2009). These factors promote item-specific processing, with a focus on an event's unique characteristics, on the detection of features that make it memorable in relation to other events (Hunt, 2006). By contrast, voluntary retrieval consists predominantly of a top-down process that often privileges representations schematic in nature and frequent in occurrence, favouring a relational processing whereby the connections and similarities between events are what makes them memorable (Hunt, 2006).

3.3.7.1. Differences in spatiotemporal specificity, distinctiveness and centrality to life story and identity

Whereas the previous subsection described how voluntary and involuntary retrieval mechanisms impose distinct constraints on the MTT experiences to be retrieved, this subsection explores how these constraints impact the phenomenological characteristics of the MTT events produced.

The privileging of unique and distinctive MTT experiences in involuntary retrieval is evidenced by their greater spatiotemporal specificity, be they past (Berntsen

& Hall, 2004; Johannessen & Berntsen, 2010) or future (Berntsen & Jacobsen, 2008) events. According to Berntsen (2009, 2012), it should also be manifest in involuntary MTT experiences being less central to an individual's life story and identity (Johannessen & Berntsen, 2010) than their voluntary counterparts, as the former would be more likely to bypass common search "scripts" and the influence of schematic processes. However, some studies (Berntsen & Jacobsen, 2008; Watson et al., 2012), despite evidencing similar trends, did not find statistically significant differences. This discrepancy will be further addressed in Chapter 6.

3.3.7.2. Differences in the emotional impact of voluntary and involuntary retrieval

In studies comparing involuntary and voluntary retrieval, the former often leads to greater physical and emotional impact (Berntsen & Hall, 2004; Watson et al., 2012). However, the existence of discrepant results (Berntsen & Jacobsen, 2008), prompted Hypothesis 3 in this thesis (see Chapter 6).

When addressing the differential emotional and physical impact of voluntary and involuntary retrieval on MTT, Berntsen (2009) suggested that they are the result of different retrieval mechanisms, pointing to theories of multiple levels of emotion activation and emotional regulation as possible explanatory frameworks.

There are several theories of multiple levels of emotion activation, including the Schematic, Propositional, Analogical, Associative and Representational Systems theory (SPAARS; Power & Dalgleish, 2008). This proposes the existence of two routes for emotion generation: a direct pathway, involuntary, modular, and not susceptible to conscious control, that generates automatic emotional responses to stimuli as a

function of their previous association in the past; and an appraisal based pathway, that takes into consideration conscious aspects regarding the personal significance and context of a stimuli's presentation, and thus evidences less automaticity. Berntsen (2009) proposed that since involuntary retrieval is characterised by an associative and noncontrolled nature it may, compared to voluntary retrieval, resort more frequently to the associative pathway of emotion generation, thereby leading to greater emotional impact. However, this hypothesis does not completely explain the superior levels of emotional reaction in involuntary retrieval, because of the SPAARS' model assumption that for a given emotion to be elicited associatively, it needs to have occurred when the event first took place, thereby leading to an event-emotion association becoming established. As such, the model cannot fully account for the situations whereby a past MTT episode associatively triggers a new emotion.

Another possible explanation for the differences in emotional and physical impact generated by involuntary and voluntary retrieval mechanisms relates to the possible deficits in emotional regulation preceding involuntary compared to voluntary retrieval (Berntsen, 2009). Emotion regulation (see Subsection 4.4.1) consists in the conscious and nonconscious use of strategies that enable individuals to modulate the components of an emotional response, leading to its maintenance, increase, or decrease (Gross & Thompson, 2007). Among these strategies is response-focused emotion regulation, applied when the emotional response has already been activated and the individual seeks to limit its impact; and antecedent-focused emotion regulation, employed before an emotional response becomes fully activated, again with the purpose of diminishing its impact. Berntsen (2009) proposed that the spontaneous and involuntary character of involuntary retrieval limits the efficiency of the latter form of

regulation, not providing the individual with sufficient time to re-assess the potential emotional situation and attenuate its emotional and physical impact.

Overall, more data needs to be collected in order to better understand how the different phenomenological aspects of a MTT experience are impacted by different types of retrieval. This thesis aims to contribute to this goal.

3.4. The Function(s) of MTT

Having described the characteristics of past and future, voluntary and involuntary MTT, it is necessary to address their underlying functions, as these can provide valuable information when interpreting the results of the present thesis. Three separate purposes have been attributed to autobiographical memories and, consequently, past MTT: a directive function, by means of which the retrieval of past MTT events helps guide an individual's future behaviour; a social function, whereby such retrieval helps enhance social cohesion among individuals; and a self function, referring to the past MTT's contribution to a sense of self-continuity and coherence (Bluck et al., 2005; Conway, 2005). Though most research has focused on voluntary past MTT, involuntary past MTT events are also believed to serve these same three functions (Bluck, Alea, & Demiray, 2010; Mace, 2010a; Rasmussen & Berntsen, 2009a; Rasmussen & Berntsen, 2009b).

Furthermore, according to Suddendorf and Corballis (1997), the overall value of past MTT also lies in its applicability to future MTT. In light of the proposed connection(s) between past and future MTT, one of the functions of past MTT is to serve as a basis for future MTT, as elements of past experience are recombined to

enable simulations of novel future events. This has been considered to be an evolutionarily adaptive process (Addis et al., 2007; Markowitsch & Staniloiu, 2011; Schacter & Addis, 2007; Schacter et al., 2012; Suddendorf & Corballis, 2007, 2008). Suddendorf and Corballis (1997, 2007) further claim that future MTT is a much improved faculty when compared to evolutionarily earlier anticipatory behaviours like instincts, as its flexibility allows individuals to generate and combine multiple possible scenarios. Consequently, future MTT is particularly relevant when planning for and evaluating future situations (Barsics et al., 2016; Hassabis & Maguire, 2007), having been associated with the optimisation of goal-directed cognition and behaviour (Cole & Berntsen, 2016).

Given their functions and characteristics, both past and future, voluntary and involuntary MTT events can have an impact not only on biological survival, but also on an individual's well-being and mental health (Lee et al., 2015; Miloyan, Bulley & Suddendorf, 2016). MTT's directive, self, and social functions have all been shown to be impacted by depression (Grace, Dewhurst, & Anderson, 2015), and the process of MTT to play a key role in several of the cognitive and emotional processes contributing to depression (see Chapter 5 for details). Accordingly, MTT is considered highly relevant for a better understanding of mood disorders such as anxiety and depression (Miloyan, Pachana, & Suddendorf, 2014), and researchers have begun to explore its possible therapeutic applications (Dalgleish & Werner-Seidler, 2014; Holmes, Lang, & Shah, 2009; Lang, Blackwell, Harmer, Davison, & Holmes, 2012; Morina et al., 2011; Neshat-Doost et al., 2012).

CHAPTER FOUR – DEPRESSION

This chapter will present an overview of depression. Most of the knowledge on MTT derives from studies assessing the general university student population, the exception being neuropsychological lesion studies. Consequently, one of the main objectives of this thesis is to contribute to knowledge on MTT by exploring the MTT processes underlying dysphoria, depression, and their respective control conditions.

The following sections provide a brief summary of the evolution of the concept of depression, followed by a description of its prevalence, course and outcome. These subsections aim to provide a clear picture of how disabling depressive disorders are, both in the milder form of dysphoria and clinically diagnosed depression, thereby highlighting the need for research that will eventually help to improve therapeutic outcomes. Afterwards, vulnerability to depression will be discussed, including the role of MTT. This serves to demonstrate the emotional and cognitive mechanisms underpinning depressive disorders.

4.1. The Evolution of Classification Systems of Depression

In the past, the term depression has been used to reference a mood state, a syndrome and a nosological disorder (Kendall, Hollon, Beck, Hammen, & Ingram, 1987; Kendell, 1976). This heterogeneity has helped ascribe additional layers of complexity to the phenomenon of depression, further complicating its understanding and treatment (Kendall et al., 1987; Kendell, 1976). A compromise within the scientific community has since been reached, with depression being conceptualised as

one of multiple categories of psychological disorders (Ingram, Atchley, & Segal, 2011), with its symptoms clustered into subtypes (Kendell, 1976).

This categorical conceptualisation of depression has, since the 1940s, led to the creation of several categorical classification systems (Kendell, 1976). While these systems enable a better communication between health professionals and the general public by clustering several symptoms and their possible meanings into a single category, they also have limitations (Ingram et al., 2011). Their exclusive reliance on diagnostic categories implies a risk of neglecting certain psychological phenomena (Persons, 1986). Additionally, there is an implicit assumption that individuals with the same diagnosis are similar, if not identical, which under-represents situations wherein two patients with the same diagnosis of depression may only share few symptoms and have very different subjective experiences of symptomatology (Fried & Nesse, 2015; Ingram et al., 2011). Finally, these classification systems establish a qualitative distinction between individuals who meet the diagnostic criteria and those who do not (Flett, Vredenburg, & Krames, 1997), despite evidence suggesting that less severe clinical diagnoses such as dysthymia can be more impairing than more severe diagnoses such as Major Depressive Disorder (MDD) (Widiger & Samuel, 2005).

Hence, there is a clear risk that categorical classification systems may fail to consider the etiological history and psychopathological profile of each individual, hence ignoring the sensitive intra-individual variability that lies between discrete categories (Andreasen, 1997). As a response to these flaws, some have argued for a dimensional (Karsten, Hartman, Ormel, Nolen, & Penninx, 2010; Rodriguez, Nuevo, Chatterji, & Ayuso-Mateos, 2012; Widiger & Clark, 2000; Widiger & Samuel, 2005) or a mixed approach to depression (Flett et al., 1997; Kessler, 2002; Kessler & Wang,

2010; Klein, 2008; Solomon, Haaga, & Arnow, 2001). Whereas a dimensional approach centres on a quantitative distinction that places clinical depression at the extreme end of a continuum containing normal sadness, subthreshold conditions and mild depression (Solomon et al., 2001), a mixed approach favours a coexistence between continuity and categorical elements for different aspects/intensity levels of depression (Flett et al., 1997; Kessler, 2002). Both approaches have been supported by studies favouring phenomenological, etiological and typological perspectives on depression, and have been shown to better explain subthreshold conditions, which validates their importance and contribution to more adequate and individual-specific interventions (Klein, 2008).

To conclude, exclusively categorical classification systems of depression are not suited to the diagnosis and understanding of depression. This is manifest in the evolution of relevant classification systems such as *The Diagnostic and Statistic Manual of Mental Disorders* (5th ed.; DSM-5; American Psychiatric Association, 2013) towards more dimensional conceptualisations, and in their proposed subtypes of depression. Until recently, the term subthreshold was used to describe individuals experiencing depressive symptoms in insufficient number or duration to warrant a diagnosis of MDD (Sadek & Bona, 2000). This has since changed. Due to findings of a significant impairment of individuals in these subthreshold conditions (Judd, Akiskal, & Paulus, 1997; Karsten et al., 2010; Rodriguez et al., 2012), DSM criteria have been restructured to account for the importance of subsyndromal diagnoses and dimensional aspects of depression, as evidenced by the inclusion of the depressive subtypes Dysthimic Disorder and Recurrent Brief Depression in both the DSM-IV-TR (American Psychiatric Association, 2000) and DSM-5 (American Psychiatric

Association, 2013). Currently, depressive disorders are considered to comprise a heterogeneous group of illnesses that can be characterized according to differing degrees of affective lability and associated cognitive, neurovegetative, and psychomotor alterations (Friedman & Anderson, 2014).

Throughout this thesis, the terms depression and depressive disorders are used interchangeably and within the DSM-IV-TR criteria for *depressive disorders*. The term dysphoria, as often occurs, is used in reference to a "form of subclinical depression defined by specific cut-off scores on measures assessing self-reported depressive symptomatology" (Joormann & Gotlib, 2010, p. 289).

4.2. Prevalence and Disability of Depression

Prevalence estimates are important in that they contribute to a better understanding of depression, more specifically of its trends within and between different sociodemographic groups (Bromet et al., 2011). Studies have repeatedly shown women to be at greater risk of developing depression when compared to men (Bromet et al., 2011; Rai, Zitko, Jones, Lynch, & Araya, 2013; Van de Velde, Bracke, & Levecque, 2010), the same applying to separated/divorced compared to married individuals (Bromet et al., 2011; Rai et al., 2013). On the contrary, studies assessing lifetime and 12-month prevalence estimates of depression exhibit several discrepancies, attributed to conceptual, substantive and measurement factors (Bromet et al., 2011; Kessler, Avenevoli, & Merikangas, 2001). Irrespective of the exact figures, the rates concerning 12-month and lifetime prevalence of depression are concerning. According to Bromet et al. (2011), the average 12-month prevalence of

MDD across 18 countries was between 2,2% and 10,4% whereas its lifetime prevalence was between 6,5% and 21,1%. The sheer enormity of these rates is aggravated by the fact they do not account for above-mentioned forms of subsyndromal depression.

The importance of depression prevalence rates is exacerbated by the level of disability this emotional disorder causes. Depression is linked to functional impairment, decrease in quality of life, medical morbidity and mortality (Spijker et al., 2004; Ustun, Ayuso-Mateos, Chetterji, Mathers & Murray, 2004). According to data from the World Health Organization, in the early 2000s depression was estimated to be the fourth leading cause of disability in the world, accounting for 10.7% of total years lived with disability. A decade later, these estimates were revised and depression was found to be the third leading cause of disease burden, accounting for 12.1% of total years lived with disability and for 4.46% of total disability-adjusted life-years (Ferrari et al., 2013). Furthermore, the Global Alliance and Chronic Disease Report of 2004 confirmed the devastating nature of MDD, finding it to be associated with the highest level of disability-adjusted life years among all mental, neurological, and substance use disorders (Collins et al., 2011). More recently, depression was reported to be the second leading cause of disease burden, with MDD accounting for 8.2% of total years lived with disability and 2.5% of total disability-adjusted life-years and dysthymia accounting for 1.4% and 0.5% respectively (Ferrari et al., 2013).

Overall, since 1990, the global burden of depressive disorders is believed to have increased by 37.5% due to population growth and ageing (Ferrari et al., 2013) and in the year 2010, at any point in time, 298 million individuals were expected to

have suffered from MDD. These statistics underline the massive and negative impact that depression has on many persons' lives.

4.3. The Outcome of Depression

Recent figures respecting recovery rates in depression are not encouraging (Boland & Keller, 2010). In the Collaborative Depression Study (Keller, Shapiro, Lavori, & Wolfe, 1982), although 70% of patients with MDD recovered from their initial episode within one year of diagnosis and treatment, a worrisome 20% still suffered from MDD after two years. Furthermore, within a five-year window of the initial episode 12% of the patients remained depressed, a percentage that decreased and stabilised at 6% within a 15-year timeframe (Keller & Boland, 1998).

Even when recovery is achieved there is always a risk of relapse. Studies of relapse rates are not consensual, with some reporting one-year follow-up relapse rates of 22% and others 30% (Boland & Keller, 2010). Additionally, Limosin et al. (2004) found a positive relationship between relapse rates and recurrence of depression, and Keller and Bolland (1998) have suggested depressed individuals experience a lifetime elevated risk for recurrence. This was corroborated by the Collaborative Depression Study, whereby two years after the index episode had occurred the recurrence rate was between 25% and 40% (Boland & Keller, 2010), whereas after ten years it had increased to 75%, and after 15 years to 87%. Furthermore, the increase in recurrence rates was positively correlated with the number of depressive episodes experienced after the index episode, with a higher number of depressive episodes leading to higher rates of recurrence and shorter time periods between depressive episodes (Keller &

Boland, 1998). This is consistent with the kindling hypothesis which suggests that after each episode individuals become more vulnerable to relapse or recurrence because successive depressive episodes can be triggered by progressively milder stressors (Monroe & Harkness, 2005). Furthermore, whereas earlier episodes of depression seem more susceptible to environmental triggers, subsequent episodes are often the result of internal cues (Boland & Keller, 2010; Lewinsohn, Allen, Seeley, & Gotlib, 1999; Maciejewski, Prigerson, & Mazure, 2001; Stroud, Davila, Hammen, & Vrshek-Schallhorn, 2011; Stroud, Davila, & Moyer, 2008).

A depressive process is dynamic and idiosyncratic, being shaped by multiple factors. Besides the aforementioned gender and marital status impact, dimensions such as age of onset, symptomatology, and comorbidity also impact its course (Boland & Keller, 2010; Gaynes et al., 1999; Moos & Cronkite, 1999). It is generally believed that a younger onset age is associated with a poorer outcome, longer duration of episodes and lower likelihood of remission (Boland & Keller, 2010; Zisook et al., 2007; but see Wilson, Hicks, Foster, McGue, & Iacono, 2014, for an alternative explanation). Additionally, certain symptoms, in particular comorbidity, have been associated with a greater difficulty in recovering from depression (Angold, Costello, & Erkanli, 1999; Gaynes et al., 1999; Moos & Cronkite, 1999).

4.4. Vulnerability to Depression

There are multiple factors of vulnerability to depression that are relevant to its onset, course, and phenomenology (Ingram et al., 2011). However, because describing them all is beyond the purpose of the current thesis, in this section only those factors

known to impact depression and MTT alike are addressed. Even though they are described individually, these factors do not exist in isolation, as they frequently interact (Ingram et al., 2011).

4.4.1. Emotion regulation processes

Emotion regulation consists of a set of heterogeneous processes that shape what emotions an individual has, when they occur, and how they are expressed (Gross, 2014). These processes can be automatic or controlled (Beer & Lombardo, 2007), conscious (Zelazo & Cunningham, 2007) or unconscious (Bargh & Williams 2007) and intrinsic or extrinsic (Gross, 2014), with MTT often counted among them (Hetherington & Moulds, 2015; Vella & Moulds, 2014). Amid the primary targets of emotion regulation are attention processes, cognitive-emotional relevant knowledge, and bodily manifestations of emotion, with the psychological functions of such regulation commonly varying between the satisfaction of short-term hedonic needs, the support of goal attainment, and the coherence of the individuals' personality system (Koole, 2009).

Emotion dysregulation is considered to be a central feature of depression (Joormann & Gotlib, 2010; Gross & Munoz, 1995; Sheppes, Suri, & Gross, 2015; Strauman 2002). Depressed individuals' emotional dysregulation often consists of an increase in frequency, intensity and duration of negative emotions, as well as a decrease in positive emotions (Gross & Munoz, 1995). These outcomes are often the result of an inadequate use of emotion regulation strategies, namely an excessive resource to emotion suppression and/or rumination (Chambers, Gullone & Allen, 2009; see Joormann & Siemer, 2014 for a review), coupled with an insufficient use of

reappraisal (Chambers et al., 2009). While the former can lead to an increased focus on negative mood and self-image, reappraisal is often conducive to the development of positive emotions (Chambers et al., 2009; Gross, 2014). Furthermore, recent research has shown that maladaptive emotional regulation is also related to the direction of emotion regulation, with depressed individuals exhibiting a "preference" for unpleasant emotions, possibly due to self-verification motives (Millgram, Joormann, Huppert & Tamir, 2015) or a reticence to approach positive emotions (Vanderlind, Stanton, Weinbrecht, Velkoff & Joormann, 2016).

Finally, depressed individuals also exhibit deficits in cognitive control that contribute to their inability to effectively regulate their mood (Joormann & Siemer, 2014). The experience of a given mood is generally associated with mood-congruent activations in working memory (Siemer, 2005), meaning that control of working memory content may prove fundamental to emotional and mood regulation (Joormann & Siemer, 2014). In this sense, depressed individuals are believed to possess deficits in their processes of cognitive inhibition, which may lead to greater difficulties in discarding mood-congruent content from working memory (Joormann & Gotlib, 2008), favouring rumination processes and hampering reappraisal and distraction processes that are essential for adequate mood and emotional regulation (Joormann & Gotlib, 2010; Joormann & Siemer, 2014). These deficits are part of a set of cognitive dysfunctions that influence emotional regulation in depression (Joormann & Gotlib, 2010).

4.4.2. Cognitive dysfunction

Cognitive dysfunction refers to cognitive deficits and biases that play an important role in the onset and maintenance of depressive disorders (see reviews in Everaert, Koster, & Derakshan, 2012, Gotlib & Joormann, 2010, Trivedi & Greer, 2014, Snyder, 2013). It serves as a mediator of adverse psychosocial outcomes in individuals suffering from MDD (Buist-Bouwman et al., 2008; see McIntyre et al., 2013, for a review).

Multiple studies (Everaert et al., 2012; Hallion & Ruscio, 2011; Ingram et al., 2011; Mathews & MacLeod, 2005) and cognitive models of depression (Beck & Haigh, 2014; Clark, Beck, & Alford, 1999; Joormann, Yoon, & Zetsche, 2007) affirm the relevance of negative biases in attention, interpretation and memory, to depression. Regarding attention, research demonstrates that depressed individuals exhibit difficulties disengaging from negative information, which possibly reflects the existence of inhibitory control deficits in depression that lead to prolonged processing of negative and goal-irrelevant aspects of information, and thereby help maintain negative affect (De Raedt & Koster, 2010; see Joormann & Gotlib, 2010, for a review). Additionally, depressed individuals tend to interpret ambiguous information negatively (Rude, Wenzlaff, Gibbs, Vane, & Whitney, 2002; Wisco & Nolen-Hoeksema, 2010a; but see Joormann & Gotlib, 2010) and exhibit strong memory biases (Williams et al., 2007), the latter manifest in the privileged recall of negatively valenced and overgeneral autobiographical episodes, which will be discussed in further depth in the next chapter.

The negative impact of the aforementioned cognitive biases is exacerbated by their frequent interaction (Everaert et al., 2012; Everaert, Tierens, Uzieblo, & Koster,

2013), known as the *combined cognitive bias hypothesis* (Hirsch, Clark, & Mathews, 2006). This is manifest by an individual's biased attention to negative stimuli increasing the likelihood of an event being interpreted negatively, which in turn increases the odds of it being recalled negatively and contributing to strengthen dysfunctional schemas (Everaert et al., 2013).

In synthesis, there is clear evidence that cognitive dysfunction fosters emotional dysregulation and promotes negative affect. This thesis aims to provide further insight into some of the cognitive processes contributing to the maintenance of depression by studying MTT and its relevant dimensions, through the comparison of its past, future, voluntary and involuntary manifestations in both dysphoric and depressed individuals. The next chapter will discuss the relationship between MTT and depression in further detail.

CHAPTER FIVE – DEPRESSION AND MENTAL TIME TRAVEL

The current state of research on MTT evidences a predominance of studies analysing past and/or voluntary MTT. Few studies have examined involuntary and/or future-oriented MTT, and even fewer have examined these MTT experiences in dysphoric and depressed individuals. In this chapter, a set of key characteristics of MTT, to be tested in the hypotheses, are discussed within the context of these populations. Variables such as spatiotemporal specificity, valence, and visual perspective are discussed, together with their relevant theory and connection to the participant groups.

5.1. Level of Specificity in MTT

This variable refers to the different levels of spatiotemporal specificity associated with re-experiencing and pre-experiencing MTT events. As mentioned in Subsection 2.4.5.1.2, a specific event is spatiotemporally contextualised, lasting less than a day, whereas general events last more than one day. General events can be extended events, that have a definite beginning and end, or categoric events, consisting of repeated occurrences (Goddard et al., 1996).

There is robust evidence in the literature on depression and cognition suggesting that depressed individuals, when compared to non-depressed/never-depressed controls, voluntarily recall more general autobiographical memories (Sumner, Griffith, & Mineka, 2010) and less specific autobiographical memories (see

van Vreeswijk & de Wilde, 2004, for a meta-analysis and Williams et al., 2007, for a review). Thus, they exhibit what is considered to be an overgeneral retrieval style, which implies the retrieval of fewer specific memories and/or more categoric and extended (general) memories (see Sumner et al., 2010, for a meta-analysis). This retrieval style negatively influences the course of depression (Brittlebank, Scott, Williams, & Ferrier, 1993; Kleim & Ehlers, 2008; Hermans et al., 2008; Raes, Hermans, Williams, Beyers et al., 2006; Sumner et al., 2010) and has been shown to persist after remission (Mackinger, Pachinger, Leibetseder, & Fartacek, 2000; Spinhoven et al., 2006), thus constituting a trait vulnerability marker (Smets, Wessel, & Raes, 2014). Additionally, the literature indicates a greater risk of developing an overgeneral retrieval style as a consequence of exposure to traumatic events, as these entail considerable cognitive/emotional impact and, as such, require a strong mobilisation of cognitive resources (Dalgleish, 2004; Williams et al., 2007).

There are several reasons why an overgeneral retrieval style is associated with a worse prognosis in depression (Raes, Williams, & Hermans, 2009). First, findings demonstrate that an overgeneral retrieval style, in both clinical (Goddard et al., 1996; Raes et al., 2005) and dysphoric populations (Goddart, Dritschel, & Burton, 1997), impairs efficient social problem solving strategies, as the fact that individuals are unable to access specific episodes of their past prevents them from using those episodes as possible solutions to present or future interpersonal problems (Arie, Apter, Orbach, Yefet, & Zalsman, 2008; Raes et al., 2005; Sutherland & Bryant, 2008; but see Dennis, Astell, & Dritschel, 2012 for a more restrictive interpretation). Also, in depressed individuals, the inability to solve social problems may help maintain

depressive symptoms by leading to more negative social encounters and less positive social reinforcement (Maccallum & Bryant, 2011; Raes et al., 2009).

Secondly, despite the lack of research, studies have suggested that an overgeneral retrieval style is likely to manifest itself not only with regard to the past, but also respecting the future, in both dysphoric (Dickson & Bates, 2006) and depressed individuals (Williams et al., 1996). This raises the hypothesis that both dysphoric and depressed individuals produce fewer past and future spatiotemporally specific MTT events when compared, respectively, to normal mood and never-depressed individuals. As a consequence, this lack of retrieval specificity may contribute to a persistence of feelings of hopelessness (Raes et al., 2009), as dysphoric and depressed individuals struggle to access specific episodes that can provide them with hope.

Thirdly, by means of overgeneral retrieval, dysphoric and depressed individuals are impaired in their exposure to past and future specific negative MTT events. According to Littrell (1998), re-experiencing an event in its full detail is a necessary condition for the individual to fully and adequately process it. However, if dysphoric and depressed individuals avoid specific events and/or are restricted to overgeneral and less detailed summaries, they will not re- or pre-experience these events in sufficient detail, hence being unable to adequately process them. As such, they remain at risk of developing or maintaining depression (Golden, Dalgleish, & Mackintosh, 2007).

A fourth and final way by which overgeneral retrieval can lead to a worse prognosis of depression relates to its reciprocal interplay with depressive rumination,

that exacerbates depressed feelings (Raes, Hermans, Williams, Beyers et al., 2006; Ramponi, Barnard, & Nimmo-Smith, 2004; Williams et al., 2007).

Overgeneral retrieval is thus a characteristic of depression (Williams, 2004), contributing to its prognosis (Brittlebank et al., 1993; Hermans et al., 2008; Sumner, Mineka, & McAdams, 2013; but see Spinhoven et al., 2006). Although questions have been raised about whether this overgeneral retrieval style might be due to the effects of depression on executive resources (Dalgleish et al. 2007; Smets et al., 2014), or to biases in testing procedures that favour schematic recall (Sumner et al., 2013), recent research seems to support the existence of reduced episodic details irrespective of executive functioning limitations (Söderlund et al., 2014). Being so, in the following subsection, the CaR-FA-X model is described, as it possesses a strong theoretical and empirical basis from which to analyse differing levels of specificity in dysphoric and depressed individuals.

5.1.1. Specificity in voluntary retrieval – the CaR-FA-X model

Initially, as described by Williams et al. (2007), the process of overgeneral retrieval was explained by the descriptions theory (Burgess & Shallice, 1996, see Subsection 3.3.5 for more details), whereby descriptions of the information sought were devised and used in an attempt to retrieve information. However, the field of memory research has shifted into more constructive and less static accounts of memory retrieval, wherein the influence of personal goals and motivational aspects is valued (Williams et al., 2007). Being so, the SMS model (see Subsection 2.4.5.1 for further details), which views MTT events as transitory and dynamic mental representations,

and emphasises the importance of current goals for the retrieval process, has served as a scaffold to the development of the CaR-FA-X model (Williams et al., 2007).

The CaR-FA-X model suggests that three mechanisms are responsible for an overgeneral retrieval style: Capture and Rumination (CaR), Functional Avoidance (FA), and impaired Executive Control (X). In depressed and dysphoric individuals an association between negative affect and specific MTT events may become established for a variety of reasons including, for instance, previous exposure to trauma (Williams et al., 2007) and biases towards negative information (Everaert et al., 2012). Functional avoidance refers to the process whereby the potential emotional impact of this association is bypassed, in this case through the retrieval of more general events (Sumner, 2012). By avoiding specific episodic elements, the individual's search processes become truncated and, consequently, mostly limited to the more general aspects of the autobiographical knowledge base, that will then be manifest through an overgeneral retrieval style (Hermans, Defranc, Raes, Williams, & Eelen, 2005; Raes, Hermans, Williams, & Eelen, 2006; Williams et al., 2007).

The relevance of rumination as a core feature of depression and its possible influence in the retrieval of past MTT events has also generated considerable interest. According to the SMS model, intermediate forms of autobiographical knowledge, such as categoric or extended events, that comprise concept-based self-representations, are the preferred form of access to the autobiographical knowledge system (Conway & Pleydell-Pearce, 2000). This means that self-relevant information will dominate the early stages of the memory search process, which in turn implies that individuals with highly activated and/or elaborated networks of emotion-related self-representations,

together with those prone to rumination, will struggle to get past these general levels and into more specific representations (Williams et al., 2007).

Depressed individuals' highly active emotion-related conceptual self-representations often form negative self-schemas, characterised by their pervasive influence in information processing (Clark et al., 1999). Consequently, when presented with emotional cue words, such negative schemas might become preferentially activated, with the individuals' memory search processes being "captured" by a network of overgeneral representations that impairs the natural progression into more specific episodic events. This capture often becomes stronger over time as a consequence of a mnemonic interlock (Williams, 1996), the process whereby the early truncation of the search process at an intermediate description level is followed by additional failed attempts to retrieve specific events. These failures eventually lead to the formation of a dominant conceptual network of intermediate descriptions (Barnhofer, Jong-Meyer, Kleinpaß, & Nikesch, 2002), meaning that in depressed individuals the memory search for sensory-perceptual episodic elements is mostly unsuccessful. They then become locked in self-related conceptual knowledge that leads to a greater proportion of categoric MTT responses.

As for individuals prone to rumination, they have been shown to be particularly prone to capture errors, a finding corroborated by experimental evidence linking overgeneral memory and rumination (Watkins & Teasdale, 2001; Watkins, Teasdale, & Williams, 2000), with overgenerality being linked to the abstract–analytical style of thinking that is a characteristic of rumination (Watkins & Teasdale, 2004).

Finally, the last aspect of the model concerns executive resources (Williams et al., 2007). According to the SMS model, the different stages of voluntary retrieval

require access to the individual's limited executive resources (Conway & Pleydell-Pearce, 2000), which garners additional importance given depressed individuals' cognitive dysfunctions (Snyder, 2013; see Subsection 4.4.2 for further details). Voluntary retrieval requires, among other processes, setting up descriptors/retrieval models, comparing them to the information retrieved, and inhibiting irrelevant information. Although all of these stages are impacted by depressed individuals' cognitive deficits, inhibitory processes have been suggested to be most affected, considerably hampering the individual's ability to maintain an informational search process until specific events are reached (Snyder, 2013).

To conclude, the three aforestated processes all contribute to overgeneral retrieval, often interacting among themselves. Furthermore, these processes account for the overgenerality that dysphoric and depressed individuals exhibit in response to both positive and negative cues. Although this may seem counterintuitive, it becomes logical when considering that dysphoric and depressed individuals may interpret positive cues negatively, as reminders of past or present failures, which in turn will be conducive to further self-referent rumination (Treynor, Gonzalez, & Nolen-Hoeksema, 2003). Such self-referent rumination will further potentiate avoidance of specific representations, a process helped by the fact that existing cognitive control deficits limit dysphoric and depressed individuals' ability to inhibit their prepotent network of general representations.

5.1.2. Specificity in involuntary retrieval

While the CaR-FA-X model explains the higher levels of overgeneral voluntary retrieval exhibited by dysphoric and depressed individuals, the fact it is

restricted to voluntary retrieval processes and has little input on the mechanisms underlying involuntary retrieval processes, means that additional research is required to investigate the levels of specificity in dysphoric and depressed individuals' involuntary MTT (Williams et al., 2007).

As seen in Subsection 3.3.6, involuntary retrieval is characterised by a direct search process that, comparatively to the more generative search process described in the CaR-FA-X model, is able to bypass the need for conceptual intermediate descriptors (general events), thereby reducing the risk of the search processes becoming truncated. Whereas in dysphoric and depressed individuals the abstract nature of schema-based information will prompt voluntary retrieval to favour the recall of general events congruent with schematised knowledge, the involuntary retrieval process consists of unique associative links that become established between current and past/future situations, favouring greater specificity upon retrieval. By bypassing deliberate search processes, involuntary retrieval diminishes schematic influence via top-down searching procedures, further promoting specificity (Berntsen, 2012).

In the general university student population this has been supported by studies (Berntsen & Hall, 2004; Johannessen & Berntsen, 2010; Mace, Atkinson, Moeckel, & Torres, 2011; Schlagman & Kvavilashvili, 2008) demonstrating that involuntary retrieval generates more specific MTT events than voluntary retrieval. However, only recently have studies begun analysing whether this trend extends to depressed individuals, with Watson et al. (2013) finding involuntarily retrieved past events to be more specific than voluntarily retrieved ones.

Concerning between-group differences, few studies have directly compared the specificity of involuntary memories retrieved by dysphoric and normal mood

individuals (Kvavilashvili & Schlagman, 2011), and by depressed and never-depressed subjects (Watson et al., 2013). The results, despite showing a similar trend to that of voluntary memories, were not statistically significant. This absence of statistical significance is consistent with involuntary retrieval's proposed ability to bypass schematic constraints.

Concerning group differences in the specificity of past and future voluntary events, existing studies have obtained mixed results. Dickson and Bates (2006) found dysphoric individuals presented lower levels of specificity in both past and future voluntary events, while Anderson and Evans (2015) found no statistically significant differences between dysphoric and control participants' specificity in either type of voluntary MTT (Anderson & Evans, 2015).

The scarcity of studies directly comparing the specificity levels exhibited in voluntary and involuntary retrieval of past MTT in normal mood, dysphoric, never-depressed and depressed individuals is a problem that extends to future MTT. Williams et al. (1996) were crucial in demonstrating that the overgeneral voluntary retrieval style exhibited by depressed individuals is also manifest in voluntarily created future scenarios. Further studies have shown that although the voluntary (Berntsen & Jacobsen, 2008; Rasmussen & Berntsen, 2013) and involuntary (Anderson & Dewhurst, 2009; Berntsen & Jacobsen, 2008) future MTT experiences of university students were less specific than their memories, a trend of greater specificity for involuntary retrieval processes was upheld in future MTT (Berntsen & Jacobsen, 2008). No similar comparisons have, however, been conducted for dysphoric or depressed individuals' future MTT.

Due to the relevance that an overgeneral retrieval style can assume in dysphoric and depressed individuals, and the many questions still persisting regarding how normal mood and dysphoric mood, as well as never-depressed and depressed individuals differ in terms of the specificity levels they exhibit in response to voluntary and involuntary, past and future MTT, the present thesis directly compares these groups of individuals on the aforementioned variables. Moreover, the promising results of specificity training techniques in therapeutic contexts (Eigenhuis, Seldenrijk, van Schaik, Raes & van Oppen, 2015; Neshat-Doost et al., 2012; Raes et al., 2009; Zohreh, Neshat-Doost, Hossein, & Mohsen, 2012), as well as their possible therapeutic benefits to depressed individuals (Van Daele, Van den Bergh, Van Audenhove, Raes, & Hermans, 2013), warrant studies that can provide information on levels of specificity and their relation to temporality and type of retrieval in different groups.

5.2. Valence in MTT

Having discussed the relevance that different levels of specificity can have in the prognosis and treatment of depression, the focus is now placed on the valence individuals attribute to their MTT events. The positive or negative valence of a MTT experience can lead to different effects, thereby causing different responses. According to Rasmussen and Berntsen (2013), these differences have been the subject of intensive research (Baumeister, Bratslavsky, Finkenauer, & Vohs, 2001; Cacioppo & Gardner, 1999; Taylor, 1991; Vaish, Grossmann, & Woodward, 2008), with studies revealing that in the general population negative events evoke stronger cognitive, behavioural, physiological and social reactions when compared with neutral or positive events.

Valence can also be the source of multiple biases, which affect information processing in general, and MTT in particular.

5.2.1. Mood congruency effects

The mood congruency hypothesis states that positive mood facilitates the implicit and explicit encoding and retrieval of positive information, whereas negative mood aids the encoding and retrieval of negative information. Consequently, individuals who are often in a positive mood (Walker, Skowronski, & Thompson, 2003) are better able to process positive stimuli, while dysphoric and depressed individuals are more effective at processing negative stimuli (Joormann & Siemer, 2004; see Barry et al., 2004; Matt, Vazquez, & Campbell, 1992; and Gaddy & Ingram, 2014 for reviews). Exceptions include when, via a mood regulation process, individuals seek to down-regulate their negative mood by retrieving positive memories and thoughts as a counterbalancing measure (Joormann & Siemer, 2004). However, when compared to never-depressed individuals, dysphoric and previously/currently depressed individuals exhibit greater difficulties recovering from negative affect states via mood-incongruent (positively valenced) memories (Joormann & Siemer, 2004; Joormann, Siemer, & Gotlib, 2007; Werner-Seidler & Moulds, 2012a; Wisco & Nolen-Hoeksema, 2010b). This greater difficulty has been proposed to be a consequence of several factors: (a) lower phenomenological intensity of positive MTT events, which is manifest in their lower levels of vividness (Werner-Seidler & Moulds, 2012b), and lower emotional intensity (Werner-Seidler & Moulds, 2012a), rendering it difficult for positive events to confer emotional benefits; (b) mood discrepancy between past and present states, whereby the recall of past positive MTT experiences

may only serve to exacerbate the perceived discrepancies between a past positive and a currently negative mood, fostering rumination that will worsen the individual's mood (Joormann, Siemer, & Gotlib, 2007); (c) a hypothesised superior emotional engagement of dysphoric and depressed individuals, that precludes them from distancing themselves from their current mood experience (Greenberg & Meiran, 2014).

5.2.2. Positivity effect in the general and university student populations

The positivity effect refers not only to the predominance of positively valenced past MTT events whereby twice as many positive memories are recalled in comparison to their negative counterparts (see Walker, Skowronski, & Thompson, 2003, for a review), but also to a predominance of positively valenced future MTT events (Berntsen & Jacobsen, 2008; D'Argembeau, Lardi & Van der Linden, 2012; D'Argembeau & Van der Linden, 2006). This positivity derives from multiple factors that differentially impact past and future MTT events. Among these is the possibility that individuals in the general population actually experience more positive than negative events; the existence of several biases that favour the recollection of positive MTT experiences (Rasmussen & Berntsen, 2013); and a greater reliance of future MTT on schematic structures, themselves positively biased. These factors are discussed below.

5.2.2.1. Positivity effect in past voluntary MTT

Among the factors contributing to a greater positivity effect in past MTT experiences are a set of influential biases such as the fading affect bias, and self-

regulation, rehearsal, and imagery biases. The fading affect bias derives from the finding that the further away in time a representation is from the present moment, the lower the intensity of the affect it produces. Hence, when extraneous variables are controlled for, a past MTT event dating back 20 years will elicit less affect than one dating back 20 minutes, with the same applying to future MTT. Additionally, the fact that this time-induced decay in affect intensity is superior in negative events means the affect intensity of positive events will last longer and translate into a positivity effect (see Walker & Skowronski, 2009, for a review).

Another positivity bias consists of negative memories being perceived to be temporally distant as a result of a self-regulatory function that seeks to reduce the impact of negative events (Wilson et al., 2009). In addition, memories of positive events are subject to greater rehearsal than those of negative events (Bohn & Berntsen, 2007; Byrne, Hyman, & Scott, 2001; Walker et al., 2009; but see Rasmussen & Berntsen, 2009a for different results). Positive memories are also rated higher on measures related to imagery, sense of reliving, and vividness (see Bohn & Berntsen, 2007, and Rasmussen & Berntsen, 2009a, for reviews), favouring the retrieval of positive past experiences.

Besides these rehearsal and imagery biases, Berntsen and Rubin (2004) also affirmed that cultural life scripts, which refer to schematic representations of culturally expected transitional events in a normal life course, also play an important role in the positivity effect, as they are biased in favour of emotionally positive events (Bohn & Berntsen, 2010; Berntsen & Rubin, 2004; Rubin, Berntsen, & Hutson, 2009).

It has also been proposed that the differences between positive and negative memories reflect the different functionalities of these two types of memories, namely

the maintenance of a positive self-image versus the optimisation of personal survival via the greater accuracy of negative memories (Levine & Bluck, 2004; Taylor, 1991; Taylor & Brown, 1988), or the remembrance of culturally normative life events as opposed to those that violate expectations and may be associated with emotional distress (Berntsen, Rubin & Siegler, 2011). According to this view there is adaptive value in remembering negative events, as these may provide necessary information for problem solving and/or the prevention of future mistakes. By contrast, in privileging positive in detriment of negative memories, individuals may develop personal and social resources that not only optimise self-image, but also promote social relations (Fredrickson & Branigan, 2005; Ross & Wilson, 2002; Taylor & Brown, 1988). These findings are consistent with Rasmussen and Berntsen's (2009a) claims that negative memories are predominantly associated with directive functions, such as problem solving and behaviour guidance, while positive memories exhibit self-defining and social-bonding functions.

5.2.2.2. Positivity effect in future voluntary MTT

The positivity effect registered in individuals' past MTT is believed to be even more pronounced in their future MTT. Several factors may be contributing to this: (a) the existence of a stronger fading affect bias for future MTT than for past MTT (Szpunar, Addis, & Schacter, 2012), as a result of individuals' greater optimism towards the future (Gallo et al., 2011); (b) imagery (Blackwell et al., 2013; Rasmussen & Berntsen, 2013), and self-regulatory (Rasmussen & Berntsen, 2013) biases in future MTT, whereby the optimism of individuals towards the future is manifest in lesser details and vividness of negative future MTT events; (c) the fact that future MTT, by

requiring a greater constructive effort than past MTT, is more reliant on scripted knowledge and self-schemas (Berntsen & Bohn, 2010; Suddendorf & Corballis, 2007). Since the general population often exhibits positivity biases as a consequence of their schemas, greater reliance upon schematic processing will likely strengthen these biases.

Additionally, this difference in positivity can derive from differences in the functions being served by past and future MTT experiences. The latter, through their involvement in emotion and self-regulatory functions, help individuals perceive their lives as being on an upwards trajectory and selectively limit the phenomenological impact of future negative MTT events (Grysman et al., 2013; Wilson et al., 2009), encouraging individuals to take actions to pursue their goals and develop social relationships (Taylor & Brown, 1988). By contrast, past MTT experiences are often important to correct past mistakes, suggesting that a phenomenological emphasis is placed on past negative MTT events (Rasmussen & Berntsen, 2013).

5.2.2.3. Positivity effect in involuntary MTT

In the present thesis it is pertinent to investigate if the above mentioned positivity effects of past and future voluntary MTT also apply to involuntary MTT. When considering a possible parallelism between the valence of voluntary and involuntary events, it is of paramount importance to examine whether the same or different memory systems/processes are involved in both types of retrieval. Two different stances exist in the literature: one advocates that both voluntary and involuntary retrieval access the same episodic memory system (Berntsen, 2009, 2012), while another suggests voluntary and involuntary episodic memories operate via two

parallel memory systems, one for each type of retrieval (Brewin et al., 2010; Ehlers, Hackmann, & Michael, 2004). The former, given its theoretical stance, argues for similarities between voluntary and involuntary retrieval, hypothesising small or no differences in the valence of both types of retrieval (Ferree & Cahill, 2009; Hall & Berntsen, 2008; Rubin et al., 2008). The latter, being predominantly couched on clinical theories, has emerged from studies involving clinical populations, and suggests involuntary retrieval facilitates individuals' access to negative information, which is congruent with the premise of a special memory system (Berntsen, 2009).

Presently, it can be argued that most research findings support the single episodic memory system view, whereby involuntary retrieval does not imply a privileged access to negative information. Studies involving general and university student populations show positivity effects for both past (Brewin & Soni, 2011; Walker, Skowronski, & Thompson, 2003) and future (Anderson & Evans, 2015; Berntsen & Bohn, 2010; Berntsen & Jacobsen, 2008) involuntary MTT, with discrepant results regarding whether either type of retrieval yields greater positivity effects (Johannessen & Berntsen, 2010; Watson et al., 2012). This congruity of results strengthens the proposal of similarities between voluntary and involuntary types of retrieval, but whether or not this hypothesis holds true for dysphoric and depressed individuals remains to be clarified.

5.2.3. Absence of positivity effect in dysphoric and depressed individuals

In dysphoric and depressed individuals, the overrepresentation of positive past MTT events is reduced or absent (Joormann & Gotlib, 2010). As mentioned in Subsection 4.4.2, both dysphoria and depressive disorders, particularly MDD, are

associated with information processing biases that favour negative information and/or diminish the individual's access to, and valuation of, positive information. Such biases extend to MTT, as research demonstrates that dysphoric (Anderson & Evans, 2015; Joormann & Siemer, 2004; Pyszczynski et al., 1987; Walker, Skowronski, Gibbons, Vogl, & Thompson, 2003) and depressed (MacLeod & Byrne, 1996; MacLeod, Tata, Kentish, & Jacobsen, 1997; MacLeod & Salaminiou, 2001; MacLeod et al., 2005; Watson et al., 2012) individuals' past and future voluntary MTT experiences are more negatively valenced when compared, respectively, to those of non-depressed or never-depressed individuals.

These biases seem to occur irrespective of type of retrieval, as dysphoric (Kvavilashvili & Schlagman, 2011) and depressed individuals (Watson et al., 2012) both retrieve significantly more negative involuntary MTT experiences, the latter frequently experiencing intrusive negative autobiographical memories of a repetitive and often traumatic nature (Patel et al., 2007). No studies have directly compared the valence of involuntary future MTT events in individuals with and without dysphoria/depression, nor have they considered interactions between temporality and retrieval type (Anderson & Evans, 2015). These are gaps in the literature that this thesis aims to address. These empirical data also have the potential to help further develop therapeutic techniques that purposely target the valence of MTT experiences to improve depressive symptoms, helping dysphoric and depressed individuals to access (Dalgleish et al., 2013) and process positive MTT events in a more concrete way, and to increase their impact in mood regulation (Hetherington & Moulds, 2015; Werner-Seidler & Moulds, 2012b; Werner-Seidler & Moulds, 2014).

5.3. Visual Perspective in MTT

Mental imagery is a key component of the cognitive "machinery", that comprises multiple sensory modalities and is involved in the representation of goals (Conway et al., 2004) and MTT experiences (Holmes & Mathews, 2010). It is relevant given its special relationship with emotions, which it impacts in one or more of the following ways (Holmes & Mathews, 2010): (a) by directly influencing the emotional systems sensitive to sensory signals; (b) as a consequence of the overlap between imagery and perception processes, that leads individuals to respond to mental imagery as if a perceptual input is occurring; (c) as a result of images being able to immerse individuals in past and future MTT experiences.

In this thesis the purpose is not to provide a detailed analysis of all the imagery components affecting emotion, but instead to analyse and compare key phenomenological characteristics of MTT so as to enable a better understanding of this process in normal mood, dysphoric, never-depressed, and depressed individuals. This subsection is exclusively devoted to an analysis of the existing literature on visual perspective in MTT.

The visual perspective associated with past and future representations is influenced by their temporal distance to the present time (Rice & Rubin, 2009), and by encoding and retrieval processes (D'Argembeau & Van der Linden, 2008; Sutin & Robins, 2008). Given that visual perspective influences an event's degree of emotionality, and considering Rice and Rubin's (2009) claim that visual images are integral to the retrieval of MTT events (Greenberg & Rubin, 2003; Rubin, 2005),

visual imagery is of obvious importance to the study of emotional disorders such as depression (Holmes & Mathews, 2010).

There are two main types of visual perspective that can be associated with an event: a field or first-person perspective, wherein the images of the MTT event are perceived directly through one's own eyes, and an observer or third-person perspective, whereby the person sees him/herself in the perceived image as an actor of the unfolding event (Nigro & Neisser, 1983). Earlier studies on visual imagery found retrospective causal attributions were influenced by a memory's visual perspective (Frank & Gilovich, 1989; Storms, 1973). When adopting a field perspective, individuals tended to make more external attributions because they often focused on the environment instead of themselves; by contrast, in an observer perspective, because the focus was more on the individual performing the actions than on the environment, there were more dispositional attributions.

Since then, additional studies have explored the differences between these two types of perspective in MTT. In voluntary MTT the observer perspective has been associated with a greater focus on objective circumstances (Nigro & Neisser, 1983), frequently involving information about spatial relations and physical appearance (McIsaac & Eich, 2004), and revolving around temporally distant events (Berntsen & Rubin, 2006b) and self-discrepant situations (Libby & Eibach, 2002). By contrast, a field perspective has been found to often imply a focus on feelings, emotional reactions, and sensations (Eich, Nelson, Leghari, & Handy, 2009; Irish, Lawlor, O'Mara, & Coen, 2008; McIsaac & Eich, 2004; Wisco & Nolen-Hoeksema, 2011), being associated with temporally closer events (Berntsen & Rubin, 2006b), and situations of greater self-congruency (Libby & Eibach, 2002).

The above mentioned findings suggest different types of perspective are differentially associated with emotion, with research also showing that when experiencing a MTT event, a switch from field to observer perspective can lead to a decrease in associated emotional ratings (Berntsen & Rubin, 2006b; D'Argembeau, Comblain, & Van der Linden, 2003), with no equivalent changes occurring in the switch from observer to field perspective (Sekiguchi & Nonaka, 2014; Vella & Moulds, 2014; Williams & Moulds, 2008). This difference, according to Robinson and Swanson (1993), may be due to the different accessibility of emotional information in both types of perspective: Whereas in a field perspective there is access to both cognitive and affective information, in an observer perspective the latter is inhibited. As such, when instructed to shift from a field to an observer perspective, it is possible for a cognitive code to drive the event's reconstruction, but the same cannot be said for the reverse, as the observer perspective is unable to adequately access affective information to produce a satisfactory shift towards a field perspective event.

In light of the different characteristics and emotional impact of both types of visual perspective, it has been suggested that they should be used therapeutically to reduce the distress caused by intrusive images and promote positive affect (Holmes, Coughtrey, & Connor, 2008; Pictet, Coughtrey, Mathews, & Holmes, 2011; Valenti, Libby, & Eibach, 2011; Wilson & Ross, 2003). Their possible application and their characteristics in normal mood, dysphoric, non-depressed/never-depressed and depressed individuals are now explored.

5.3.1. Visual perspective in normal mood, dysphoric, never-depressed, and depressed individuals' MTT

Different findings have been obtained for the visual perspective associated with the MTT experiences of these different groups of individuals, the majority of which circumscribed to past voluntary MTT events. Results obtained from the general student population and from non-depressed subjects show that past voluntary MTT events are predominantly retrieved from a field perspective (D'Argembeau et al., 2003; Nelis, Debeer, Holmes, & Raes, 2013; Nigro & Neisser, 1983), the same applying to future voluntary MTT experiences (Holmes et al., 2008). As for involuntary MTT, Johannessen and Berntsen (2010) suggested that similar perspectives are adopted in both types of past MTT retrieval. No studies have assessed visual perspective in future involuntary MTT events, a gap in the literature the present thesis seeks to address.

The existing literature on dysphoric individuals is even more limited. Nelis et al. (2013) found no difference between dysphoric and control individuals in terms of their proportions of past voluntary MTT events with an observer perspective. Nevertheless, there was a positive correlation between depressive symptoms (BDI-II scores) and the production of observer type memories in response to positive, but not negative cues within the dysphoric group.

A similar connection between valence and type of perspective was obtained by Kuyken and Howell (2006) and Lemogne et al., (2006, 2009) for depressed individuals. Kuyken and Howell (2006) found that depressed adolescents retrieved more past voluntary MTT experiences from an observer perspective than non-depressed adolescents. Although this difference was manifest in both positively and

negatively valenced memories, it was stronger for the positively valenced ones. Lemogne et al. (2006, 2009) also found a superior proportion of observer-type past voluntary events in depressed individuals, although in both cases these differences applied solely to positively valenced memories.

This greater use of the observer perspective by depressed individuals has been suggested to be applicable to future MTT (Holmes et al., 2008) and to be detrimental for recovery (Dalgleish & Werner-Seidler, 2014). When applied to negative MTT experiences, the possible short term benefit of emotionally avoiding an event's immediate negative impact will likely prove harmful for that event's longer term emotional processing (Holmes & Mathews, 2010; Kuyken & Moulds, 2009). As for positive MTT events, an observer perspective is bound to reduce their affective impact (Bergouignan et al., 2008; Lemogne et al., 2009; McIsaac & Eich, 2002; Nigro & Neisser, 1983), which will likely serve to reinforce the depressive cycle. In this regard, Werner-Seidler and Moulds (2012b) showed the importance of having depressed individuals focus on the details of positive MTT experiences in order to increase the positive emotional impact of MTT, crucial for recovery. Holmes et al. (2008) presented a similar view, encouraging the use of field perspective in therapeutic setting to address positive future MTT experiences. There is thus a bidirectional interaction between visual perspective and emotion (Holmes & Mathews, 2010).

The similarities and differences between past and future MTT, described in detail throughout this introduction, suggest the existence of several points of convergence and divergence between multiple factors in both temporal dimensions, visual perspective among them (D'Argembeau & Van der Linden, 2004). However, no study has comprehensively performed a comparative analysis that takes into

account both temporality, retrieval type, and mood condition. The current thesis attempts to address this gap in knowledge through a set of hypotheses described in the next chapter.

CHAPTER SIX – AIMS AND HYPOTHESES

6.1. Aims of Empirical Studies 1 and 2

The overarching objectives of this thesis are to contribute to existing knowledge about Mental Time Travel (MTT) and to promote understanding about how MTT influences and is influenced by dysphoria and depression. An increased understanding of MTT's processes may ultimately facilitate the development of therapeutic applications.

In this thesis, a MTT experience refers to an autobiographical event, of both semantic and episodic content, that is subjectively re-experienced (past MTT) or pre-experienced (future MTT) by means of autonoetic consciousness. This subjective and phenomenological experience involves sensorial, contextual, emotional and cognitive elements, manifest in variables such as the visual perspective, spatiotemporal specificity, self-relevance, valence, and physical/mood impact associated with the MTT event. In both Studies 1 and 2 a methodology was employed that enabled the recording, in a naturalistic setting, of these phenomenological characteristics of past and future, voluntary and involuntary MTT events, in normal mood, dysphoric, never-depressed, and depressed individuals (see Chapters 7 and 10 for more details).

In Study 1, the MTT experiences of individuals with dysphoric symptoms were compared to individuals with normal mood, whereas in Study 2 patients diagnosed with Major Depressive Disorder (MDD) were matched to a control group of never-depressed individuals.

The design adopted for Studies 1 and 2 was similar to that used by previous studies (Berntsen & Jacobsen, 2008; Watson et al., 2012), thus allowing for comparability of results and possible cumulative findings. Furthermore, by means of this design it was possible to conduct two separate but interconnected studies, as similar procedures (including a diary-like measure) were used to test similar hypotheses on populations exhibiting different (graded) levels of mood. This graded nature of mood was the subject of additional post-hoc analyses.

A single study design including all three groups (depressed, dysphoric, controls) would have enabled a better assessment of mood as a continuous factor, with existing model variance restricted to a single study instead of spread across two studies. However, this alternative study design would have required matching all three groups per age and gender. Fulfilling this requirement would have expanded the timeline of the data collection process and likely precluded the use of a university students' sample, as a consequence of the depressed participants' socio-demographic characteristics. As several MTT studies using this thesis' methodology have resorted to university students, a valuable means for comparison would thus have been lost.

Both studies focused on two key orthogonal dimensions in MTT: type of retrieval, concerning whether the MTT event is deliberately or spontaneously produced, and temporality, relating to whether the MTT event refers to a past or future experience. As mentioned in Chapter 3, type of retrieval and temporality have recently become the object of intense scrutiny, as more studies have begun analysing both involuntary and future MTT, given their impact in everyday life. Additionally, and as described in Chapter 5, research on how temporality and type of retrieval affect MTT has extended beyond the general university students' population to dysphoric and

depressed individuals, with researchers beginning to explore possible therapeutic applications associated with the manipulation of MTT. However, because the characteristics and mechanisms of different types of MTT in clinical populations remain relatively unclear (Newby, Lang, Werner-Seidler, Holmes, & Moulds, 2014; Miloyan et al., 2014), additional studies are required that explore the relation between mood disorders and MTT.

The objective of this thesis is to contribute to the field of MTT research by analysing and directly comparing four types of MTT in dysphoric mood vs. normal mood individuals (Study 1) and depressed vs. never-depressed individuals (Study 2): past voluntary MTT, past involuntary MTT, future voluntary MTT and future involuntary MTT. These are the products of the intersection between type of retrieval and temporality (see Table 1).

Table 1. MTT as a result of the intersection between temporality and type of retrieval

Type of Retrieval	Temporality	
	Past	Future
Voluntary	Past Voluntary MTT	Future Voluntary MTT
Involuntary	Past Involuntary MTT	Future Involuntary MTT

Of the four types of MTT described, past voluntary MTT has been the most frequently studied (Berntsen, 2009, 2012). Past involuntary MTT, though largely understudied when compared to its voluntary counterpart, has benefited from recent interest in past years (Berntsen, 2009), whereas future voluntary and involuntary MTT

remain relatively unexplored. These deficiencies in the MTT literature are highlighted by the fact that only one study compared all four types of MTT, using a sample of university students (Berntsen & Jacobsen, 2008), with no studies to date having performed said comparisons for individuals with dysphoric mood or clinical depression. The current thesis aimed to address this research gap by testing hypotheses that are: (a) centred on the impact that type of retrieval, temporality, and participant group/depressive mood severity can have on MTT; (b) relevant in terms of their possible clinical and psychotherapeutic application.

6.2. Hypotheses and Analyses of Empirical Studies 1 and 2

The hypotheses tested in Study 1 and Study 2 are presented in Table 2 below. As can be seen, they are similar, the only differences pertaining to the participant groups being compared in each study. Each hypothesis tested one phenomenological aspect of MTT, with Hypotheses 1, 3, 4 and 5 comprising both within-group (Hypotheses 1a, 1c, 1d, 3a, 3c, 3d, 4a, 4c, 4d, 5b) and between-group (Hypotheses 1b, 3b, 4b, 5a) analyses. The within-group analyses enabled a direct focus on MTT processes, investigating the effects of type of retrieval, temporality, and their interaction across the entire sample. The between-group analyses examined the effect of group (normal mood vs. dysphoria, never-depressed vs. depressed) as well as the interaction between group and MTT.

Additional post-hoc analyses were performed wherein instead of categorical between-group comparisons, the severity of depressive symptoms was used as a

covariate, to examine depressive symptoms as a continuous rather than categorical variable.

In Hypothesis 2, two dependent variables were assessed: the Centrality to Identity and the Centrality to Life Story of the MTT event generated. These two variables can be ascribed to the overarching factor of self-relevance, and as such were analysed together. The same applies to Hypothesis 3, wherein the dependent variables of Physical Reactions and Mood Impact were analysed together, to assess the impact caused by the MTT experience.

In addition to the hypotheses being tested, in both Studies 1 and 2 the mean totals of MTT events and semantic associates produced are presented. These analyses served to test whether participants exhibited difficulties in experiencing certain types of MTT (past vs. future, voluntary vs. involuntary).

Also, the temporal distribution and temporal distance of the MTT events was analysed. This enabled an assessment of the degree of similarity involving the encoding and consolidation processes of different types of MTT (see Section 3.3.1), and permitted comparisons between the samples used in Studies 1 and 2 with those of similar studies in the literature.

Table 2. Hypotheses tested in Studies 1 and 2

Hypothesis Number	Key factor	Dependent Variable	Hypotheses
Hypothesis 1a	Type of Retrieval	Spatiotemporal Specificity	Past and future involuntary MTT events will be more specific/less general than their voluntary counterparts regardless of participant group.
Hypothesis 1b	Participant Group	Spatiotemporal Specificity	The past and future, voluntary and involuntary MTT events of dysphoric (Study 1) and depressed (Study 2) groups will be less specific/more general than the MTT events of their respective control groups.
Hypothesis 1c	Temporality	Spatiotemporal Specificity	Future voluntary and involuntary MTT events will be less specific/more general than their past counterparts regardless of participant group
Hypothesis 1d	Interaction between Type of retrieval and Temporality	Spatiotemporal Specificity	The difference in specificity between past and future MTT events will be greater in voluntary compared to involuntary retrieval, regardless of participant group.
Hypothesis 2a	Type of Retrieval	Centrality to Life and Centrality to Identity [Self-Relevance]	Past and future involuntary MTT events will be less central to life story and identity than their voluntary counterparts regardless of participant group.
Hypothesis 2b	Temporality	Centrality to Life and Centrality to Identity [Self-Relevance]	Future voluntary and involuntary MTT events will be more central to life story and identity than their past counterparts regardless of participant group.
Hypothesis 2c	Interaction between Type of Retrieval and Temporality	Centrality to Life and Centrality to Identity [Self-Relevance]	The difference in centrality to life story and identity between voluntary and involuntary retrieval will be greater in future compared to past MTT regardless of participant group.
Hypothesis 3a	Type of Retrieval	Mood Impact and Physical Reactions [Impact]	Past and future involuntary MTT events will cause greater mood impact and physical reactions than their voluntary counterparts regardless of participant group.
Hypothesis 3b	Participant Group	Mood Impact and Physical Reactions [Impact]	The past and future, voluntary and involuntary MTT events of dysphoric (Study 1) and depressed (Study 2) groups will cause greater mood and physical impact than the MTT events of their respective control groups.
Hypothesis 3c	Temporality	Mood Impact and Physical Reactions [Impact]	Past voluntary and involuntary MTT events will entail similar mood impact and physical reactions to their future counterparts regardless of participant group.

Hypothesis Number	Key factor	Dependent Variable	Hypotheses
Hypothesis 3d	Interaction between Type of Retrieval and Temporality	Mood Impact and Physical Reactions [Impact]	The difference in mood impact and physical reactions between voluntary and involuntary retrieval will be similar across past and future MTT regardless of participant group.
Hypothesis 4a	Type of Retrieval	Valence	Past and future involuntary retrieval will elicit similar mean numbers of negatively valenced MTT events compared to their voluntary retrieval counterparts regardless of participant group.
Hypothesis 4b	Participant Group	Valence	The past and future, voluntary and involuntary MTT events of dysphoric (Study 1) and depressed (Study 2) groups will be more negative/less positive than the MTT events of their respective control groups.
Hypothesis 4c	Temporality	Valence	Future voluntary and involuntary MTT events will be more positive/less negative than their past counterparts regardless of participant group.
Hypothesis 4d	Interaction between Type of Retrieval and Temporality	Valence	The difference in valence between past and future MTT events will be greater in voluntary compared to involuntary retrieval regardless of participant group.
Hypothesis 5a	Temporality	Visual Perspective	Any between-group differences in terms of mean numbers of observer and field perspective events in past MTT will be replicated in future MTT (both Study 1 and 2).
Hypothesis 5b	Type of Retrieval	Visual Perspective	Past and future MTT voluntary events will exhibit a similar perspective to that exhibited by their involuntary counterparts regardless of participant group.

6.3. Hypothesis 1 – Level of Spatiotemporal Specificity

Hypothesis 1 tested the level of spatiotemporal specificity of the MTT events produced by the participants in Study 1 and Study 2, with the different levels of specificity being assessed by the Principal Investigator (PI). As described in Section 5.1, past and future MTT events can be classified into general (including categoric,

and extended events), or specific events. Since these classifications are mutually exclusive, more specific events imply fewer general events, and vice versa, meaning the concepts of higher/lower specificity overlap with lower/higher overgenerality. In the literature, different studies comparing groups have used either specific or general MTT events.

The manifold impact of the level of specificity, described in Section 5.1, captured the interest of the scientific community, both from a theoretical (Conway & Pleydell-Pearce, 2000; Williams et al., 2007) and clinical standpoint (Neshat-Doost et al., 2012; Sumner et al., 2013). However, research focus on specificity followed different trajectories for past and future MTT, and for voluntary and involuntary types of retrieval.

Regarding past MTT, the initial predominance of voluntary memory research contributed to a plethora of studies directly comparing the specificity levels exhibited by the general university student population**,** dysphoric, nondepressed/never-depressed and depressed individuals (see Chapter 5). Results showed that dysphoric and depressed individuals recalled less specific voluntary memories, which prompted the development of the Car-FA-X model (see Subsection 5.1.1).

By contrast, and as detailed in Subsection 5.1.2, few studies have directly compared the aforementioned populations on the specificity of their involuntary past MTT or their voluntary future MTT, while no studies have performed such comparisons for involuntary future MTT – a limitation in the literature that the present thesis aims to address via Hypothesis 1b.

The studies comparing the specificity of voluntary future MTT in dysphoric and depressed individuals with that of their respective control groups found similar

results to those of voluntary past MTT, as dysphoric and depressed individuals retrieved less specific events (see Subsection 5.1.2). On the contrary, studies performing these comparisons for involuntary past MTT did not obtain statistically significant differences in specificity. Thus, when combined, these findings seem to suggest that by enabling access to more specific events, involuntary retrieval may help circumvent the overgenerality typical of dysphoric and depressed individuals, reducing group differences in specificity.

This greater specificity of involuntary compared to voluntary past MTT events is couched on the different mechanisms underlying both types of retrieval (see Subsection 3.3.7) and was predicted by the CaR-FA-X model. While involuntary retrieval is believed to privilege cue-item discriminability and distinctiveness, leading to the retrieval of more specific events (see Subsection 3.3.6.2.3), voluntary retrieval favours top-down search processes, that are more easily influenced by schematic knowledge and, thus, lead to the retrieval of less specific/more overgeneral events (see Subsection 3.3.5). However, although multiple studies involving the general university student population have supported the greater specificity of involuntary compared to voluntary retrieval, there are few studies with dysphoric and depressed individuals (see Subsection 5.1.2). This may be due to the limited number of studies that have directly compared both populations' past MTT specificity, a limitation this thesis attempts to address via Hypothesis 1a.

In what concerns future MTT, the formulation of hypotheses is complicated by a lack of studies (see Subsection 5.1.2). The extrapolation that future MTT will exhibit a similar trend to past MTT, meaning involuntary future MTT will be more specific than voluntary future MTT, has only been corroborated in studies with university

students, since no studies have directly compared the levels of specificity of involuntary and voluntary future MTT for either dysphoric or depressed individuals – a gap in knowledge that the present thesis attempts to address via Hypothesis 1c.

Studies involving university students have consistently shown that voluntary and involuntary future MTT events are less specific/more general than their past counterparts (Anderson & Dewhurst, 2009; Berntsen & Jacobsen, 2008; Rasmussen & Berntsen, 2013). Future MTT, compared to past MTT, is a more complex and effortful process of event generation, which makes it harder for individuals to progress through their hierarchical autobiographical knowledge base in order to elicit/create specific events (see Subsection 3.2.4 for further details). Therefore, when asked to mentally travel to the future, individuals will be more likely to stop short of a specific event, producing a general one instead (Anderson & Dewhurst, 2009). This premise was tested in Hypothesis 1c.

As for the interaction between type of retrieval and temporality, the fact that different retrieval mechanisms characterise voluntary and involuntary retrieval may prove a crucial factor, as the greater degree of constructive effort and tendency for overgenerality evidenced in future MTT should be particularly evident in voluntary retrieval. The reason for this lies in voluntary retrieval's schema-based nature and relational processing, which when compared to involuntary retrieval's privileging of item-specific processing suggests the possibility of greater differences in specificity between past and future MTT. This premise was tested in Hypothesis 1d.

In conclusion, the testing of Hypothesis 1 enabled a direct comparison of the specificity levels of past and future, voluntary and involuntary MTT, as exhibited by different participant groups. Both Studies 1 and 2 are pioneer in this field of research

as they are the first to perform both within- and between-group comparisons for all four types of MTT in normal mood, dysphoric, never-depressed and depressed individuals.

6.4. Hypothesis 2 – Self-Relevance

Hypothesis 2 tested the self-relevance of the events produced by the participants of Study 1 and 2.

The importance of the centrality of an event towards an individual's identity and life has been underlined by cognitive models of depression (Beck, Rush, Shaw, & Emery, 1979), since key events are often used to attribute meaning to other past experiences and set expectations towards the future, which in the case of depression may lead to the exacerbation of depressed mood and negative cognitions via negative and traumatic self-defining events (Berntsen & Rubin, 2007; Boals, 2010). However, recent findings have questioned the relation between an event's self-relevance and depression (Newby & Moulds, 2011a), making this a pertinent topic of analysis. A possible explanation for this discrepancy lies in the degree of the overlapping between the self-relevant events sampled and the trauma and depression-related episodes experienced by individuals (Newby & Moulds, 2011b).

The rationale supporting Hypothesis 2 partially expands that of Hypothesis 1, as it also centres on the impact that the different processes underlying type of retrieval can have on MTT. The literature regarding past MTT shows that voluntary retrieval, due to its schema-based search descriptions, is likely to favour the recall of self-relevant representations that are important to an individual's life story and identity

(Berntsen, 2012). As for involuntary retrieval, because it can bypass such schema-induced constraints, it often privileges distinct over self-relevant information (Berntsen, 2009). These findings were corroborated by studies performing direct comparisons of voluntary and involuntary memories for PTSD (Rubin et al., 2008) and university students (Johannessen & Berntsen, 2010), while using self-report items similar to those of the current research. A different result was obtained by Berntsen and Jacobsen (2008), who despite not finding statistically significant differences reported medium-sized effects that were in line with the literature.

As occurs with most phenomenological variables of MTT, there is a lack of studies directly comparing the self-relevance of voluntary and involuntary past MTT in dysphoric and depressed individuals. Watson et al. (2012) is the only study that has directly examined the self-relevance of voluntary and involuntary memories in depressed patients, finding no statistically significant differences, while no studies have compared the self-relevance of voluntary and involuntary past MTT in dysphoric individuals. Similarly, only Berntsen and Jacobsen (2008) have directly compared the ratings of centrality to life and centrality to identity for voluntary and involuntary future MTT, finding no statistically significant differences in university students.

In light of these limitations in the literature, Hypothesis 2a assessed whether past and future involuntary MTT events are less self-relevant than their voluntary counterparts across the different groups of individuals assessed in Studies 1 and 2.

Additionally, research suggests that future MTT, when compared to past MTT, is more prototypical (Berntsen & Bohn, 2010; Kane et al., 2012), possibly because of the reduced influence of encoding/maintenance effects in future events, as these are yet to occur – memories of the future may constitute an exception. Consequently,

cultural life scripts are dominant in future MTT, which suggests a stronger self-narrative, that would be manifest in more schematic and self-relevant events for future compared to past MTT. This premise was tested in Hypothesis 2b.

In what concerns the interaction between type of retrieval and temporality, it is expected that the difference in self-relevance between voluntary and involuntary retrieval will be greater in future compared to past MTT events, because of the more schematic nature of future compared to past voluntary MTT. This premise was tested in Hypothesis 2c.

Respecting between-group comparisons, self-relevance has been under-researched for both past and future MTT. Only Watson et al. (2012) directly compared never-depressed and depressed individuals' ratings of centrality for life and identity in voluntary MTT, and only two studies performed such comparisons for involuntary MTT (Newby & Moulds, 2011b; Watson et al., 2012). Although results showed greater self-relevance of voluntary memories in depressed compared to non-depressed/never-depressed individuals, there were inconsistent findings for involuntary memories. Unlike Watson et al. (2012), who found that depressed participants attributed greater self-relevance to involuntary memories comparatively to never-depressed controls, Newby and Moulds (2011b) found no group differences. This discrepancy might have been due to the latter study assessing only negatively valenced involuntary memories, and using a different measure to assess self-relevance.

The existing results, coupled with the fact that no studies have directly compared the ratings of self-relevance of normal mood and dysphoric individuals' past MTT and of normal mood, dysphoric, never-depressed and depressed individuals' future MTT, precludes the formulation of between-group hypotheses. However, such

a gap in the literature strengthens the importance of conducting these between-group comparisons in order to further develop existing knowledge about MTT and its interaction with mood and mood disorders.

To conclude, although there is a consensus about the greater self-relevance of voluntary compared to involuntary, and future compared to past MTT, few studies have performed direct comparisons of self-relevance ratings for voluntary and involuntary past and future MTT, within and between groups of normal mood, dysphoric, never-depressed and depressed individuals. Hypothesis 2 therefore sought to address this issue, with Study 1 directly comparing self-relevance ratings for all four types of MTT in normal mood and dysphoric individuals whereas Study 2 is the first study to do so for never-depressed and depressed individuals. Examining the relationship between past and future MTT in the context of self-relevance in dysphoria and depression may help further our understanding of the cognitive mechanisms underlying depression (Berntsen & Bohn, 2010).

6.5. Hypothesis 3 – Mood Impact and Physical Reactions

Hypothesis 3 tested the impact (in terms of mood and physical reactions) of the MTT events produced by the participants of Study 1 and Study 2.

Mood, as considered in this hypothesis, refers to a diffuse affective state, that can "carry over to a broader class of situations and behavioural targets" (Fiedler & Hütter, 2014, p.146), being subjectively appraised by participants as positive or negative. Physical reactions, on the other hand, refer to behavioural responses that are

a consequence of MTT experiences, and can range from crying and shuddering, to laughing and smiling.

Mood has a considerable impact on cognitive and behavioural functioning, with positive mood promoting top-down processing and creative inferences, whereas negative mood often triggers stimulus-driven bottom-up processing and more conservative inferences (Fiedler & Hütter, 2014). Moreover, Teasdale (1988) has shown that negative mood can act as a stressor, interacting with latent depressogenic schemas that cause depressed mood, leading to cognitive reactivity (Scher, Ingram, & Segal, 2005).

Research on the mood impact of, and physical reactions to past MTT in university students has been prolific, with inconsistent results. Whereas Berntsen and Hall (2004), Hall and Berntsen (2008) and Rubin et al., (2008) showed that involuntary memories generated more physical reactions than voluntary memories, other studies found similar albeit not statistically significant differences (Berntsen & Jacobsen, 2008; Johannessen & Berntsen, 2010). Respecting mood impact, Berntsen and Hall (2004) and Rubin et al., (2008) also demonstrated that involuntary memories generated greater mood impact than voluntary memories, with Hall and Berntsen (2008) finding a similar but not statistically significant trend. Once more, Berntsen and Jacobsen (2008) and Johannessen and Berntsen (2010) obtained slightly different results, as they did not find any trends involving general mood impact and type of retrieval, although both studies found involuntary memories elicited statistically significant more negative mood impact than voluntary memories.

Two explanations may account for the apparent relationship between type of retrieval and mood impact in past MTT: (a) involuntary memories have an associative

and spontaneous nature that enables faster retrieval times which, in turn, permits skirting antecedent emotional regulation strategies (Gross, 2001; Gross & Thompson, 2007), leading to greater emotional impact and physical reactions when compared to voluntary memories. It is likely that these emotion regulation strategies apply, in particular, to negatively perceived events, and hence their proportion relative to the general number of mood impact memories may be crucial for the detection of statistically significant differences between mood impact and physical reaction in different retrieval types – see Berntsen and Jacobsen (2008) and Johannessen and Berntsen's (2010) above; (b) there are different levels of emotion activation, some of which allow emotions to be activated associatively, with no preceding cognitive evaluation (see Subsection 3.3.7.2). These are predominant in involuntary memories (Berntsen, 2009), and thereby lead to greater mood impact and physical reactions when compared to the more evaluative emotion generation processes that characterise voluntary memories.

Similarly to Hypotheses 1 and 2, few studies have directly compared the influence that type of retrieval has in the mood impact and physical reactions of dysphoric and depressed individuals' past MTT, and normal mood, dysphoric, never-depressed and depressed individuals' future MTT. Furthermore, Watson et al. (2012) raised doubts about whether the strong reactions experienced by depressed individuals were limited to the spontaneous retrieval of negative and stressful events or if these heightened physical and emotional reactions were also associated with other forms of autobiographical memory retrieval, such as positive involuntary memories.

Regarding future MTT, Berntsen and Jacobsen (2008) is the only study to have directly compared levels of physical reaction and mood impact caused by involuntary

and voluntary future MTT events, using a sample of university students. This study suggested a parallel between future and past MTT, as involuntary retrieval generated a non-statistically significant superior amount of physical reactions and mood impact in both past and future MTT than voluntary retrieval, with the differences equating to medium-sized effects.

Based on the above, Hypothesis 3a tested the premise that involuntary retrieval would elicit MTT events with greater mood and physical impact than those elicited by voluntary retrieval, regardless of temporality or participant group. Also, the fact that both Berntsen and Jacobsen (2008) and Rasmussen and Berntsen (2013) did not find a statistically significant effect of temporality on the mood impact of the MTT events produced by participants suggests similarities between past and future MTT events. Given the apparent consistency across temporality of the effect of type of retrieval, Hypothesis 3c tests the premise that past voluntary and involuntary events will entail similar mood and physical impact to that of their future counterparts. As for Hypothesis 3d, it proposed that the differences in mood and physical impact involving past voluntary and involuntary events would be similar to the differences exhibited by future voluntary and involuntary events.

The sparseness of studies addressing the impact of temporality and type of retrieval in MTT impact also extends to between-group comparisons. No studies have compared dysphoric/depressed individuals with healthier control participants respecting future MTT (voluntary or involuntary) and only one study (Watson et al., 2012) has directly compared never-depressed and depressed individuals' mood and physical impact for past MTT. This study found that although depressed individuals registered higher mean proportions of physical reactions, the difference was not

statistically significant. Concerning mood impact, depressed subjects registered a statistically significant greater proportion of mood reactions to both voluntary and involuntary memories, a difference largely due to their greater recall of voluntary and involuntary events that caused a negative mood impact. In light of these findings, Hypothesis 3b proposed that dysphoric and depressed individuals would produce MTT events that cause greater mood and physical impact than those produced by control participants.

In conclusion, several questions remain unanswered. By testing Hypotheses 3a, 3b, 3c and 3d, Studies 1 and 2 aimed to provide novel data that can discern the interactions between type of retrieval, temporality and participant group regarding the physical reactions and mood impact caused by MTT.

6.6. Hypothesis 4 – Valence

Hypothesis 4 tested the valence of the MTT events produced by the participants of Study 1 and Study 2.

As discussed in Subsection 5.2.2.3, there are different perspectives on whether voluntary and involuntary type of retrieval access the same self-referential memory system, with different theories predicting different outcomes regarding the valence of MTT events. Theories supporting a two-system view claim that involuntary retrieval constitutes a privileged form of access to negative information, meaning involuntary retrieval should elicit more negative events, whereas single episodic system theories claim there is no privileged access to negative information granted by involuntary retrieval.

The studies in the literature comparing the valence of voluntary and involuntary MTT events have produced mixed results, an issue Hypothesis 4a attempted to address. Berntsen (1998), initially using different participants to assess voluntary and involuntary memories, found the latter were more positive. However, recent studies that used the same participants to assess both voluntary and involuntary memories, obtained different results. Hall and Berntsen (2008) and Johannessen and Berntsen (2010) did not find statistically significant differences in the valence of events elicited by both types of retrieval, an outcome that was corroborated by Rubin et al. (2008) and Schlagman and Kvavilashvili (2008) but not by Berntsen and Jacobsen (2008), who found involuntary memories were more negative.

The lack of studies addressing the phenomenological characteristics of MTT across temporality and type of retrieval extends to valence. In university students, only one study has directly compared valence ratings for future voluntary vs. involuntary MTT, reporting more negative ratings for involuntary future MTT (Berntsen & Jacobsen, 2008). Regarding dysphoric individuals, no study has directly compared the valence associated with voluntary and involuntary retrieval, for either past or future MTT. As for depressed individuals, Watson et al. (2012) is the only study to have compared the ratings of valence for past voluntary and involuntary MTT, finding a statistically significant greater proportion of negative voluntary memories compared to negative involuntary memories. No equivalent studies have been performed for future MTT, nor comparing the valence exhibited in all four types of MTT.

In spite of limited research, existing studies have consistently proposed that future MTT is more positive/less negative than past MTT (see Subsection 3.2.4.2 for details), a premise tested in Hypothesis 4c. Moreover, the fact that schemas often contribute to a positivity bias in future MTT (Wilson & Ross, 2003; Wilson et al., 2009) suggests that the greater positivity of future compared to past MTT may be exacerbated in voluntarily retrieved events, wherein relational processing and schematic influences are predominant (see Subsection 3.3.7 for further details).

Further exploring the issue of valence, although a number of studies have found a positivity effect in general university students for both types of retrieval, encompassing both past and future MTT (see Subsection 5.2.2.3), the literature also shows that, when compared to normal mood and nondepressed/never-depressed individuals, dysphoric and depressed individuals' past and future MTT lacks such positivity, being more negatively valenced (see Subsection 5.2.3). A caveat exists, however, concerning the generalisability of these findings, as most of the studies involving valence have been circumscribed to specific types of MTT, namely past and voluntary events. Consequently, Hypothesis 4b assessed the premise that the MTT events of dysphoric and depressed individuals would be more negative/less positive than those produced by their respective control groups.

To conclude, there is an imbalance in the literature that limits an adequate comprehension of the interactions between type of retrieval, temporality and mood/mood disorders concerning valence. The present thesis attempted to address this gap in knowledge via Hypothesis 4.

6.7. Hypothesis 5 – Visual Perspective

This hypothesis assessed the visual perspective associated with the MTT events produced by the participants of Studies 1 and 2.

The type of perspective associated with a past and future MTT experience involves visual imagery and can either reflect a first person (field perspective) or a third person view (observer perspective). As discussed in Section 5.3 visual images, as an integral part of MTT, are important to its understanding. The visual perspective underlying a MTT event has been shown to have a powerful effect on emotion, playing a key role in psychological disorders such as depression. Because of this, a number of studies have looked into the possibility of utilising visual perspective in a therapeutic context, either to potentiate positive emotions or reappraise negative MTT events (see Subsection 5.3.1 for details).

Given the positive impact that visual perspective can have in depressive symptomatology, this thesis attempts to address existing gaps in knowledge by analysing and comparing the visual perspective of past and future, voluntary and involuntary MTT in normal mood, dysphoric, never-depressed, and depressed individuals. The interactions between visual perspective and type of retrieval have been particularly under-researched, and the same can be said for existing research on future MTT and its interaction with type of retrieval in different clinical groups (see Section 5.3). Consequently, Hypothesis 5a attempted to address some of these gaps in knowledge, by analysing both types of visual perspective across different types of retrieval and MTT temporality. It was proposed that any differences between normal mood and dysphoric participants' (Study 1) use of observer and field perspective in past MTT events would be replicated for future MTT events, with the same occurring

for possible differences between never-depressed and depressed participants (Study 2). Hypothesis 5a is based on existing results and on the constructive episodic simulation hypothesis (see Subsection 3.2.3.3), which emphasises the similarities between past and future MTT processes.

As for Hypothesis 5b, it proposed that type of retrieval does not have a statistically significant impact on the type of perspective associated with MTT events, a premise that is couched in previous findings (Johannessen & Berntsen, 2010; Mace et al., 2011; Watson et al., 2012).

CHAPTER SEVEN – METHODOLOGY OF STUDY 1

This chapter will describe the methodological approach used in Study 1. The following aspects are described: The participants' inclusion and exclusion criteria, research design, sampling, measurement, and statistical procedures.

7.1. Research Design

This quasi-experimental study had a 2 x (2 x 2) mixed factorial design. Temporality (past vs. future) and type of retrieval (voluntary vs. involuntary) were within-subjects' independent variables whereas participant group (dysphoric vs. normal mood individuals) was the between-subjects' variable. There were four possible forms of MTT as a result of the intersection between the orthogonal dimensions of temporality and type of retrieval. The choice of this design was based on previous studies (Berntsen & Hall, 2004; Berntsen & Jacobsen, 2008).

7.2. Participants

7.2.1. Inclusion and exclusion criteria

As inclusion criteria, participants needed to be able to read, write and be physically and cognitively able to perform the required tasks. All participants were students at a Portuguese university, between 17 and 64 years of age, which ensured the first two criteria were met. The remaining two criteria were determined based on observation during the initial contact.

Exclusion criteria were self-reported history of memory problems/conditions and the refusal to provide a signed informed consent.

7.2.2. Recruitment

Recruitment, which began on the 10th of November 2011 and ended on the 18th of January 2013, followed three different approaches: (a) Eligible subjects studying at the Instituto Superior de Psicologia Aplicada – Instituto Universitário (ISPA-IU) were approached by a research assistant, who provided them with detailed information about the study. Those who showed interest were scheduled for a first session; (b) the ISPA-IU Psychology Lab was contacted by the Principal Investigator (PI) and interested students were scheduled for a first session; (c) a non-probability snowball sampling technique was used, with students who participated in the study referring it to fellow students who were then approached at ISPA-IU.

7.2.3. Sample size

The sample size objective, set before recruitment began, was to collect the maximum number of participants possible. There were feasibility concerns that derived from the need to conduct two face-to-face sessions, with a diary-notebook task in-between that would protract throughout a minimum of 14 days. These, along with general time constraints, led to no *a priori* power analyses being conducted. A non-probability sampling technique of convenience sampling was used. As shown in Figure 3, 100 students attended the study's first session and were presented with the Three Step Diary Questionnaire, in the form of a notebook. However, 29 failed to

complete it, citing reasons such as insufficient time availability or loss of the notebook. The remaining 71 students completed the study.

After the data collection was complete, participants were characterized into dysphoric mood vs. normal mood groups. The established cut-off point (10) was used as the minimum score for mild depression values in the BDI-IA, in line with previous studies (Beck, Steer, & Garbin, 1988; Cox, Enns, Borger, & Parker, 1999; Deardorff & Funabiki, 1985). The BDI-IA was administered in two sessions – before and after the Three Step Diary Questionnaire (see procedure in Section 7.3), which, on average, took 46 days to complete. Participants were excluded from analysis if they scored above the threshold in the first session but scored below it on the second session (n = 9) or vice versa (n = 5). This criterion sought to ensure, as much as possible, the mood consistency of both groups. Consequently, these 14 participants were excluded. An additional participant was excluded because she failed to record any future MTT events in the notebook. The sociodemographic characteristics and clinical measures' scores of excluded participants are presented in Appendix 1.

Therefore, in the final sample for analysis, only participants who had registered a score ≥10 on the BDI-IA for *both* sessions were assigned to the dysphoric group, whereas only participants who had a score <10 in the BDI-IA in *both* sessions were assigned to the normal mood group. With these screening criteria, the final sample consisted of 56 participants, including 17 in the dysphoric mood group vs. 39 in the normal mood group.

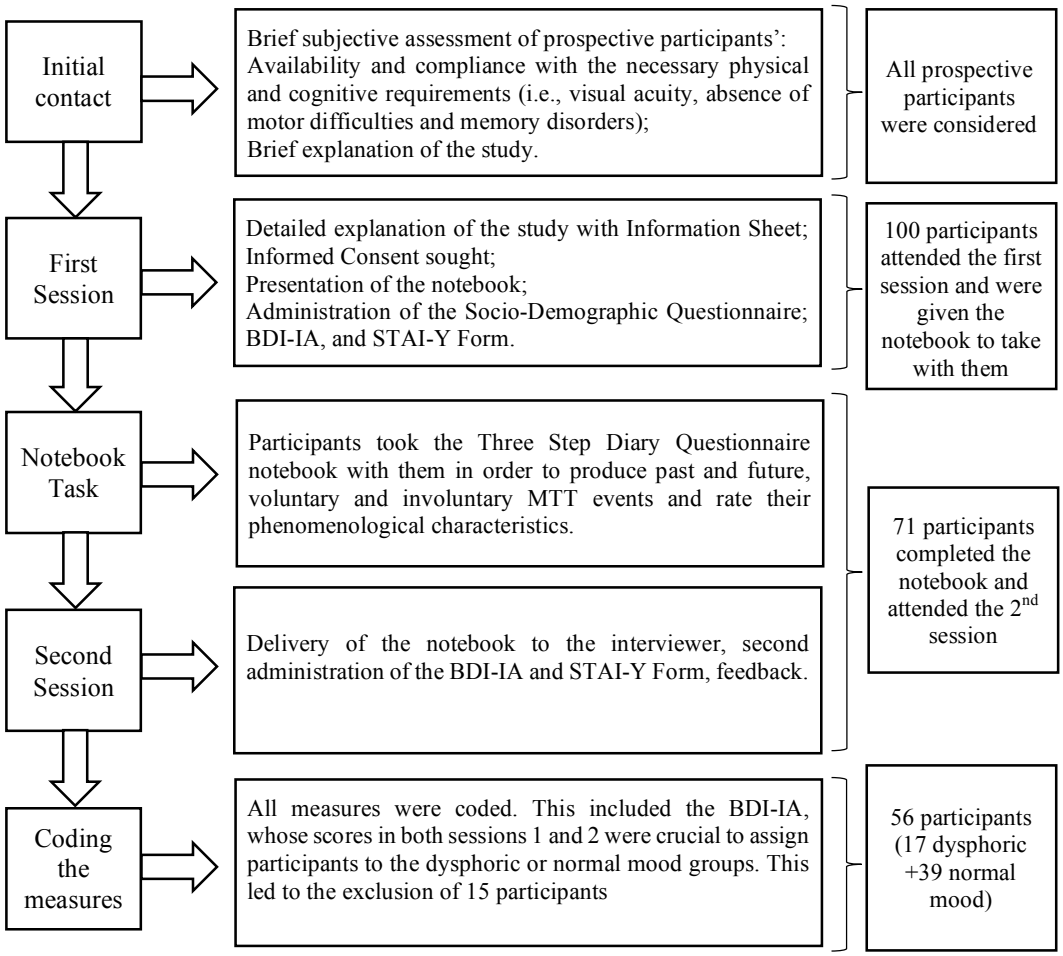


Figure 3. Flowchart of the data collection process in Study 1

7.3. Setting and Procedure

The study required two face-to-face sessions with the notebook task in-between. These sessions involved single or multiple participants, depending on participant availability, and were usually held at ISPA-IU (in the Psychology Lab, in the Health Psychology Research Unit or in one of ISPA-IU's classrooms). On the few occasions when students were unable to travel to ISPA-IU, a neutral office site was used that guaranteed the necessary conditions of privacy and silence.

All first sessions followed the ensuing predetermined protocol: (a) the research assistant introduced herself and those involved in the research; (b) the overall aims of the study and the different stages requiring the participants' involvement were explained; (c) the notebooks comprising the Three Step Diary Questionnaire were delivered and participants were informed they should carry them at all times. A detailed explanation of this task, including the notebook's structure and concepts was then provided; (d) participants were presented with an information sheet describing the overall characteristics of the study, a feedback form, to be completed after the diary task had been finished, and an informed consent sheet which they were requested to sign; (e) the following measures were administered: sociodemographic questionnaire, Beck Depression Inventory (BDI-IA) and the State-Trait Anxiety Inventory (STAI), Y Form.

The next stage of the study consisted in the completion of the Three Step Diary Questionnaire. Because this measure is comprised of two sections, one for recording past MTT events and the other for recording future MTT events, a counterbalancing procedure was adopted to control for order effects (Harris, 2010). Thus, two notebook versions of the Three Step Diary Questionnaire were devised, differing only in the counterbalancing order with which both past and future MTT experiences were required, with participants being randomly given one of the versions during the first session. After writing down all the involuntary and voluntary MTT experiences pertaining to the past (or future) section of the notebook, participants then did the same for the remaining section.

Participants were asked to register only past events that involved a feeling of re-experience, as if these events were being relived. Similarly, only future events that

involved a feeling of pre-experience, as if they were being pre-lived, should be registered in the questionnaire. Instructions were provided that participants register only past events that had occurred in reality, as well as future events that were likely to occur, thus avoiding alternative and fantasy-prone past and future scenarios.

The Three Step Diary Questionnaire required participants to register between a minimum total of 7 and a maximum of 14 voluntary and involuntary, past and future MTT events. Of these, only a maximum of two involuntary and respective voluntary events could be produced per day. This diary task had an open-ended time period which, paired with the restrictions on the maximum number of events registered per day, meant that the participants would take between a minimum of 14 days to complete the task – 7 days for past (involuntary and voluntary) events and 7 days for future (involuntary and voluntary) events – and a maximum of several months, depending on Study 1's timeline.

Although the literature shows that past and future, voluntary and involuntary MTT experiences are common everyday phenomena, participants were given ample time to complete the notebook task, to avoid creating a feeling of time pressure and ensure that the involuntary MTT experiences recorded in the study really were unbidden, rather than provoked by task and time constraints. The rationale for the minimum and maximum numbers of MTT events solicited was couched on two reasons: (a) it made the notebook's timeline easier to understand, as in a best case scenario, participants would take a full two weeks to complete the diary-task, with one week for past voluntary and involuntary MTT, and the other for their future counterparts; (b) it allowed for some control over the variability of the MTT events produced. If instead of a minimum of seven events per MTT category only one or two

had been solicited, the results obtained would be more susceptible to extraneous variables such as a particularly positive or negative occurrence on the day of the task. By requiring a minimum of seven events per MTT condition, and requesting they be produced over seven different days, a more representative set of results could be obtained.

Similarly to Berntsen and Hall (2004) and Berntsen and Jacobsen (2008), participants were instructed to follow a three-step recording procedure of their representations. In the first stage, once an involuntary representation occurred, participants recorded keyword phrases and ratings in response to a specific set of questions presented in the notebook – in Table 3 these questions are marked with an asterisk. The purpose of this first stage was to allow participants to immediately register the past or future MTT event, as well as the context in which it came to mind, without over-relying on retrospection and inferences (Berntsen & Jacobsen, 2008). The second step required participants to complete the involuntary event questionnaire they had begun earlier that day. To achieve this goal, keyword phrases and ratings that had been registered during the first stage proved useful. The third and final step occurred once the questionnaire for the involuntary event was complete. Participants then removed an adhesive label located in the following page of the notebook to reveal a cue word. It was in response to this cue that a voluntary MTT event was produced, followed by the completion of its questionnaire (see Subsection 7.4.4 for details of this task).

This structured three stage approach was devised to ensure participants had time to complete their involuntary and voluntary MTT events unimpeded and without losing key information. Being so, whenever it was possible for participants to merge

steps 1 and 2 together – meaning registering the involuntary event and immediately answering all of its questions – they were advised to do so.

Once the Three Step Diary Questionnaire was finished and participants had completed the feedback form (see Appendix 2), they contacted/were contacted by the research assistant to schedule a second session. In this final face-to-face meeting, the research assistant collected the notebook and the feedback form, administering once again the BDI-IA and the STAI.

7.4. Measures

The four measures used can be found in Appendices 3 to 6 and are presently described using the order by which they were applied.

7.4.1. Sociodemographic questionnaire

Participants were asked their age, gender, education level, if they had a history of mental health, followed by which mental health disorder they suffered from, and if they were on any type of medication (see Appendix 3). These questions were selected because they involved characteristics that, directly or indirectly, might affect memory processes.

7.4.2. Beck Depression Inventory (BDI-IA)

The BDI was designed by Beck, Ward, Mendelson, Mock and Erbaugh (1961) to measure behavioural manifestations in depression. The original version was composed of 21 items measuring: Mood, Pessimism, Sense of Failure, Lack of

Satisfaction, Guilty Feeling, Sense of Punishment, Self-Hate, Self Accusations, Self Punitive Wishes, Crying Spells, Irritability, Social Withdrawal, Indecisiveness, Body Image, Work Inhibition, Sleep Disturbance, Fatigability, Loss of Appetite, Weight Loss, Somatic Preoccupation and Loss of Libido (Beck et al., 1961).

A revised version, the BDI-IA (Beck et al., 1979), was considered to be better suited for self-administration and enabled easier scoring procedures. This revised version maintained the same 21 categories and Likert-type rating procedure, with each item being scored from 0 to 3, and the same total score range from 0 to 63, obtained by summing up individual item scores. The cut-off scores of both versions were identical and the following levels proposed: < 10 points indicated None or Minimal Depression; ≥ 10 and ≤ 18, Mild to Moderate Depression; ≥ 19 and ≤ 29, Moderate to Severe Depression and ≥ 30 Severe Depression (Beck et al., 1988). The BDI-IA takes an estimated five to ten minutes to complete.

The BDI-IA exhibits good reliability (Richter, Werner, Heerlein, Kraus, & Sauer, 1998), with high levels of internal consistency for both psychiatric and non-psychiatric samples – Cronbach alphas between $\alpha = 0.86$ (Beck & Steer, 1984) and $\alpha = 0.90$ (Beck, Steer, Ball & Ranieri, 1996) for psychiatric samples, and a mean Cronbach alpha of $\alpha = 0.81$ obtained in 15 studies using non-psychiatric samples (Beck et al., 1988). Test-retest reliability showed $r \geq 0.60$, with high convergent validity for clinical assessments of depression and other depression measurement instruments – results were particularly good for psychiatric samples (Beck et al., 1988). Construct validity was evidenced by the fact that the BDI-IA exhibited the hypothesised relationships between physiological, behavioural and attitudinal variables in depression (Beck et al., 1988) and the measure's discriminant validity allowed for a

distinction between psychiatric and non-psychiatric samples. Regarding factorial validity, results were controversial because even though multiple studies (Clark, Cavanaugh, & Gibbons, 1983; Richter et al., 1998) stated the BDI-IA represents a single underlying general syndrome of depression, there was less consensus regarding its number of factors – between one and nine factors were found (Richter et al., 1998), though the majority of the studies propose three factors (Beck et al., 1988). Beck and Lester (1973), together with Tanaka and Huba (1984), considered these three highly interrelated factors to be Negative Attitudes towards the Self, Performance Difficulties and Somatic Disturbances (Beck et al., 1988).

In 1996 the BDI was revised to the latest version of the instrument, the BDI-II (Smarr, 2003). This revision sought to make the BDI-II an instrument more consonant with DSM-III-R and DSM-IV criteria, which led to items such as Weight Loss, Body Image Change and Somatic Preoccupation being substituted by the items Agitation, Concentration Difficulty and Worthlessness (Beck et al., 1996).

For this study, because a Portuguese version of the BDI-II did not exist at the time of the data collection, an unpublished 1990 Portuguese version of the BDI-IA, developed by Cláudio**,** tested and validated using a sample of 1500 students (Claudio, 2004) was used (see Appendix 4). This version was chosen over a previous adaptation of the original version of the BDI (Vaz Serra & Abreu, 1973) because of the limitations of the BDI's initial version. Other options existed, such as the Center for the Epidemiologic Studies of Depression Scale (CES-D), which has been translated and validated for the Portuguese population (Gonçalves & Fagulha, 2004) and could have been used as an alternative to measure the depressive symptomatology. However, because a majority of the studies with similar objectives and methodology used the

BDI (Johannessen & Berntsen, 2010; Sumner et al., 2010), it was chosen here to facilitate comparisons across studies.

A recent unpublished thesis (Pereira, 2012), when assessing Claudio's BDI-IA version in a community sample (N = 281), found a Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO) of 0.93 which, according to Hutcheson and Sofroniu (1999), is a superb value for factor extraction since it yields distinct and reliable factors (Field, 2009). Thus, after a component factor analysis was performed, and considering the eigenvalue rule (Kaiser, 1960 cit by Devellis, 2012), a three-factor solution was found which is consistent with previous studies indicating Negative Attitudes towards the Self, Performance Difficulties and Somatic Disturbances as the three factors of the BDI-IA (Beck & Lester, 1973; Beck et al., 1988; Tanaka & Huba, 1984). The assessment of reliability via internal consistency analysis produced a good Cronbach alpha value, $\alpha = 0.90$, for the overall score of the scale (Pereira, 2012).

An analysis of the psychometric properties of the BDI-IA for the current study (N = 71 with the inclusion of participants that did not satisfy the BDI criteria for either group), replicated good internal consistency for the first and second sessions – Cronbach $\alpha = 0.82$ and Cronbach $\alpha = 0.85$, respectively. Test-retest reliability, with a mean interval of 46 days, was conducted as a further analysis of reliability, and an adequate result was obtained, with $r = 0.66$ ($p < .001$).

Despite its worldwide use, there are several limitations transversal to all versions of the BDI (Hagen, 2007), which will be reflected on in Chapter 13.

7.4.3. State-Trait Anxiety Inventory (STAI) – Y Form

The STAI is a self-report measure, published by Spielberger in 1970, which assesses the severity of feelings of anxiety (McDowell, 2006). It establishes a distinction between state anxiety, which refers to transitory anxiety levels that involve unpleasant feelings of tension and apprehensive thoughts, and trait anxiety, which evaluates a more general tendency for "anxiety proneness" and perceiving situations as threatening (Julian, 2011; Kennedy, Schwab, Morris, & Beldia, 2001). The STAI's first version was entitled STAI-X and composed of two sub-scales, one to measure state anxiety and the other to measure trait anxiety, each containing 20 items, five of which were common to both sub-scales (McDowell, 2006). The STAI-X was later revised due to its poor discrimination between anxiety and depression and questionable factor structure. This revision led to a change in 12 of the 40 original items, thus creating the currently used STAI-Y, published in 1983 (McDowell, 2006).

The STAI-Y, like its predecessor, is composed of two sub-scales, a State Anxiety (S-Anxiety, henceforth referred to as STAIS), and a Trait Anxiety Scale (T-Anxiety, henceforth referred to as STAIT) (Julian, 2011). Whereas the instructions of the STAIS sub-scale refer participants to the present moment, those of the STAIT focus on how individuals usually feel (see Appendix 5). Both sub-scales have 20 items each, with 0-4 response options. In the STAIS scale they are: Not at all; somewhat; moderately so; and very much so. For the STAIT scale the response options are almost never; sometimes; often; and almost always (Julian, 2011). These response options are scored differently because 19 of the 40 total items are reversed items. Total scores for each sub-scale range from 20 to 80, with higher scores indicating greater levels of anxiety (Julian, 2011). A cut-off point of 39-40 has been suggested for clinically

significant symptoms in the STAIS Scale. The estimated time to apply the STAI-Y Form is 10 minutes.

Multiple studies have found high values of Cronbach alpha for the STAI-Y in different populations, thus demonstrating its strong internal consistency (McDowell, 2006). Cronbach alpha values ranging between $\alpha = 0.81$ and $\alpha = 0.95$ were found for the STAIS Scale in studies using student, community and clinical samples, whereas corresponding values for the STAIT Scale varied between $\alpha = 0.67$ and $\alpha = 0.92$ (McDowell, 2006). The correlation between both sub-scales varied from sample to sample (Kennedy et al., 2001) and test-retest reliability, with a 30-day interval, showed results between $r = 0.34$ and $r = 0.62$ for the STAI-S Scale and between $r = 0.71$ and $r = 0.75$ for the STAIT Scale (McDowell, 2006). Content validity assessments showed that five of the eight symptoms of Generalised Anxiety Disorder in the DSM-IV were obtained using the STAI-Y. Convergent validity analyses showed correlations between the STAIS Scale and the Beck Anxiety Inventory varying between $r = 0.47$ and $r = 0.64$ (McDowell, 2006). The STAIT Scale exhibited correlation values ranging from 0.44 and 0.68 for the Beck Anxiety Inventory (McDowell, 2006). As for discriminant validity, whereas in neuropsychiatric groups the mean average scores were higher than those obtained by the general population (McDowell, 2006), in a study of mixed diagnosis psychiatric outpatients the STAIT Scale was the only sub-scale that enabled discrimination between individuals with and without an anxiety disorder (Kabacoff, Segal, Hersen, & Van Hasselt, 1997).

The factorial validity of the STAI-Y was better than that of the STAI-X, with multiple studies finding four factors. These factors represented the differences between the STAIS Scale and the STAIT Scale, as well as the differences between positively

and negatively worded items (Bernstein & Eveland, 1982; McDowell, 2006; Vagg, Spielberger, & O'Hearn, 1980).

For the current study we used the Portuguese version of the STAI-Y Form, translated and adapted by Silva and Campos (1998). The Depression Anxiety Stress Scale (Lovibond & Lovibond, 1995), which has been translated and validated for the Portuguese population (Pais-Ribeiro, Honrado, & Leal, 2004a; Pais-Ribeiro, Honrado, & Leal, 2004b) was a possible alternative for the measurement of anxiety, but the STAI's status as one of the most widely researched and used measures (Grös, Antony, Simms, & McCabe, 2007) together with its simple and fast procedure, led to its choice.

Silva and Campos (1998), using a sample of university students (N = 701), found an item-total correlation of r = 0.77 for STAIS and r = 0.74 for STAIT. Cronbach alphas of $\alpha = 0.89$ and $\alpha = 0.91$ were obtained for STAIS scores of male and female university students respectively, and a Cronbach alpha of $\alpha = 0.90$ was found for STAIT scores in both male and female university students (Silva & Campos, 1998). Test-Retest reliability, involving a 60-day interval, was tested in a group of psychology students (N = 86), with r = 0.59 for STAIS and r = 0.80 for STAIT (Silva & Campos, 1998).

In the current study (N = 71), analyses of the translated version of STAI-Y form showed good internal consistency, as Cronbach alpha for the STAIS was $\alpha = 0.89$ for both sessions. Test-retest reliability, with a mean interval of 46 days, was conducted as a further analysis of reliability, with $r = 0.54$ ($p < .01$). For the STAIT, the Cronbach alpha in both sessions was also good - $\alpha = 0.90$ and $\alpha = 0.93$ for the first and second session, respectively. Test-retest reliability, with a mean interval of 46 days, was adequate, as $r = 0.67$ ($p < .01$).

7.4.4. Three Step Structured Diary Questionnaire

The initial version of the Three Step Structured Diary Questionnaire was first used by Berntsen (1996). This initial version consisted only of two steps: (a) the recording of keyword phrases along with the completion of a pre-specified subset of questions for involuntary representations; (b) the completion of the remaining questions involving the involuntary representations. Neither future events nor voluntary word cued events were included in this study (Berntsen, 1996). In 1998, Berntsen compared the results obtained in the 1996 study with those from a voluntary memory task, thus setting the stage for comparisons between voluntary and involuntary memories (Berntsen, 1998). A study ensued (Berntsen & Hall, 2004) where such comparisons were performed in a single sample, which required the addition of a third and final step to the methodology – the recording of a voluntary memory for every involuntary memory produced. These voluntary memories were triggered by cues present in the notebook and, after a voluntary representation was recorded, participants were required to answer a set of questions similar to those asked for involuntary representations.

In recent years, several studies have adapted the Three-Step Diary Questionnaire. Berntsen and Jacobsen (2008) introduced a new temporal framework when they compared past and future involuntary MTT experiences and Watson et al. (2012) used the questionnaire to compare involuntary and voluntary past MTT events of different groups of individuals (depressed vs. never-depressed individuals). In Study 1, past and future, voluntary and involuntary representations of dysphoric and normal mood individuals were compared, thus incorporating into one study elements that, at the time, had only been explored separately, and by different studies. In this

study, a back translation of Berntsen and Jacobsen's (2008) version of the questionnaire was performed. Three PhD students, PI included, individually performed a forward translation of the questionnaire to Portuguese. Then, once unanimous agreement was reached about a final version of the Portuguese translation, a back translation into English was performed by a fourth PhD student. The English version obtained was near identical to the original.

Two changes were made to the questionnaire used by Berntsen and Jacobsen (2008). The first concerned question 12, which refers to mood impact. In Berntsen and Jacobsen (2008), participants were asked if the representation had impacted their mood and, if so, whether that impact was positive, negative or neutral. We further developed this question by allowing participants to go beyond mood impact valence and to state whether they had experienced an emotion, naming it (see Table 3 or Appendix 6).

The second change concerned the introduction of an additional question (Question 21) at the end of the questionnaire that sought to identify the perspective associated with the representation. Recent versions of the questionnaire have already incorporated this variable (Watson et al., 2012) but the present thesis used Nigro and Neisser's (1982) exact wording.

In the Three Step Structured Diary Questionnaire each question measures a different variable of the participant's recorded event and there is no total score (see Table 3 below for all the questions and Appendix 6 for the questions as presented in the notebook format). The translated version used for Studies 1 and 2 has a total of 21 questions per past and future involuntary representation, followed by a smaller subset of 13 of those questions (question 7 and questions 10-21) for each past and future voluntary representation. Seven questions are open-ended questions, one is a partially

categorised question, and the remaining questions are closed questions. Of these, questions 4, 5, 11, 14-18 involve Likert-type scoring, ranging between 1 and 5 or -2 and 2. Questions 10 and 13 are dichotomous and questions 9 and 12 are categorical. Questions 19 and 20 are numerical. The wording for questions of past and future representations is similar, the only difference being the verb tense.

After the participant records an involuntary event and answers the questions, a cue word is presented in the notebook to trigger a voluntary representation of an event. The notebook possessed a total of 14 cue words, arrayed in the following predefined order for both past and future MTT: *Joy, Water, Loneliness, Happiness, Pen, Sadness, Intelligence, Chair, Illness, Love, Shoe, Fear, Friendship, Table* (in English translation). These 14 nouns – five positive, five neutral and four negatively valenced – were selected from Claudio's (2004) autobiographical memory test, which comprised a total of 30 nouns, 10 of which were positive, 10 were negative and 10 neutral. The 14 nouns chosen were those that elicited a higher mean average of responses from both non-depressed and depressed participants, with fewer missing values (Cláudio, 2004). They were sequenced so that cue valence repeatedly alternated, thus avoiding possible contamination effects (Cláudio, 2004). Verbal instructions and four verbal examples, one for each type of MTT, were provided to participants during the first session, with the two example cue words being *Rain* and *Door* (in English translation).

Table 3. Questions presented for each MTT event produced in the notebook

Question	Type of retrieval involved
* 1. Where were you when the past/future event came to your mind?	Involuntary only
* 2. What were you doing?	Involuntary only
* 3. Did you think of something else while you were doing this?	Involuntary only
* 4. Was your attention concentrated on certain tasks or thoughts? (1 = ‘‘strongly unconcentrated”; 5 = ‘‘strongly concentrated”)	Involuntary only
* 5. How was your mood (-2 = ‘‘very poor”; 0 = “neutral”; 2 = ‘‘very good”)	Involuntary only
6. Describe in your own words the situation in which the past/future event came to mind	Involuntary only
* 7. Describe the past/future event.	Voluntary and Involuntary
8. Compare the content of the future event representation with what had taken place in your thoughts and surroundings right before the future event came to your mind. Did anything in your surroundings, or anything in your activity, attention, or what had been on your mind repeat itself in the representation of the future event? Check the most salient commonalities (person(s)/place/sensory experience/object/ feeling/life theme/ theme/activity/wording/other/no commonalities).	Involuntary only
9. Were the commonality/ies present in your external/physical surroundings or only present in thought?	Involuntary only
10. Does this past/future representation refer to a particular episode in your future? (yes/no)	Voluntary and Involuntary
* 11. How vivid is the past/future event representation? (1 = ‘‘cloudy and imageless”; 5 = ‘‘as clear and vivid as if it was experienced again”).	Voluntary and Involuntary
* 12. Did the past/future event representation affect your mood? (positive/negative/no impact). If it did affect your mood, which of the following emotions did it cause (joy/sadness/disgust/anger/fear/Other – which other?)	Voluntary and Involuntary
* 13. Did you react physically in response to the past/future event representation– for example by talking to yourself, smiling, crying, shivering, palpitation, laughing, hitting things etc. (yes/no/ if yes, please write how).	Voluntary and Involuntary
14. Have you previously thought about this past/future event representation? (1 = ‘‘never”; 5 = ‘‘very often”)	Voluntary and Involuntary
15. Is the past/future representation about an event that was/will be central to your life story? (1 = ‘‘not central to your life story”; 5 = ‘‘very central to your life story”).	Voluntary and Involuntary
16. Is the positive/future representation about an event that was/will be central to your identity? (1 = ‘‘not central to your identity”; 5 = ‘‘very central to your identity”).	Voluntary and Involuntary
* 17. Is the remembered/imagined past/future event positive or negative (-2 = ‘‘very negative”; 0 = “neutral”; 2 = ‘‘very positive”).	Voluntary and Involuntary
* 18. Is the remembered/imagined past/future event an emotionally intense situation (1 = ‘‘without intensity”; 5 = ‘‘very intense”).	Voluntary and Involuntary
* 19. In roughly how long time was the remembered/imagined future event in your consciousness? Provide your best estimate in seconds: _____or minutes _____.	Voluntary and Involuntary
20. How old are you in the imagined future event? (age in years).	Voluntary and Involuntary
21. Think again about the past/future event representation you remembered/imagined. Select which of the following options better translates how you viewed this past/future event and answer the question of the option selected: A – In your past/future event representation you remember/imagine the scene as an observer might see it. Such an observer would see you as well as other aspects of the situation. If this perspective is appropriate, what is the position from which the scene is being observed (from behind you, above you, in front of you, etc.)? B – In your past/future event representation you remember/imagine the scene from your original point of view, not as an external observer would see it. If this perspective is appropriate, what parts of the scene are “visible”? N – Neither of the above perspectives fits your past/future event representation. If this is the case, how would you describe your visual perspective of the past/future event?	Voluntary and Involuntary

This questionnaire was chosen for several reasons. It allows researchers to obtain voluntary and involuntary MTT events together with their phenomenological characteristics and context. These data facilitate comparisons between different types of MTT (Ball & Little, 2006). Furthermore, the current research design enables between- and within-group comparisons regarding information obtained in a naturalistic context, as events are recorded in a timeframe close to their occurrence. Real-life occurrences are hence captured and, although more vulnerable to extraneous influences comparatively to controlled settings, they allow the researcher to witness everyday processes, which may prove relevant for theory development. Finally, the use of the three-step procedure minimises the influence of voluntary recall processes on involuntary retrieval, which is important to allow a clearer understanding of the differences between both.

7.5 Ethical Considerations

The study was approved by the Research Ethics Committee of the School of Health in Social Sciences of the University of Edinburgh, by ISPA-IU and by ISPA's Psychology Lab in Portugal (see Appendix 7).

Participants were provided with a clear and detailed document of informed consent as well as an information sheet (see Appendices 8 and 9). All eligible subjects had a minimum of 24 hours to decide upon participation. Confidentiality was ensured by attributing to each participant's data a number and by storing all data, physical and electronic, in secure locations – physical data were stored in a locked cabinet at the

Health Psychology Research Unit in ISPA-IU, and electronic data were safeguarded by a password-protected computer.

Participants did not receive any form of payment nor were they given course credits for their contribution to the study. Participants were fully informed that they could end their participation at any moment. In the information sheet, they were provided with full contact information of the PI, the research collaborator and the primary supervisor.

7.6. Statistical Procedures

Sociodemographic variables were examined using *t tests* and Pearson's *chi-square* tests for between-group comparisons. When applicable, 95% confidence intervals are presented, and in situations of non-normal distribution, bias-corrected and accelerated bootstrap confidence intervals (BCa) are presented, as they produce better estimates. Mixed-design ANOVAs were applied to analyse the results of both the clinical measures as well as the variables of relevance respecting both studies' hypotheses. In all mixed-design ANOVAs, participant group (normal mood vs. dysphoric mood) was the between-group factor, and temporality (past vs. future) or/and type of retrieval (voluntary vs. involuntary retrieval) were within-group factors. For all statistical analyses Levene's test of homogeneity was used, with the median as a reference whenever possible, given that it constitutes a more robust measure (Field, 2013). Because in Study 1 there was a considerable discrepancy between the participant groups' sample sizes, the situations where the assumption of homogeneity of variance was not satisfied were addressed in the respective Tables describing the

analyses. Significant interaction effects deriving from omnibus ANOVAs were investigated using Bonferroni adjusted pairwise comparisons. Since data derived from multiple observations from each participant, individual event records were not treated as independent observations, meaning analyses were based on the means registered by each participant for the variables of interest.

Post-hoc ANCOVAs were performed to complement the mixed-design ANOVAs addressing all hypotheses. In these post-hoc analyses the within-group factors of temporality (past vs. future) and type of retrieval (voluntary vs. involuntary) were upheld but participant groups were disaggregated, meaning no between-group factors were used. Instead, the participants' BDI-IA score (averaged across both sessions) was used as a covariate, to allow for depressive symptomatology to be assessed as a continuous variable. This average score was used because, compared to a single time-point measurement, it better represented the participants' depressive symptomatology across the protracted diary task. As suggested by Schneider, Avivi-Reich and Mozuraitis (2015), the presence of within-group factors in this quasi-experimental design meant the covariate had to be centred across all participants.

In Hypotheses 1, 3, 4 and 5, analyses involved mean proportions instead of mean totals. The objective was to control for differences in the number of MTT events produced under different temporality and retrieval conditions (see Table 6 in Subsection 8.3), while enabling comparisons with similar studies.

7.6.1. Effect sizes

Between-group analyses performed via *t* tests led to the calculation of Hedge's *g* (Borenstein, Hedges, Higgins, & Rothstein, 2009) instead of Cohen's *d* (provided in

appendixes) or Glass's Δ. The rationale underlying this option was twofold: first, Cohen's *d* provides a biased estimate of the population effect size, which is corrected in Hedges'*g*. Although the difference between both is very small, particularly for sample sizes above 20, the fact that Hedge's *g* is more accurate warrants its application in between- and within-group differences (Cumming, 2012; Läkens, 2013); second, Hedge's *g* is better suited for comparisons involving different sized groups, as it uses a weighted and pooled standard deviation for its calculations (Ellis, 2010).

Additionally, in situations of heterogeneity of variance, the calculation of Hedges'*g* becomes biased, as its assumes homogeneity. Thus, additional care is taken in the extrapolation of conclusions in these scenarios. All of the above mentioned effect size calculations were performed using the ESCI software.

In situations where ANOVAs are described, two effect sizes are presented: the partial eta squared (η_p^2), and the generalised eta squared (η_g^2). The partial eta squared (η_p^2) is also presented in situations where ANCOVAs are described. According to the relevant literature, the use of partial eta squared to compare effect sizes between different studies should only occur when said studies follow similar experimental designs (Läkens, 2013; Olejnik & Aljina, 2003). In face of this limitation, a possible alternative is the generalised eta squared (η_g^2), which by excluding variation from other factors in effect size calculations, makes effect sizes comparable across different designs. Consequently, and as recommended by Läkens (2013), both effect sizes are presented. Additionally, when interpreting the results, it is of import to take into consideration that both the partial and generalised eta square effect sizes constitute uncorrected effect size estimates, limited to an estimation of the amount of variance explained by the sample, not the population. These limitations were not addressed in

the present thesis, as the adequate alternative, partial omega squared (ω_p^2), involves exceedingly complex calculations when applied to designs such as those in this thesis (Läkens, 2013).

7.6.2. Missing data

As three of the five hypotheses being tested in both studies involved variables of a categorical nature, namely degree of specificity (specific, extended, categoric) in Hypothesis 1, presence or absence of physical and mood reactions in Hypothesis 3, and visual perspective (field, observer, both perspectives, no perspective) in Hypothesis 5, no replacement of missing values was required.

As for Hypothesis 2, referring to the mean ratings (1 to 5) of centrality to life and identity attributed to the MTT events produced, and Hypothesis 4, respecting the valence scores (-2 to +2) attributed to these events, their missing values amounted to 1.39% of the answers provided in the respective datasets in Study 1. Given the limited impact of missing values in both variables, evidenced by their low percentage overall; the nature of the datasets, whereby semantic associates were also coded as missing values; and the option for a coherent treatment of the different data, missing values in Hypotheses 2 and 4 were not estimated.

7.6.3. Criteria for the coding of eligible MTT events

In all hypotheses, eligible MTT events did not include semantic associates or omissions (blank responses). There are two stances in the literature regarding what can be considered as an autobiographical event and, subsequently, how to evaluate its level of specificity (see Chapter 3 for further details). One includes omissions and semantic

representations as valid items, to be considered in the calculation of the proportions of specific, extended, and categoric events. This is supported by studies arguing that semantic associates constitute a macro level of overgenerality and should thus be considered, along with omissions, under the category of general events, as their existence may derive from attempts to avoid the recollection of specific events (Raes, Hermans, Williams, Demyttenaere et al., 2006; Raes, Hermans, Williams, & Eelen, 2007). A second stance proposes the exclusion of semantic associates and omissions. It is this latter approach that was adopted in the current thesis due to: (1) the clear predominance of studies adopting this stance (Raes et al., 2007), which increases the pool of viable studies for comparison; (2) the fact that if omissions were to be included as MTT events, their usefulness would be limited to Hypothesis 1. In the remaining hypotheses omissions could not be considered, as the participants' failure to produce a MTT event in the notebook meant no ratings or answers were provided to questions regarding said event, which in turn meant missing values in the variables of interest. Consequently, semantic associates and omissions are only addressed in Section 8.3 and Table 6, with the purpose of informing the reader of their frequency in Study 1.

7.6.4. Hypothesis testing in general

When testing the hypotheses of Study 1, two different sets of information are provided. The first, concerns all the MTT events produced by the participants, meaning that specific, extended, and categoric MTT events were all analysed in relation to the variable of interest. The second set of data is a subset of the first, as it refers exclusively to MTT events classified as specific, meaning they are temporally and spatially delimited within a one-day period, while still involving the pre- and re-experience of

a MTT event.

The reason why both sets of data are presented is that each set can be considered to encapsulate a different perspective on MTT, the former taking into consideration the importance and contribution of categoric and extended forms of autobiographical representation to MTT, and the latter following a more stringent approach to the study of MTT that is restricted to the autobiographical representations that fit strict spatiotemporal specificity criteria (see Chapter 2). Both approaches have been adopted by previous studies, with the term MTT being used indiscriminately by both camps. In enabling their direct comparison, the current study also aimed to identify possible differences in the results associated with either stance.

In Study 1, the analyses of the different hypotheses focus on the results accounting for all MTT events. However, significant discrepancies with the results produced by specific MTT episodes are described. The reason for the primacy attributed to the analyses involving all MTT events is two-fold: first, it denotes, arguably, a more holistic approach, that assumes a more continuous and less categorical view of MTT, consistent with the evolution of memory systems as described in Chapter 2; second, given the relevance of an overgeneral retrieval style in depression, it was deemed adequate to account for general events and their phenomenological characteristics when analysing MTT in dysphoric and depressed individuals.

CHAPTER EIGHT – RESULTS OF STUDY 1

This chapter presents the results of Study 1, assessing MTT in dysphoric vs. normal mood participants. The sociodemographic characteristics of the participants of Study 1 (Section 8.1) and their scores on the clinical measures (8.2) will now be presented. The mean totals of MTT events, semantic associates, and omissions are described (8.3), followed by analyses of the temporal distribution of MTT events produced (8.4), and of their temporal distance in relation to the participants' age at the time of notebook completion (8.4.1). These preliminary analyses precede those testing Study 1's hypotheses (Sections 8.5 – 8.9), with Section 8.10 providing a summary of the hypotheses' testing in a table format. Section 8.11 summarises results from the post-hoc ANCOVAs.

8.1. Sociodemographic Variables

Table 4 presents age, gender, number of successfully completed education years, and history of mental health. Both groups were well matched with no statistically significant group differences across any of these variables.

Table 4. Demographic characteristics of Study 1 (means and standard deviations)

	Dysphoric group n = 17	Normal mood group n = 39	Statistical tests [a]	C.I 95% BCa	Effect Size and respective 95% C.I.
Age (years)	24.47 (6.39)	27.77 (7.97)	t=-1.51 n.s	[-7.11, 0.45]	h= -0.43 [-1.01, 0.14]
Gender (male/female)	5/12[c]	9/30[c]	χ=0.25 n.s	n.a	V=0.07
Education years [a]	14.12 (1.62)	14.62 (1.60)	t=-1.01 n.s	[-1.43, 0.41]	h= -0.31 [-0.88, 0.26]
Mental Health history [b]	5[c]	5[c]	χ=2.22 n.s	n.a	V=0.20

Notes.
[a] Refers to the number of successfully completed school years.
[b] Refers to previous/current history of psychopathology, determined by the participant having attended/attending a mental health service. No participant mentioned having been/currently being under treatment for depressive disorder.
[c] Number of participants.
n.s = not statistically significant; n.a = non-applicable.

8.2. Clinical Measures

BDI-IA and the STAI-Y Form scores obtained in the two sessions (pre- and post-notebook completion) are described in Table 5 below. As expected, there were statistically significant group differences across all clinical measures, with dysphoric mood participants showing higher levels of depression, state and trait anxiety compared to normal mood participants. Time was found to be a statistically significant main effect for the BDI-IA and the STAIT, with higher mean scores being registered in the first session compared to the second session. There were no statistically significant interactions between group and time.

Table 5. Results of the clinical measures applied in Study 1 (means and standard deviations)

	Dysphoric group n = 17		Normal mood group n = 39[a]		Main Effects and Effect Sizes		Interaction
	1st Session	2nd Session	1st Session	2nd Session	Participant Group	Time (Session)	Group*Time
BDI-IA	15.47 (5.33)	14.47 (4.27)	5.03 (2.65)	3.97 (2.56)	$F = 126.12$*** $\eta_p^2 = 0.70$ $\eta_g^2 = 0.67$	$F = 8.91$** $\eta_p^2 = 0.14$ $\eta_g^2 = 0.0064$	F =0.006 n.s $\eta_p^2 < 0.001$ $\eta_g^2 < 0.001$
STAIS	39.24 (7.12)	40.82 (6.59)	32.41 (7.27	32.24 (6.50)	$F = 19.54$*** $\eta_p^2 = 0.27$ $\eta_g^2 = 0.21$	$F = 0.31$ n.s $\eta_p^2 = 0.0058$ $\eta_g^2 = 0.0012$	$F = 0.98$ n.s $\eta_p^2 = 0.018$ $\eta_g^2 = 0.0038$
STAIT	46.35 (7.97)	46.06 (8.49)	35.97 (7.97)	32.31 (7.39)	$F = 34.32$*** $\eta_p^2 = 0.39$ $\eta_g^2 = 0.34$	$F = 4.06$* $\eta_p^2 = 0.069$ $\eta_g^2 = 0.0091$	$F = 2.94$ n.s $\eta_p^2 = 0.052$ $\eta_g^2 = 0.0066$

Notes.
[a] Only 38 normal mood participants provided all the data for the STAIS.
* $p < .05$; ** $p < .01$; *** $p < .001$; n.s = not statistically significant.

8.3. Mean Totals of MTT Events, Semantic Associates and Omissions

The mean totals of MTT events produced in the notebook task are presented in Table 6. Congruent with the rationale presented in Subsection 7.6.4, two different sets of MTT events are analysed in Table 6, one respecting all MTT events produced by participants (meaning specific, extended and categoric MTT events) and the other restricted to spatiotemporally specific MTT events. Furthermore, the mean totals of semantic associates and omissions are also analysed. Both semantic associates and omissions are excluded from all subsequent analyses in Study 1.

Three factor 2 x (2 x 2) mixed-design ANOVAs were used to perform all the analyses in Table 6. Results show that when considering all MTT events, there were statistically significant main effects of temporality and type of retrieval, with past and involuntary conditions eliciting superior mean numbers of MTT events across the participants, regardless of participant group. In the case of exclusively specific MTT events, the statistically significant main effects of temporality and type of retrieval were qualified by an interaction between these factors, $F(1, 54) = 13.56$, $p = .001$, $\eta_p^2 = 0.20$ and $\eta_g^2 = 0.022$. Subsequent post hoc analyses revealed statistically significant higher mean totals in past compared to future conditions in both voluntary and involuntary retrieval. However, when considering temporality, there were statistically significant higher mean totals in involuntary compared to voluntary conditions only in future MTT.

Table 6. Mean totals and standard deviations of all MTT events (specific, categoric, and extended), exclusively specific MTT events, semantic associates, and omissions, in accordance with participant group, temporality, and type of retrieval

	Dysphoric group n = 17				Normal mood group n = 39				Main Effects and effect sizes		
	Past		Future		Past		Future		Participant Group	Temporality	Type of Retrieval
	IV	V	IV	V	IV	V	IV	V			
All MTT	13.53 (0.72)	13.41 (0.87)	12.82 (1.47)	11.94 (2.08)	13.54 (0.91)	13.26 (1.33)	12.38 (2.22)	12.08 (2.37)	$F = 0.098$ n.s $\eta_p^2 = 0.0018$ $\eta_g^2 = 0.0010$	$F = 19.97$*** $\eta_p^2 = 0.27$ $\eta_g^2 = 0.088$	$F = 5.22$* $\eta_p^2 = 0.088$ $\eta_g^2 = 0.012$
Specific MTT	10.94 (2.41)	11.06 (1.98)	8.12 (3.43)	6.71 (3.02)	10.72 (2.88)	10.85 (2.48)	8.51 (3.14)	6.64 (2.40)	$F = 0.002$ n.s $\eta_p^2 < 0.001$ $\eta_g^2 < 0.001$	$F = 100.88$*** ↔ $\eta_p^2 = 0.65$ $\eta_g^2 = 0.25$	$F = 6.79$*↔ $\eta_p^2 = 0.11$ $\eta_g^2 = 0.016$
Semantic Associates	0.47 (0.72)	0.59 (0.87)	1.06 (1.43)	2.00 (2.12)	0.44 (0.91)	0.62 (1.23)	1.54 (2.16)	1.82 (2.28)	$F = 0.054$ n.s $\eta_p^2 = 0.001$ $\eta_g^2 < 0.001$	$F = 19.28$*** $\eta_p^2 = 0.26$ $\eta_g^2 = 0.084$	$F = 5.02$ * $\eta_p^2 = 0.085$ $\eta_g^2 = 0.011$
Omissions	0	[a] 0	0.12 (0.33)	0.059 (0.24)	0	[a] 0.13 (0.52)	0.05 (0.22)	0.077 (0.27)	$F = 0.26$ n.s $\eta_p^2 = 0.005$ $\eta_g^2 = 0.0011$	$F = 1.08$ n.s $\eta_p^2 = 0.02$ $\eta_g^2 = 0.0051$	$F = 0.32$ n.s $\eta_p^2 = 0.006$ $\eta_g^2 = 0.0015$

Notes.
All MTT = Includes all MTT events, namely specific, categoric, and extended MTT events.
Specific MTT = Includes only specific MTT events.
Semantic Associates = Representations that are either non-autobiographical or lack autonoetic re- and pre-experience.
Omissions = Blank responses/missing values.
Temporality = Past vs. Future; Type of Retrieval = Involuntary vs. Voluntary Retrieval; IV = Involuntary Retrieval; V = Voluntary Retrieval.
[a] Heterogeneity of variance.
n.s = not statistically significant. * $p < .05$, *** $p < .001$; ↔ $p < .01$ interaction involving the factors signalled.

8.4. Temporal Distribution of MTT Events

The temporal distribution of the MTT events produced by dysphoric and normal mood participants was analysed via multiple 2 x (2) mixed-design ANOVA's, with type of retrieval as the within-group factor (see Appendix 10 for all results). Five-year timeframe categories were used to aggregate events. These analyses, by allowing a comparison between voluntary and involuntary MTT events, can provide a measure of the impact that type of retrieval has on the temporal distribution of MTT experiences.

Figure 4 shows that type of retrieval was not a statistically significant main effect for the temporal distribution of past MTT. This is perceptible given the degree of overlap between the temporal frequency distributions of voluntary and involuntary events. As for participant group, it was only a statistically significant effect for MTT events dating from the participants' 16-20 years of age period, wherein dysphoric participants registered higher mean proportions of past MTT events when compared to normal mood participants, $F(1, 54) = 5.13$, $p = .027$, $\eta_p^2 = 0.087$ and $\eta_g^2 = 0.073$. This may have been a consequence of dysphoric participants' lower mean age, which implied several of their recent memories would be concentrated in the 16-20 years of age category (for related findings, see temporal distance analyses in Subsection 8.4.1).

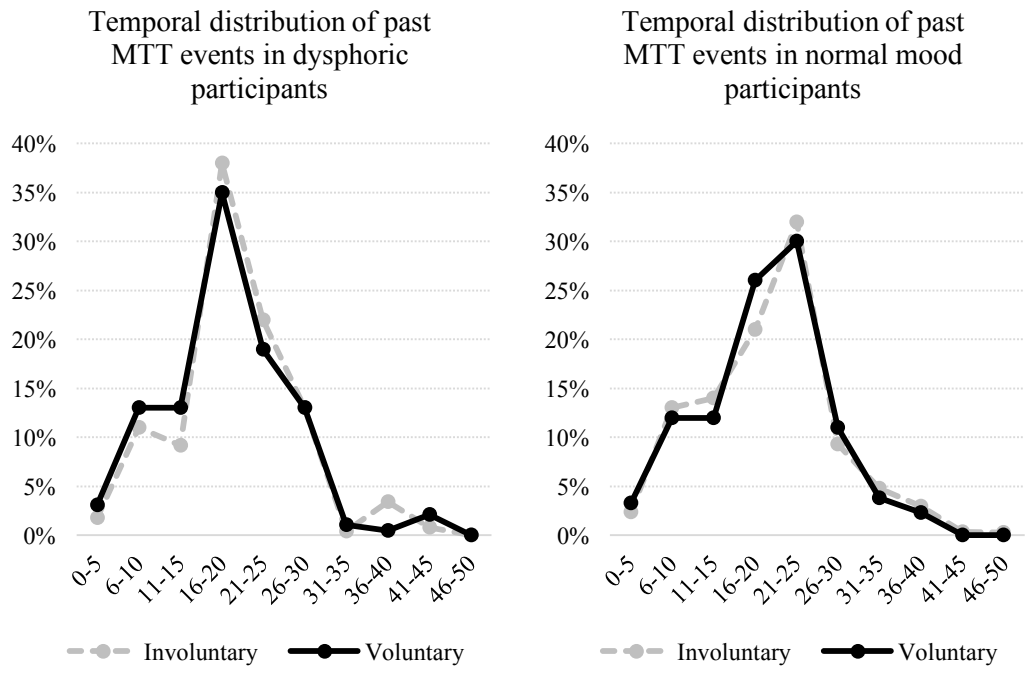


Figure 4. Temporal distribution of past MTT events (mean proportions of events from each age category) in dysphoric and normal mood participants according to type of retrieval

Figure 5, on the other hand, concerns the temporal distribution of voluntary and involuntary future MTT events, and it comprises a superior number of statistically significant main effects and interactions. Consistent with their younger age, dysphoric participants were found to produce statistically significant higher mean proportions of future MTT events dating from the 16-20 years of age category, $F(1, 53) = 5.38$, $p = .024$, $\eta_p^2 = 0.092$ and $\eta_g^2 = 0.089$. Furthermore, when considering the average age of each participant group (Table 4) with the temporal distribution of their future events (Figure 5), results seem to suggest involuntary retrieval privileges access to more recent future events. This interpretation derives from three findings: (a) normal mood participants produced higher mean proportions of future involuntary compared to voluntary events from the 21-25 years of age category, $F(1, 53) = 6.33$, $p = .015$, η_p^2

= 0.11 and $\eta_g^2 = 0.0039$; (b) dysphoric participants produced higher mean proportions of future involuntary compared to voluntary events from the 26-30 years of age category, $F(1, 53) = 4.36$, $p = .042$, $\eta_p^2 = 0.076$ and $\eta_g^2 = 0.0053$; (c) higher mean proportions of future voluntary compared to involuntary events were found for the 31-35 age range, $F(1, 53) = 4.16$, $p = .046$, $\eta_p^2 = 0.073$ and $\eta_g^2 = 0.0063$, and the 61-85 age range, $F(1, 53) = 8.24$, $p = .006$, $\eta_p^2 = 0.14$ and $\eta_g^2 = 0.072$.

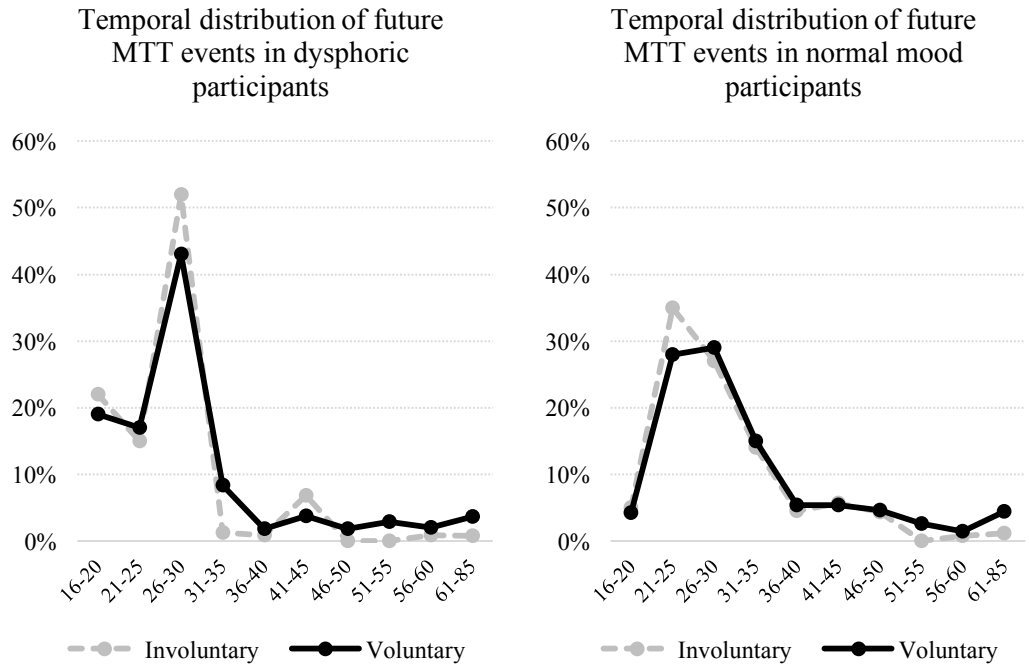


Figure 5. Temporal distribution of future MTT events (mean proportions of events from each age category) in dysphoric and normal mood participants according to type of retrieval

8.4.1. Temporal distance of MTT events

The temporal distance of MTT events concerns the difference, in years, between the participants' age at the time of the notebook task and their age when the MTT event occurred (past MTT) or is estimated to occur (future MTT). Five-year timeframes, similar to those employed for temporal distribution, were used to aggregate events, and existing data was analysed via multiple 2 x (2 x 2) mixed-design ANOVAs (see Table 7 below). Results are congruent with the interpretation that the involuntary retrieval of future MTT events, when compared to voluntary retrieval, will lead to more recent (same year) experiences being retrieved, $F(1, 53) = 16.24$, $p < .001$, $\eta_p^2 = 0.24$ and $\eta_g^2 = 0.020$. Moreover, as temporal distance increased, participants had more difficulty generating events from the distant future (>15 years) compared to the distant past.

Table 7. Mean proportions and standard deviations of the temporal distance of MTT events in accordance with participant group, temporality, and type of retrieval

	Dysphoric group n = 17				Normal mood group n = 39				Main Effects and effect sizes		
Temporal distance	Past		Future		Past		Future		Participant Group	Temporality	Type of Retrieval
	IV	V	IV	V	IV	V	IV	V			
Same year	0.36 (0.23)	0.35 (0.26)	0.75 (0.24)	[a] 0.54 (0.20)	0.29 (0.25)	0.28 (0.22)	0.70 (0.30)	[a] 0.57 (0.33)	$F = 0.49$ n.s $\eta_p^2 = 0.009$ $\eta_g^2 = 0.0049$	$F = 50.71$***♠ $\eta_p^2 = 0.49$ $\eta_g^2 = 0.24$	$F = 20.32$ ***♠ $\eta_p^2 = 0.28$ $\eta_g^2 = 0.024$
Between 2-5 years	0.31 (0.19)	0.24 (0.16)	0.13 (0.16)	0.23 (0.14)	0.27 (0.18)	0.24 (0.15)	0.17 (0.22)	0.21 (0.21)	$F = 0.002$ n.s $\eta_p^2 < 0.001$ $\eta_g^2 < 0.001$	$F = 5.40$ ** ↔ $\eta_p^2 = 0.092$ $\eta_g^2 = 0.039$	$F = 0.16$ n.s ↔ $\eta_p^2 = 0.003$ $\eta_g^2 < 0.001$
Between 6-10 years	0.18 (0.12)	0.19 (0.12)	0.071 (0.10)	0.10 (0.083)	0.12 (0.10)	0.18 (0.12)	0.071 (0.12)	0.11 (0.14)	$F = 0.86$ n.s $\eta_p^2 = 0.016$ $\eta_g^2 = 0.0044$	$F = 14.060$ *** $\eta_p^2 = 0.21$ $\eta_g^2 = 0.091$	$F = 5.18$* $\eta_p^2 = 0.09$ $\eta_g^2 = 0.018$
Between 11-15 years	[a] 0.064 (0.066)	0.088 (0.10)	[a] 0.015 (0.035)	0.054 (0.073)	[a] 0.13 (0.12)	0.11 (0.13)	[a] 0.035 (0.076)	0.042 (0.071)	$F = 2.10$ n.s ♣ $\eta_p^2 = 0.038$ $\eta_g^2 = 0.015$	$F = 16.49$***♣ $\eta_p^2 = 0.24$ $\eta_g^2 = 0.087$	$F = 1.47$ n.s $\eta_p^2 = 0.027$ $\eta_g^2 = 0.0031$
Between 16-20 years	0.068 (0.10)	0.088 (0.097)	0.0091 (0.026)	0.019 (0.043)	0.090 (0.11)	0.073 (0.092)	0.012 (0.040)	0.017 (0.050)	$F = 0.027$ n.s $\eta_p^2 = 0.001$ $\eta_g^2 < 0.001$	$F = 23.86$ *** $\eta_p^2 = 0.31$ $\eta_g^2 = 0.13$	$F = 0.35$ n.s $\eta_p^2 = 0.007$ $\eta_g^2 < 0.001$
Between 21-25 years	0.026 (0.056)	0.036 (0.061)	0	0.0053 (0.022)	0.024 (0.050)	0.038 (0.092)	0	0.0085 (0.031)	$F = 0.014$ n.s $\eta_p^2 < 0.001$ $\eta_g^2 < 0.001$	$F = 9.41$ ** $\eta_p^2 = 0.15$ $\eta_g^2 = 0.059$	$F = 2.45$ n.s $\eta_p^2 = 0.044$ $\eta_g^2 = 0.0071$
Over 25 years	[a] 0	[a] 0.011 (0.044)	0.024 (0.048)	0.048 (0.066)	[a] 0.063 (0.16)	[a] 0.074 (0.18)	0.012 (0.040)	0.052 (0.068)	$F = 1.96$ n.s $\eta_p^2 = 0.036$ $\eta_g^2 = 0.016$	$F = 0.017$ n.s $\eta_p^2 < 0.001$ $\eta_g^2 < 0.001$	$F = 8.83$** $\eta_p^2 = 0.14$ $\eta_g^2 = 0.0085$

Notes. [a] Heterogeneity of variance.
n.s = not statistically significant. * $p < .05$, ** $p < .01$, *** $p < .001$; ♣ $p < .05$ for the interaction involving the factors signalled, ↔ $p < .01$ for the interaction involving the factors signalled, ♠ $p < .001$ for the interaction involving the factors signalled;

8.5. Hypothesis 1 – Level of Spatiotemporal Specificity

Hypothesis 1 tests the level of spatiotemporal specificity exhibited by dysphoric and normal mood participants. Such testing was performed via four sub-hypotheses: Hypothesis 1a stated that past and future involuntary MTT events would be more specific/less general than their voluntary counterparts regardless of participant group; Hypothesis 1b stated that the past and future, voluntary and involuntary MTT events of dysphoric participants would be less specific/more general than the MTT events of normal mood participants; Hypothesis 1c stated that future voluntary and involuntary MTT events would be less specific/more general than their past counterparts regardless of participant group; Hypothesis 1d stated that the difference in specificity between past and future MTT events would be greater in voluntary compared to involuntary retrieval, regardless of participant group.

The analyses comprised 2 x (2 x 2) mixed-design ANOVAs using the mean proportions of specific, extended and categoric MTT events as dependent variables.

8.5.1. Mean proportions of specific MTT events

In what concerns the mean proportions of specific MTT events, analyses showed a statistically significant main effect of temporality, whereby future MTT events were less specific than past events regardless of type of retrieval and participant group – a result consistent with Hypothesis 1c. This main effect of temporality was qualified by an interaction with type of retrieval, $F(1, 54) = 13.09$, $p < 0.01$, $\eta_p^2 = 0.19$, $\eta_g^2 = 0.024$, with post hoc analyses revealing statistically significant higher mean proportions of specific events in past compared to future MTT in both voluntary and

involuntary retrieval, although differences in specificity between past and future were greater for voluntarily retrieved events regardless of group – thus supporting Hypothesis 1d. Additionally, there were statistically significant higher mean proportions of specific events in involuntary compared to voluntary retrieval but only for future MTT (see Figures 6 and 7). This result partially supports Hypothesis 1a, as involuntary future MTT events were more specific than voluntary events. However, because no such differences occurred for past MTT, Hypothesis 1a is only partially supported.

As presented in Table 8, there was no statistically significant main effect of group, meaning that contrary to Hypothesis 1b, normal mood participants were not more specific in their MTT events than dysphoric participants.

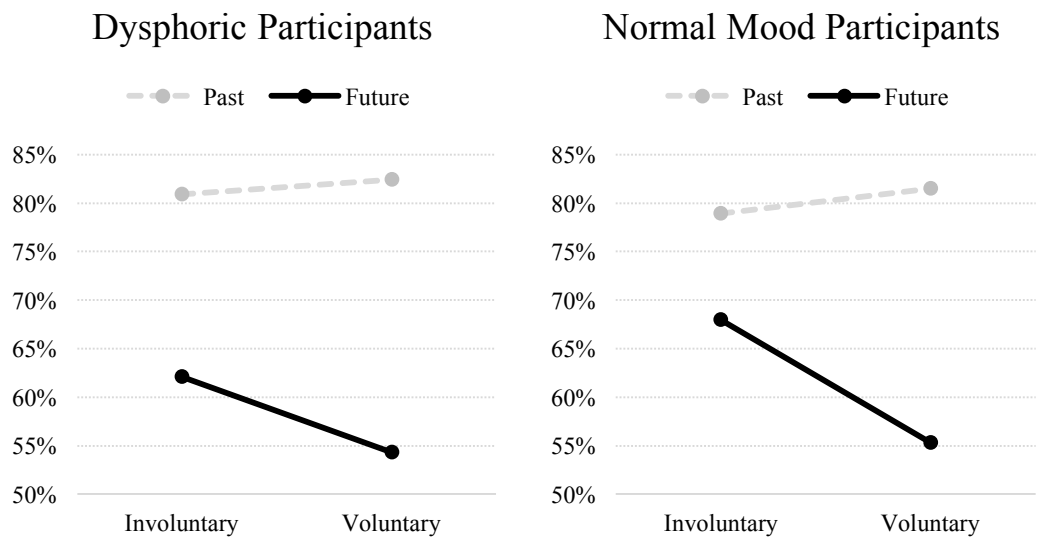


Figure 6. Interaction between temporality and type of retrieval regarding mean proportion of specific MTT events produced by both participant groups

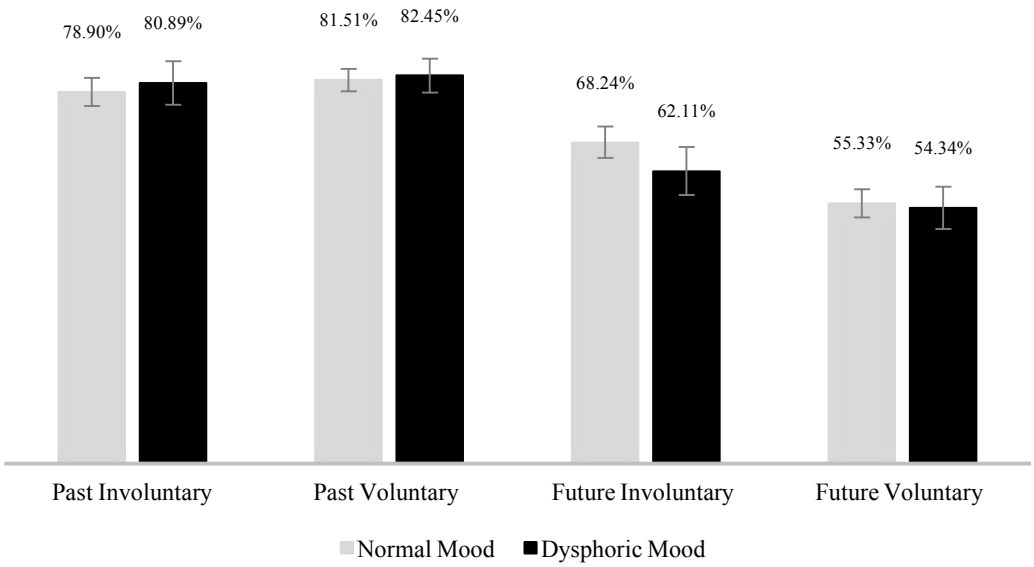


Figure 7. Mean proportions of specific MTT events in accordance with participant group, temporality and type of retrieval. Error bars represent standard errors.

Table 8. Mean proportions and standard deviations of specific, extended, and categoric MTT events, in accordance with participant group, temporality and type of retrieval

	Dysphoric group n = 17				Normal mood group n = 39				Main Effects and effect sizes		
Level of Specificity	Past		Future		Past		Future		Participant Group	Temporality	Type of Retrieval
	IV	V	IV	V	IV	V	IV	V			
Specific	.81 (.17)	.82 (.14)	.62 (.23)	.54 (.21)	.79 (.20)	.82 (.15)	.68 (.20)	.55 (.18)	$F = 0.078$ n.s $\eta_p^2 = 0.0014$ $\eta_g^2 < 0.001$	$F = 57.74$***↔ $\eta_p^2 = 0.52$ $\eta_g^2 = 0.22$	$F = 3.92$ n.s ↔ $\eta_p^2 = 0.068$ $\eta_g^2 = 0.01$
Extended	.049 (.081)	.056 (.06)	.069 (0.099)	.07 (.088)	.074 (.091)	.095 (.086)	.095 (.14)	.11 (.11)	$F = 2.54$ n.s $\eta_p^2 = 0.045$ $\eta_g^2 = 0.021$	$F = 2.10$ n.s $\eta_p^2 = 0.037$ $\eta_g^2 = 0.0063$	$F = 0.61$ n.s $\eta_p^2 = 0.011$ $\eta_g^2 = 0.0022$
Categoric	.14 (.14)	.12 (.13)	.31 (.20)	.39 (.21)	.14 (.14)	.09 (.12)	.22 (.16)	.34 (.20)	$F = 2.24$ n.s $\eta_p^2 = 0.04$ $\eta_g^2 = 0.014$	$F = 44.73$***♠ $\eta_p^2 = 0.45$ $\eta_g^2 = 0.23$	$F = 2.60$ n.s ♠ $\eta_p^2 = 0.05$ $\eta_g^2 = 0.0077$

Notes.
n.s = not statistically significant. *** $p < .001$.
↔ $p < .01$ for the interaction involving the factors signalled; ♠ $p < .001$ for the interaction involving the factors signalled.

8.5.2. Mean proportions of extended MTT events

In what respects extended MTT events, no statistically significant main effects or interactions were found (see Figure 8 and Table 8), contrary to all Hypotheses (1a, 1b, 1c, 1d).

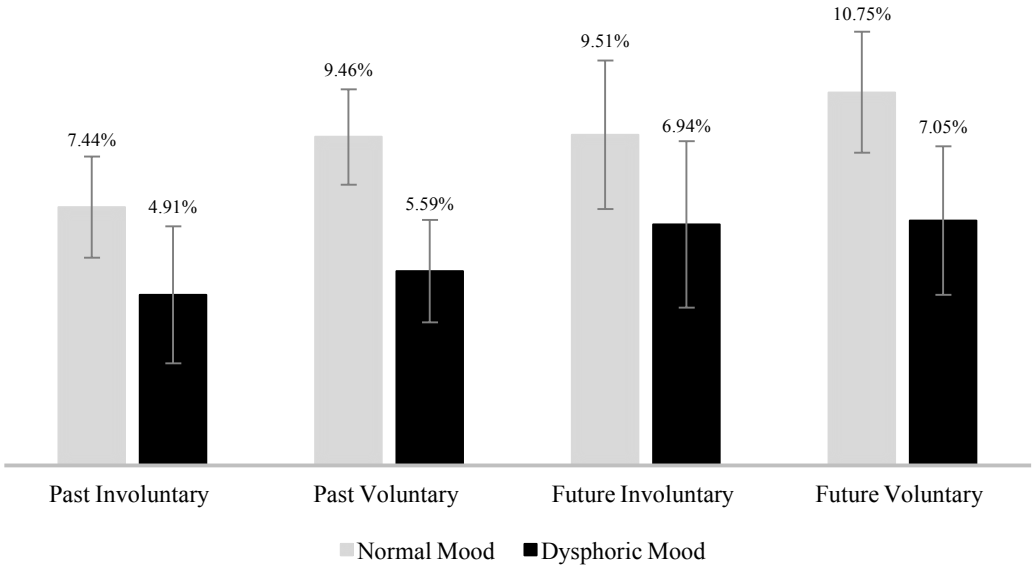


Figure 8. Mean proportions of extended MTT events in accordance with participant group, temporality and type of retrieval. Error bars represent standard errors.

8.5.3. Mean proportions of categoric MTT events

Regarding the mean proportions of categoric MTT events, analyses showed a statistically significant main effect of temporality, whereby future MTT events were more general than past events regardless of type of retrieval and participant group – a result consistent with Hypothesis 1c. This main effect was qualified by an interaction between temporality and type of retrieval, $F(1, 54) = 15.10$, $p < 0.001$, $\eta_p^2 = 0.22$, $\eta_g^2 = 0.033$. Subsequent post hoc analyses evidenced statistically significant lower mean proportions of categoric events in past compared to future MTT in both voluntary and involuntary retrieval, although differences between past and future were greater for

voluntarily retrieved events regardless of group – thus supporting Hypothesis 1d. Furthermore, as can be seen from Figures 9 and 10, only in future MTT were there statistically significant lower mean proportions of categoric events in involuntary compared to voluntary retrieval, with these results being diametrically opposite to those obtained for specific MTT events.

These findings partially support Hypothesis 1a as the transition from an involuntary to a voluntary type of retrieval in future MTT produced an increase in participants' overgenerality levels, while no similar increase occurred for past MTT. Also, as evident from Table 8, contrary to Hypothesis 1b, there was no statistically significant main effect of participant group. Taken together, the results partially supported Hypothesis 1a, did not support Hypothesis 1b, and supported Hypotheses 1c and 1d.

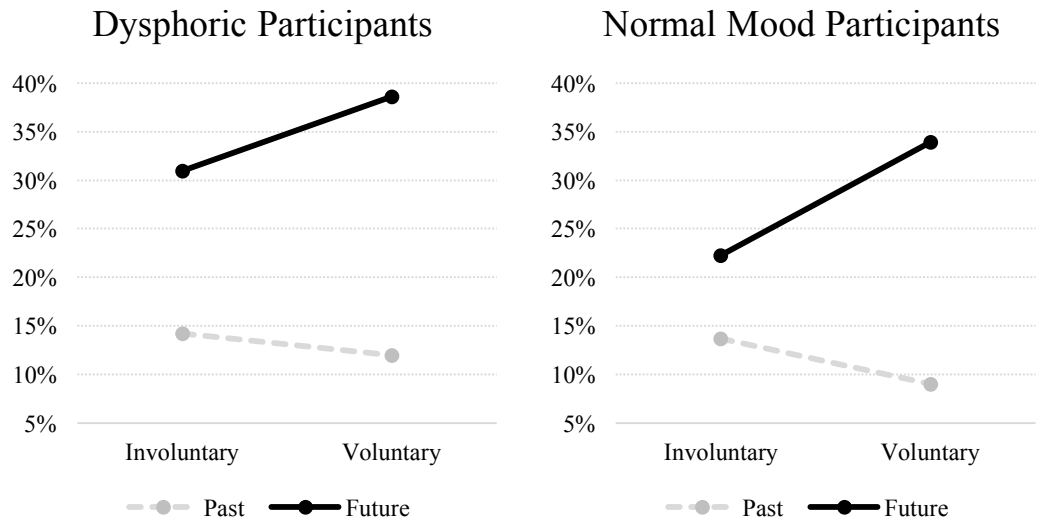


Figure 9. Interaction between temporality and type of retrieval regarding mean proportion of categoric MTT events produced by both participant groups

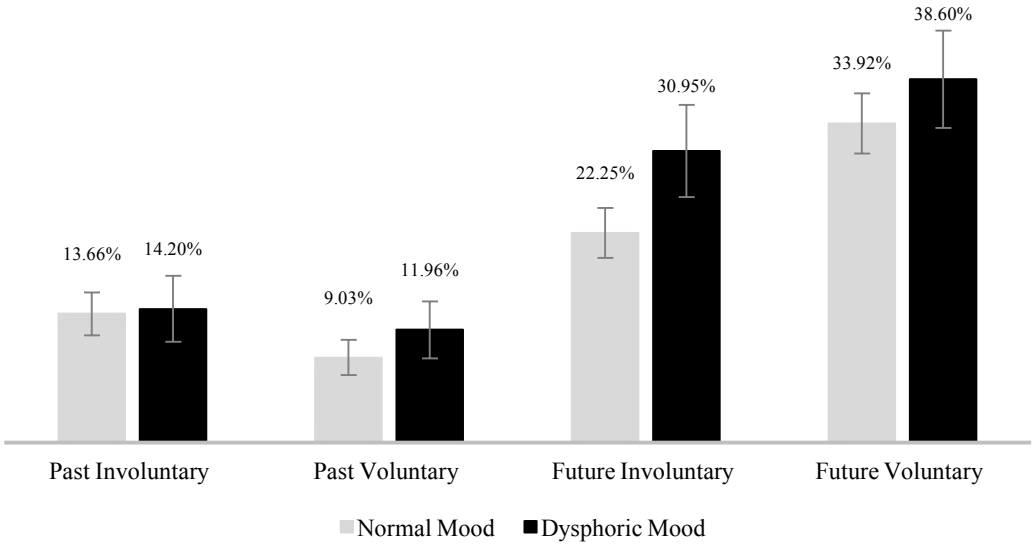


Figure 10. Mean proportions of categoric MTT events in accordance with participant group, temporality and type of retrieval. Error bars represent standard errors.

8.6. Hypothesis 2 – Self-Relevance

In assessing self-relevance, Hypothesis 2a stated that regardless of temporality and participant group, individuals would consider involuntary MTT events as less central to their identity and life story than voluntary MTT events. Hypothesis 2b proposed that future voluntary and involuntary MTT events would be more central to identity and life story than their past counterparts regardless of participant group, whereas Hypothesis 2c claimed that the difference in centrality to identity and life story between voluntary and involuntary retrieval would be greater in future compared to past MTT, regardless of participant group. To test these hypotheses, 2 x (2 x 2) mixed-design ANOVAs were performed with the mean scores of centrality to life and centrality to identity of MTT events as dependent variables. These analyses were then

performed for specific MTT events, following the rationale presented in Subsection 7.6.4.

8.6.1. Centrality to Life of all MTT events

Table 9 and Figure 11 show a statistically significant main effect of type of retrieval due to participants assigning higher mean scores of centrality to life to voluntary compared to involuntary MTT events, thus supporting Hypothesis 2a. There were no statistically significant main or interaction effects of participant group and temporality, which meant Hypotheses 2b and 2c were not supported.

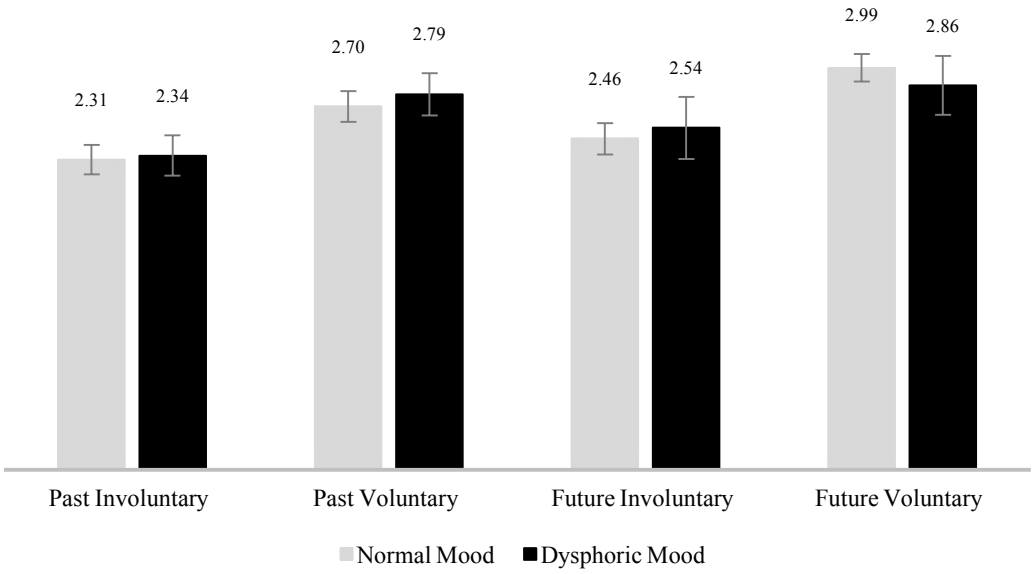


Figure 11. Mean scores for centrality to life of all MTT events, in accordance with participant group, temporality and type of retrieval. Error bars represent standard errors.

8.6.2. Centrality to Life of specific MTT events

Performing similar analyses in specific MTT events, voluntary retrieval was once more found to elicit higher mean scores of centrality to life, thus supporting

Hypothesis 2a (see Table 9). Furthermore, the difference between voluntary and involuntary retrieval was superior in future compared to past MTT, thus supporting Hypothesis 2c.

In this analysis temporality was also found to be a statistically significant main effect, with specific future MTT events being more central than specific past MTT events, a finding consistent with Hypothesis 2b.

Table 9. Mean scores (1 to 5) and standard deviations of the centrality to identity and centrality to life of all MTT events and of exclusively specific MTT events, in accordance with participant group, temporality, and type of retrieval

	Dysphoric group n = 17				Normal mood group n = 39				Main Effects and effect sizes		
	Past		Future		Past		Future		Participant Group	Temporality	Type of Retrieval
	IV	V	IV	V	IV	V	IV	V			
Centrality Life All MTT	2.34 (0.61)	2.79 (0.64)	2.54 (0.94)	2.86 (0.92)	2.31 (0.68)	2.70 (0.62)	2.46 (0.73)	2.99 (0.64)	F = 0.01 n.s $\eta_p^2 < 0.001$ $\eta_g^2 < 0.001$	F = 3.73 n.s $\eta_p^2 = 0.065$ $\eta_g^2 = 0.013$	F = 50.72 *** $\eta_p^2 = 0.48$ $\eta_g^2 = 0.069$
Centrality Life specific MTT	2.29 (0.58)	2.73 (0.62)	2.31 (1.02)	2.98 (0.91)	2.23 (0.71)	2.64 (0.69)	2.40 (0.71)	3.07 (0.86)	F = 0.003 n.s $\eta_p^2 < 0.001$ $\eta_g^2 < 0.001$	F = 4.27 * $\eta_p^2 = 0.073$ $\eta_g^2 = 0.018$	F = 51.35 *** $\eta_p^2 = 0.49$ $\eta_g^2 = 0.10$
Centrality Identity All MTT	2.07 (0.60)	2.55 (0.66)	2.30 (0.93)	2.65 (0.91)	2.06 (0.69)	2.41 (0.74)	2.18 (0.77)	2.62 (0.75)	F = 0.18 n.s $\eta_p^2 = 0.0034$ $\eta_g^2 = 0.0024$	F = 3.02 n.s $\eta_p^2 = 0.053$ $\eta_g^2 = 0.011$	F = 66.61 *** $\eta_p^2 = 0.55$ $\eta_g^2 = 0.06$
Centrality Identity specific MTT	2.04 (0.65)	2.47 (0.64)	2.11 (0.96)	2.84 (0.92)	1.97 (0.68)	2.36 (0.76)	2.11 (0.73)	2.65 (0.90)	F = 0.27 n.s $\eta_p^2 = 0.005$ $\eta_g^2 = 0.0031$	F = 3.81 n.s $\eta_p^2 = 0.066$ $\eta_g^2 = 0.017$	F = 92.65 *** $\eta_p^2 = 0.63$ $\eta_g^2 = 0.090$

Notes.
n.s = not statistically significant. * $p < .05$, *** $p < .001$.

8.6.3. Centrality to Identity of all MTT events

The findings exhibited in Table 9 and Figure 12 demonstrate a statistically significant main effect of type of retrieval, with participants assigning higher mean scores of centrality to identity to voluntary compared to involuntary MTT events, thereby supporting Hypothesis 2a. These results were not impacted by participant group or temporality, since both factors did not show statistically significant effects. Together with the findings for centrality to life, both sets of results do not support Hypotheses 2b and 2c.

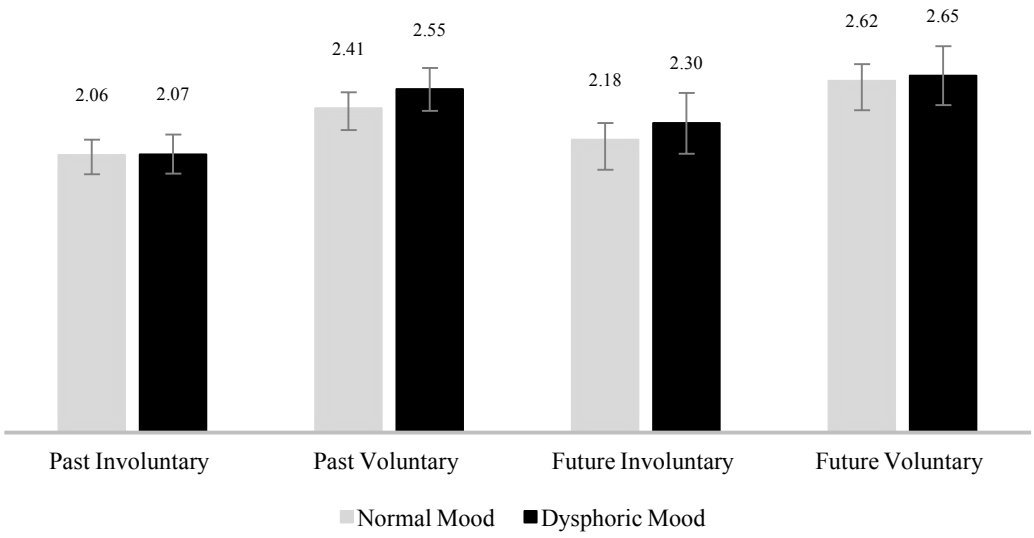


Figure 12. Mean scores for centrality to identity of all MTT events, in accordance with participant group, temporality and type of retrieval. Error bars represent standard errors.

8.6.4. Centrality to Identity of specific MTT events

Analyses of centrality to identity of specific MTT events produced similar results to those obtained for all MTT events. While voluntary retrieval was found to elicit higher mean scores of centrality to identity when compared to involuntary retrieval, supporting Hypothesis 2a, there were no statistically significant main effects

of participant group or temporality, meaning results were not consistent with Hypothesis 2b. However, similar to Centrality to Life in Specific MTT events, Hypothesis 2c was supported as the difference between voluntary and involuntary retrieval was larger in future MTT than in past MTT (see Table 9).

8.7. Hypothesis 3 –Mood Impact and Physical Reactions

Hypothesis 3 tested the physical and mood impact of the MTT events produced by dysphoric and normal mood participants. This testing was further divided into four sub-hypotheses: Hypothesis 3a proposed past and future involuntary MTT events would cause more physical reactions and mood impact than their voluntary counterparts regardless of participant group; Hypothesis 3b stated that past and future, voluntary and involuntary MTT events of dysphoric participants would cause more physical reactions and mood impact than the MTT events of normal mood participants; Hypothesis 3c proposed past voluntary and involuntary MTT events would entail similar physical reactions and mood impact to that of their future counterparts, regardless of participant group; Hypothesis 3d stated the difference in physical reactions and mood impact between voluntary and involuntary retrieval would be similar across past and future MTT, regardless of participant group.

To assess the level of impact, mixed-design 2 x (2 x 2) ANOVAs were performed using the mean proportions of MTT events with associated physical reactions and mood impact as dependent variables. Similar analyses were also performed for exclusively specific MTT events.

8.7.1. Physical Reactions in response to all MTT events

In what concerns the mean proportions of physical reactions to MTT events (see Table 10), analyses showed the existence of statistically significant main effects of temporality and type of retrieval, whereby more physical reactions were produced in association with voluntary retrieval, compared to involuntary retrieval, and in past MTT, compared to future MTT (see Figure 13). Hence, inconsistent with Hypothesis 3a, involuntary retrieval did not elicit higher mean proportions of physical reactions. Moreover, contrary to Hypothesis 3b, dysphoric participants did not register superior mean proportions of physical reactions when compared to normal mood participants. Hypothesis 3c was also not supported by the results, as the proportion of reactions to past and future events was not similar, with past events eliciting greater proportions of physical reactions. However, the gap between the physical reactions elicited by voluntary and involuntary retrieval was similar across past and future, thus supporting Hypothesis 3d.

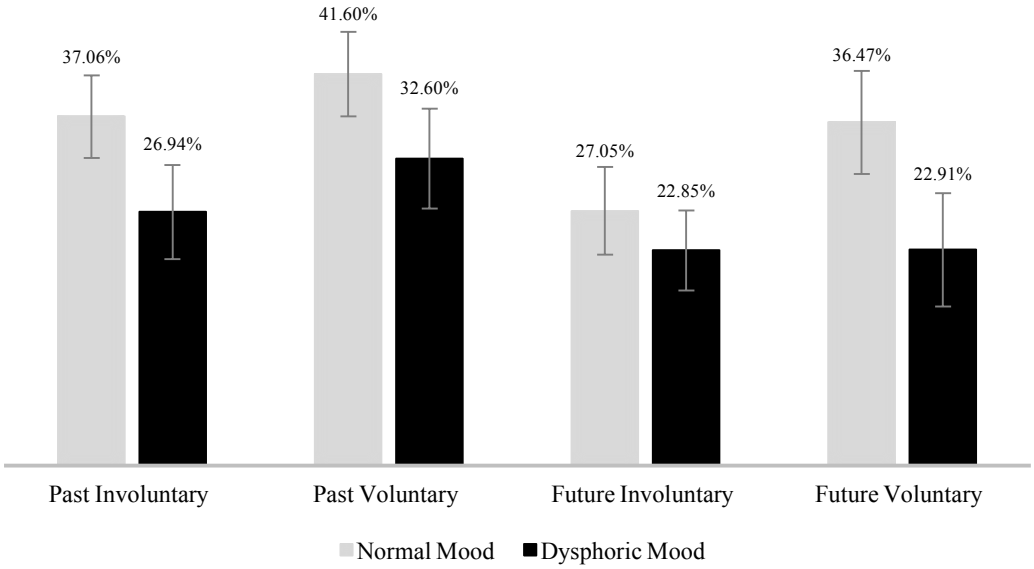


Figure 13. Mean proportions of physical reactions to all MTT events, in accordance with participant group, temporality and type of retrieval. Error bars represent standard errors.

8.7.2. Physical Reactions in response to specific MTT events

Analyses of the mean proportions of physical reactions produced in response to specific MTT events evidenced similar results to those obtained for all MTT events. There were no statistically significant group differences and more physical reactions were produced in voluntarily retrieved specific MTT events and for past MTT comparatively to involuntary and future MTT, respectively (see Table 10). Also, the gap between the physical reactions elicited by voluntary and involuntary retrieval was similar across past and future.

Table 10. Mean proportions and standard deviations of the physical reactions and mood impact associated with all MTT events and with exclusively specific MTT events, in accordance with participant group, temporality, and type of retrieval

	Dysphoric group n = 17				Normal mood group n = 39				Main Effects and effect sizes		
	Past		Future		Past		Future		Participant Group	Temporality	Type of Retrieval
	IV	V	IV	V	IV	V	IV	V			
Physical Reactions All MTT	.27 (.21)	.33 (.22)	[a].23 (.18)	[a].23 (.25)	.37 (.27)	.42 (.28)	[a].27 (.29)	[a].36 (.34)	F = 1.69 n.s η_p^2 = 0.030 η_g^2 = 0.024	F = 11.34 ** η_p^2 = 0.17 η_g^2 = 0.014	F = 4.33 * η_p^2 = 0.074 η_g^2 = 0.0067
Physical Reactions specific MTT	.27 (.20)	.35 (.24)	.25 (.25)	.27 (.29)	.36 (.27)	.43 (.29)	.28 (.32)	.38 (.36)	F = 1.15 n.s η_p^2 = 0.021 η_g^2 = 0.015	F = 5.93* η_p^2 = 0.099 η_g^2 = 0.0076	F = 6.11 * η_p^2 = 0.10 η_g^2 = 0.011
Mood Impact All MTT	.52 (.25)	.62 (.24)	.56 (.24)	.66 (.29)	.55 (.24)	.68 (.22)	.57 (.24)	.72 (.20)	F = 0.49 n.s η_p^2 = 0.009 η_g^2 = 0.006	F = 1.93 n.s η_p^2 = 0.034 η_g^2 = 0.0048	F = 23.67 *** η_p^2 = 0.31 η_g^2 = 0.050
Mood Impact specific MTT	.53 (.25)	.62 (.26)	.55 (.20)	.69 (.28)	.51 (.26)	.66 (25)	.56 (28)	.75 (.22)	F = 0.14 n.s η_p^2 = 0.003 η_g^2 = 0.0015	F = 3.45 n.s η_p^2 = 0.060 η_g^2 = 0.011	F = 23.88 *** η_p^2 = 0.31 η_g^2 = 0.068

Notes.
[a] Heterogeneity of variance.
n.s = not statistically significant. * $p < .05$, ** $p < .01$, *** $p < .001$.

8.7.3. Mood Impact of all MTT events

Respecting the mean proportions of MTT events that caused mood impact, analyses show a statistically significant main effect of type of retrieval, whereby voluntarily retrieved MTT events were associated with superior mood impact when compared to involuntarily retrieved MTT events (see Table 10 and Figure 14). Thus, results were inconsistent with Hypothesis 3a, as involuntary retrieval did not elicit higher mean proportions of mood-impacting MTT events. Furthermore, and contrary to Hypothesis 3b, dysphoric participants did not register superior mean proportions of mood-impacting MTT events when compared to normal mood participants.

Contrary to the findings involving physical reactions, temporality was not a statistically significant main effect, thus supporting the similarities proposed by Hypothesis 3c. The gap between the mood reactions elicited by voluntary and involuntary retrieval was similar across past and future, thus supporting Hypothesis 3d.

Coupled with the findings of Subsection 8.7.1 regarding physical reactions, the results do not support Hypotheses 3a, 3b, nor 3c. The latter, was supported by the results involving mood impact but not by those regarding physical impact.

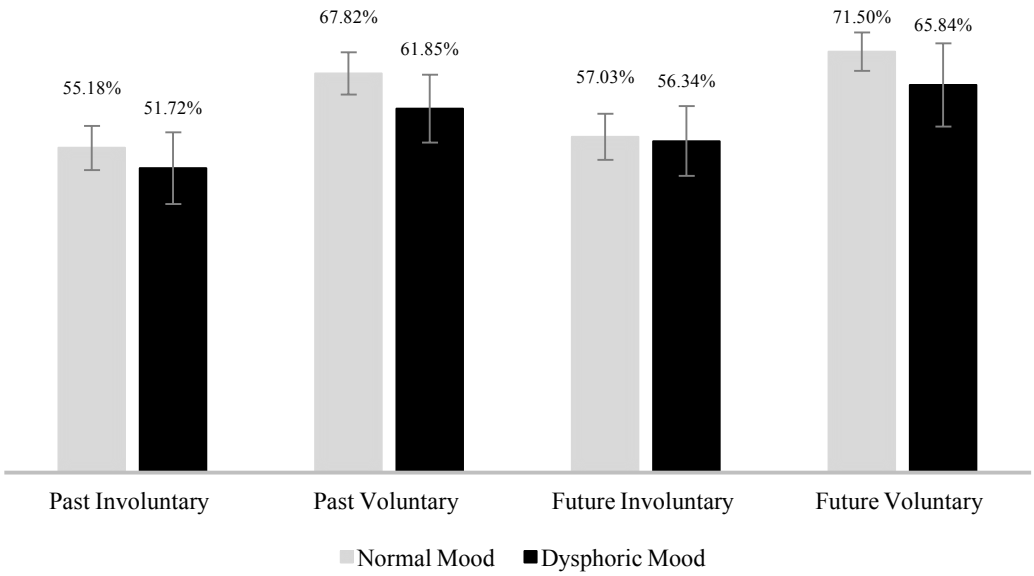


Figure 14. Mean proportions of mood reactions to all MTT events, in accordance with participant group, temporality and type of retrieval. Error bars represent standard errors.

8.7.4. Mood impact of specific MTT events

Analyses of the mean proportions of mood-impacting specific MTT events yielded similar findings to those obtained for all MTT events. More mood-impacting specific MTT events were produced in voluntary compared to involuntary retrieval, with no statistically significant main effects of participant group and temporality (see Table 10), and a similar gap between the mood reactions elicited by voluntary and involuntary retrieval across past and future.

8.8. Hypothesis 4 – Valence

Hypothesis 4 tested the valence of MTT events with four sub-hypotheses: Hypothesis 4a proposed that past and future involuntary MTT would exhibit similar mean numbers of negative events when compared to their voluntary counterparts,

regardless of participant group; Hypothesis 4b stated that dysphoric mood participants would retrieve less positive/more negative past and future, voluntary and involuntary MTT events than normal mood participants; Hypothesis 4c proposed future voluntary and involuntary MTT events would be more positive/less negative than their past counterparts, regardless of participant group; Hypothesis 4d stated the difference in valence between past and future MTT events would be greater in voluntary compared to involuntary events regardless of participant group.

Two separate 2 x (2 x 2) mixed-design ANOVAs were performed. The first mixed-design ANOVAs employed mean valence scores (-2 to +2) as the dependent variable. For the second mixed-design ANOVAs, MTT events were coded in accordance with their valence (those with a -2 or -1 score were classified as negative, those with a 0 score as neutral, and those with a +1 or +2 score as positive). This enabled the use of mean proportions of positive, neutral and negative MTT events as dependent variables in mixed-design ANOVAs, allowing for a more detailed outlook on the premises of Hypothesis 4. Similar analyses were then performed for exclusively specific MTT events.

8.8.1. Mean valence of all MTT events

The analyses of the mean valence of MTT events showed statistically significant main effects of temporality, type of retrieval, and participant group (see Table 11 and Figure 15). Involuntary MTT events had higher (more positive) mean scores than voluntary events, the same occurring for future compared to past MTT – consistent with Hypothesis 4c; Normal mood participants were found to produce higher mean scores compared to dysphoric participants – consistent with Hypothesis

4b; and the superior difference in valence between past and future voluntary compared to involuntary events was only manifest in dysphoric individuals – thus failing to support Hypothesis 4d.

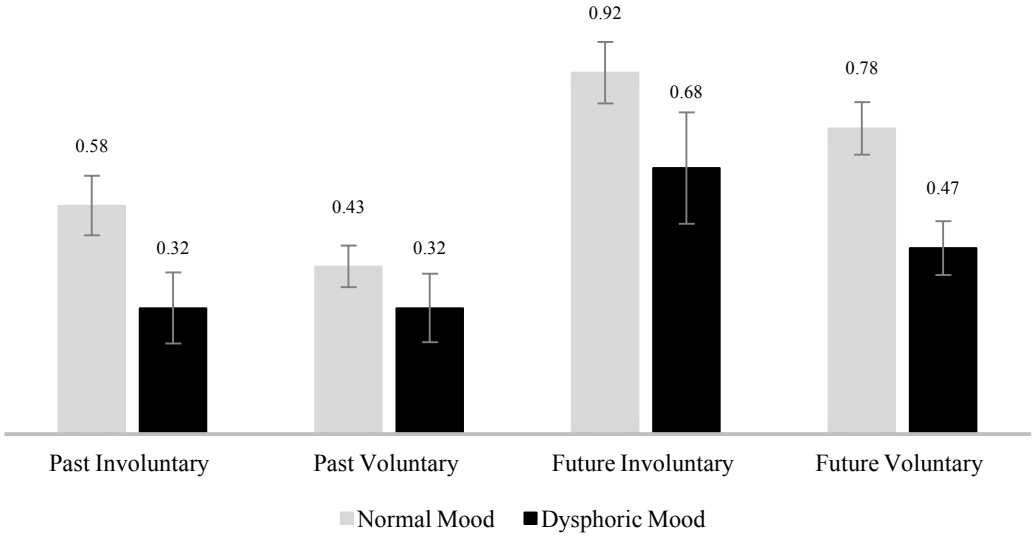


Figure 15. Mean valence scores for all MTT events, in accordance with participant group, temporality and type of retrieval. Error bars represent standard errors.

Table 11. Mean valence scores (-2 to +2) and standard deviations of all MTT events and of exclusively specific MTT events, in accordance with participant group, temporality, and type of retrieval

	Dysphoric group n = 17				Normal mood group n = 39				Main Effects and effect sizes		
	Past		Future		Past		Future		Participant Group	Temporality	Type of Retrieval
	IV	V	IV	V	IV	V	IV	V			
All MTT	0.32 (0.38)	0.32 (0.36)	0.68 (0.59)	0.47 (0.28)	0.58 (0.47)	0.43 (0.33)	0.92 (0.49)	0.78 (0.42)	$F = 7.93$** $\eta_p^2 = 0.13$ $\eta_g^2 = 0.059$	$F = 20.64$ *** $\eta_p^2 = 0.28$ $\eta_g^2 = 0.092$	$F = 5.39$ * $\eta_p^2 = 0.091$ $\eta_g^2 = 0.017$
Specific MTT	0.26 (0.44)	0.32 (0.40)	0.61 (0.54)	0.60 (0.65)	0.51 (0.56)	0.46 (0.36)	0.87 (0.59)	0.89 (0.58)	$F = 5.42$ * $\eta_p^2 = 0.091$ $\eta_g^2 = 0.040$	$F = 20.64$ *** $\eta_p^2 = 0.28$ $\eta_g^2 = 0.087$	$F = 0.007$ n.s $\eta_p^2 < 0.001$ $\eta_g^2 < 0.001$

Notes.
n.s = not statistically significant. * $p < .05$, ** $p < .01$, *** $p < .001$.

8.8.2. Mean valence of specific MTT events

The analyses of the mean valence of specific MTT events also showed statistically significant main effects of temporality and participant group, with future MTT eliciting higher mean scores than past MTT and dysphoric mood participants registering lower mean scores in specific MTT events when compared to normal mood participants. However, and unlike the analyses centred on all MTT events, type of retrieval was not a statistically significant main effect.

8.8.3. Mean proportions of negative, neutral, and positive MTT events

Regarding negative MTT events, results demonstrated statistically significant main effects of temporality and type of retrieval, with past MTT eliciting more negatively valenced events compared to future MTT, and voluntary retrieval producing more negative events than involuntary retrieval (see Table 12 and Figure 16). Thus, these findings supported Hypothesis 4c but did not support Hypothesis 4a.

Also, contrary to Hypothesis 4b, dysphoric participants did not produce a statistically significant higher mean proportion of negative events compared to normal mood participants, and the difference in valence between past and future MTT events was similar in voluntary and involuntary events, thereby not supporting Hypothesis 4d.

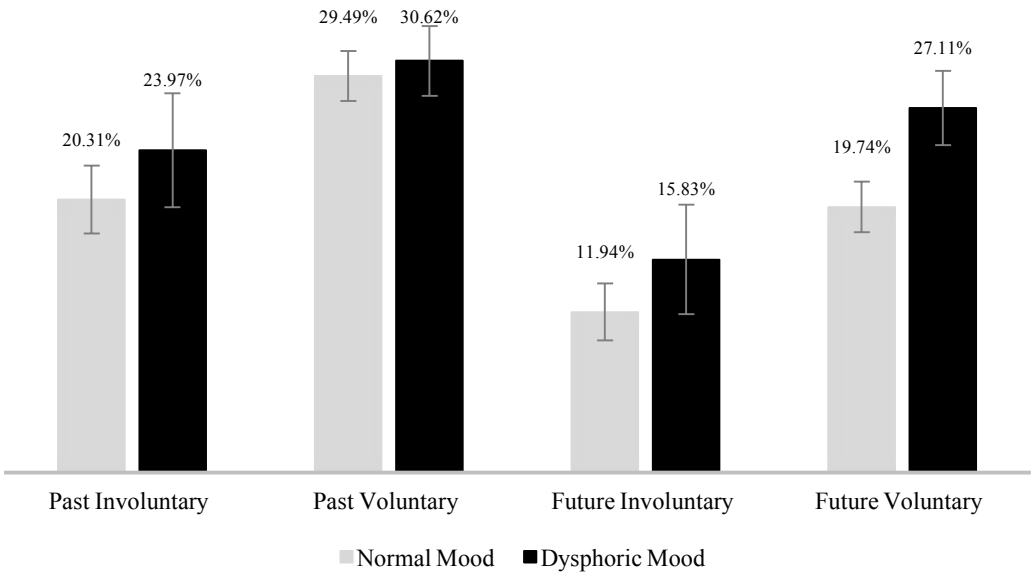


Figure 16. Mean proportions of negative MTT events, in accordance with participant group, temporality and type of retrieval. Error bars represent standard errors.

In what concerns neutral MTT events, as demonstrated by Figure 17, both participant group and type of retrieval were statistically significant main effects. Dysphoric individuals produced higher mean proportions of neutral MTT events when compared to normal mood participants, and involuntary retrieval was found to be associated with superior proportions of neutral MTT events comparatively to voluntary retrieval.

Table 12. Mean proportions and standard deviations of all MTT events and exclusively specific MTT events in accordance with valence, participant group, temporality, and type of retrieval

	Dysphoric group n = 17				Normal mood group n = 39				Main Effects and effect sizes		
	Past		Future		Past		Future		Participant Group	Temporality	Type of Retrieval
	IV	V	IV	V	IV	V	IV	V			
All Negative MTT	.24 (.17)	.31 (.11)	.16 (.17)	.27 (.11)	.20 (.16)	.29 (.11)	.12 (.13)	.20 (.12)	F = 2.53 n.s η_p^2 = 0.045 η_g^2 = 0.019	F = 14.48 *** η_p^2 = 0.21 η_g^2 = 0.061	F = 20.91 *** η_p^2 = 0.28 η_g^2 = 0.082
Specific Negative MTT	.25 (.18)	.29 (.13)	.13 (.17)	[a].26 (.22)	.22 (.19)	.29 (.13)	.13 (.17)	[a].16 (.13)	F = 1.23 n.s η_p^2 = 0.022 η_g^2 = 0.0081	F = 15.14 *** η_p^2 = 0.22 η_g^2 = 0.063	F = 10 ** η_p^2 = 0.16 η_g^2 = 0.035
All Neutral MTT	.30 (.22)	.21 (.17)	.26 (.19)	.18 (.19)	.19 (.14)	.17 (.14)	.17 (.14)	.13 (.14)	F = 4.32 * η_p^2 = 0.074 η_g^2 = 0.042	F = 2.89 n.s η_p^2 = 0.051 η_g^2 = 0.0087	F = 11.37** η_p^2 = 0.17 η_g^2 = 0.028
Specific Neutral MTT	.31 (.22)	.23 (.19)	.35 (.25)	.15 (.18)	.20 (.17)	.17 (.15)	.18 (.18)	.13 (.15)	F = 5.27 * ♣ η_p^2 = 0.089 η_g^2 = 0.051	F = 1.60 n.s η_p^2 = 0.029 η_g^2 = 0.0043	F = 20.67 *** ♣ η_p^2 = 0.28 η_g^2 = 0.050
All Positive MTT	.46 (.16)	.49 (.15)	.58 (.23)	.55 (14)	.60 (.16)	.54 (.13)	.71 (.18)	.67 (.15)	F = 12.40 *** η_p^2 = 0.19 η_g^2 = 0.091	F = 17.51 *** η_p^2 = 0.25 η_g^2 = 0.077	F = 2.12 n.s η_p^2 = 0.038 η_g^2 = 0.0062
Specific Positive MTT	.44 (.17)	.49 (.17)	.52 (.23)	.59 (.23)	.58 (.19)	.54 (.14)	.69 (.22)	.71 (.19)	F = 11.05 ** η_p^2 = 0.17 η_g^2 = 0.080	F = 17.18 *** η_p^2 = 0.24 η_g^2 = 0.069	F = 1.05 n.s η_p^2 = 0.019 η_g^2 = 0.0031

Notes.
[a] Heterogeneity of variance. n.s = not statistically significant. * $p < .05$, ** $p < .01$, *** $p < .001$.
♣ $p < .01$ for the interaction involving the factors signalled.

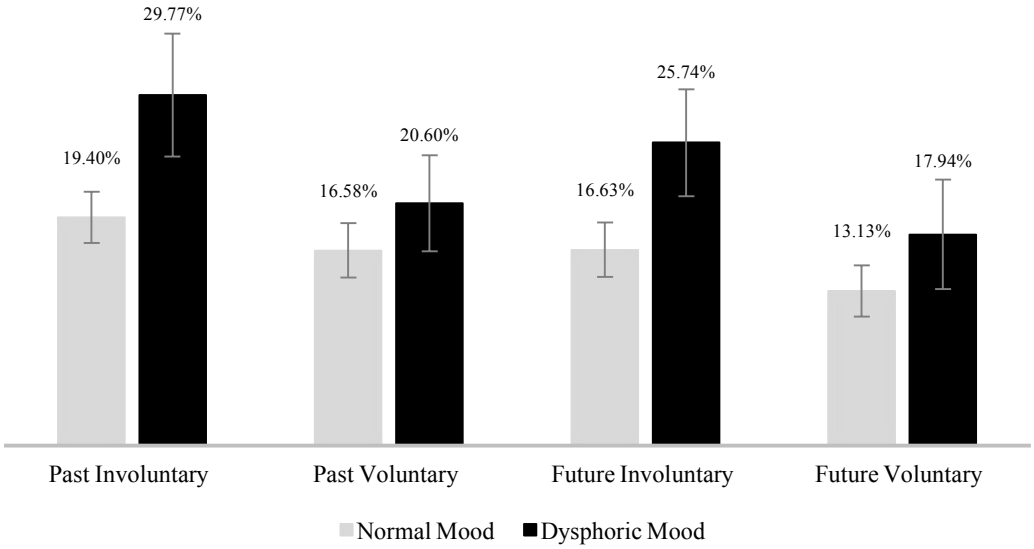


Figure 17. Mean proportions of neutral MTT events, in accordance with participant group, temporality and type of retrieval. Error bars represent standard errors.

As for positive events, results demonstrate that both participant group and temporality were statistically significant main effects, with dysphoric participants producing lower mean proportions of positively valenced MTT events than normal mood participants, and future MTT generating greater mean proportions of positively valenced events compared to past MTT (see Table 12 and Figure 18). While these between-group differences were consistent with Hypothesis 4b, the superior positivity of future compared to past MTT was once again consistent with Hypothesis 4c. However, following the trend of negatively valenced events, the difference in valence between past and future MTT events was similar across voluntary and involuntary events, thereby not supporting Hypothesis 4d.

Together with the results obtained for negatively valenced events, the findings of Study 1 are consistent with Hypotheses 4b and 4c, but do not support Hypotheses 4a and 4d.

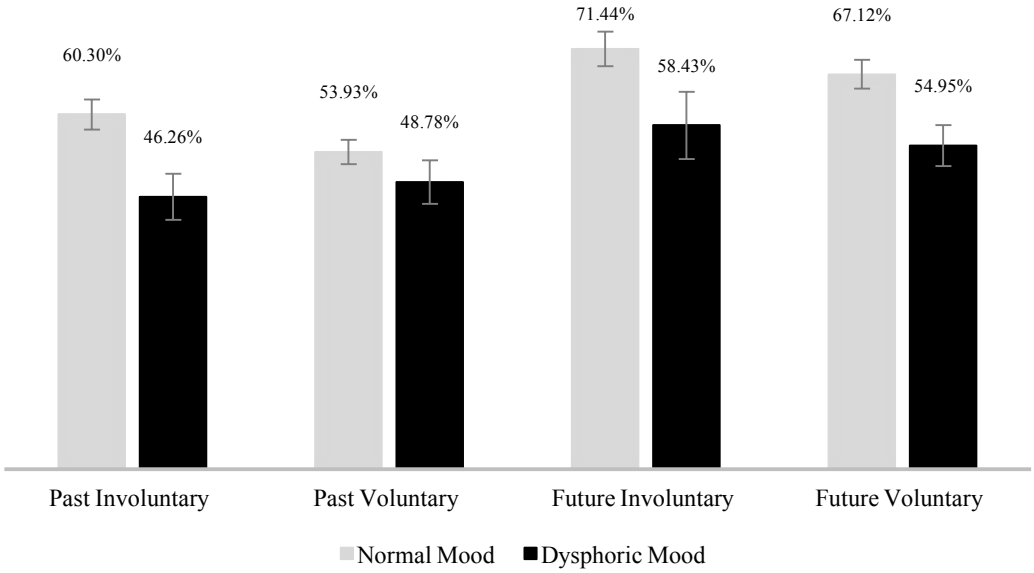


Figure 18. Mean proportions of positive MTT events, in accordance with participant group, temporality and type of retrieval. Error bars represent standard errors.

8.8.4. Mean proportions of negative, neutral, and positive specific MTT events

Analyses of the valence of specific MTT events produced similar results to those obtained for all MTT events. The exception occurred in neutral specific MTT events, whereby a statistically significant interaction was found between participant group and type of retrieval, $F(1, 54) = 6.80$, $p = .0012$, $\eta_p^2 = 0.11$ and $\eta_g^2 = 0.017$. Additional post hoc analyses suggested statistically significant higher mean proportions of neutral events generated in involuntary retrieval compared to voluntary retrieval, but only for dysphoric participants. This allowed dysphoric participants to register higher means of neutral MTT events compared to normal mood participants, as between-group differences were restricted to involuntary retrieval.

8.9. Hypothesis 5 – Visual Perspective

Hypothesis 5 was subdivided into two sub-hypotheses: Hypothesis 5a stated that any between-group differences in terms of mean numbers of observer and field perspective in past MTT would be replicated in future MTT, whereas Hypothesis 5b proposed past and future MTT voluntary events will exhibit a similar perspective to that exhibited by their involuntary counterparts regardless of participant group. To test these hypotheses, 2 x (2 x 2) mixed-design ANOVAs were performed with the mean proportions of MTT events with field, observer, no perspective, and both perspectives' as dependent variables. Similar analyses were performed on exclusively specific MTT events.

8.9.1. Mean proportions of different types of visual perspective in all MTT events

In terms of MTT events viewed from a field perspective (1st person), results showed a statistically significant main effect of temporality, whereby past MTT generated a higher mean proportion of field-perspective events than future MTT. There were no statistically significant main effects for participant group or type of retrieval (see Table 13 and Figure 19).

Table 13. Mean proportions and standard deviations of the visual perspective associated with all MTT events and with exclusively specific MTT events in accordance with participant group, temporality, and type of retrieval

	Dysphoric group n = 17				Normal mood group n = 39				Main Effects and effect sizes		
	Past		Future		Past		Future		Participant Group	Temporality	Type of Retrieval
	IV	V	IV	V	IV	V	IV	V			
Field (All MTT)	.44 (.25)	.50 (.24)	.33 (.27)	.37 (.28)	.55 (.28)	.55 (.29)	.43 (.31)	.41 (.24)	$F = 1.22$ n.s $\eta_p^2 = 0.022$ $\eta_g^2 = 0.016$	$F = 17.25$ *** $\eta_p^2 = 0.24$ $\eta_g^2 = 0.041$	$F = 0.90$ n.s $\eta_p^2 = 0.016$ $\eta_g^2 = 0.0013$
Field (Specific MTT)	.47 (.25)	.49 (.25)	.37 (.29)	.41 (.32)	.54 (.30)	.56 (.30)	.44 (.35)	.44 (.25)	$F = 0.74$ n.s $\eta_p^2 = 0.0091$ $\eta_g^2 = 0.014$	$F = 9.42$ ** $\eta_p^2 = 0.15$ $\eta_g^2 = 0.025$	$F = 0.64$ n.s $\eta_p^2 = 0.012$ $\eta_g^2 = 0.0012$
Observer (All MTT)	.47 (.28)	.38 (.27)	.57 (.30)	.52 (.30)	.36 (.31)	.40 (.31)	.52 (.32)	.52 (.25)	$F = 0.24$ n.s $\eta_p^2 = 0.004$ $\eta_g^2 = 0.0034$	$F = 19.31$ *** $\eta_p^2 = 0.26$ $\eta_g^2 = 0.040$	$F = 0.92$ n.s $\eta_p^2 = 0.017$ $\eta_g^2 = 0.0012$
Observer (Specific MTT)	.43 (.28)	.40 (.28)	.53 (.30)	.49 (.34)	.38 (.21)	.40 (.32)	.53 (.35)	.48 (.27)	$F = 0.07$ n.s $\eta_p^2 < 0.001$ $\eta_g^2 < 0.001$	$F = 10.76$ ** $\eta_p^2 = 0.17$ $\eta_g^2 = 0.025$	$F = 0.90$ n.s $\eta_p^2 = 0.016$ $\eta_g^2 = 0.0014$
Both Perspectives (All MTT)	0 (0)	.01 (.04)	.005 (.02)	.007 (.03)	.02 (.06)	.01 (.03)	.006 (.03)	.007 (.05)	$F = 0.20$ n.s $\eta_p^2 = 0.022$ $\eta_g^2 = 0.0033$	$F = 1.21$ n.s $\eta_p^2 = 0.011$ $\eta_g^2 = 0.0033$	$F = 0.58$ n.s $\eta_p^2 = 0.004$ $\eta_g^2 < 0.001$
Both Perspectives (Specific MTT)	0 (0)	.01 (.04)	0 (0)	0 (0)	.02 (.06)	.01 (.03)	.004 (.03)	.006 (.04)	$F = 0.60$ n.s $\eta_p^2 = 0.011$ $\eta_g^2 = 0.0070$	$F = 4.59$ * $\eta_p^2 = 0.075$ $\eta_g^2 = 0.010$	$F = 0.27$ n.s $\eta_p^2 < 0.001$ $\eta_g^2 < 0.001$
No Perspective (All MTT)	.10 (.17)	.10 (.16)	.10 (.24)	.09 (.24)	.07 (.12)	.04 (.08)	.05 (.08)	.07 (.10)	$F = 1.46$ n.s $\eta_p^2 = 0.026$ $\eta_g^2 = 0.020$	$F = 0.03$ n.s $\eta_p^2 = 0.001$ $\eta_g^2 < 0.001$	$F = 0.04$ n.s $\eta_p^2 = 0.001$ $\eta_g^2 < 0.001$
No Perspective (Specific MTT)	.09 (.18)	.10 (.18)	0.10 (.24)	.10 (.25)	.07 (.14)	.03 (.07)	.03 (.07)	.07 (.15)	$F = 1.71$ n.s $\eta_p^2 = 0.031$ $\eta_g^2 = 0.020$	$F = 0.05$ n.s $\eta_p^2 = 0.0015$ $\eta_g^2 < 0.001$	$F = 0.02$ n.s $\eta_p^2 < 0.001$ $\eta_g^2 < 0.001$

Notes. n.s = not statistically significant. ** $p < .01$, *** $p < .001$

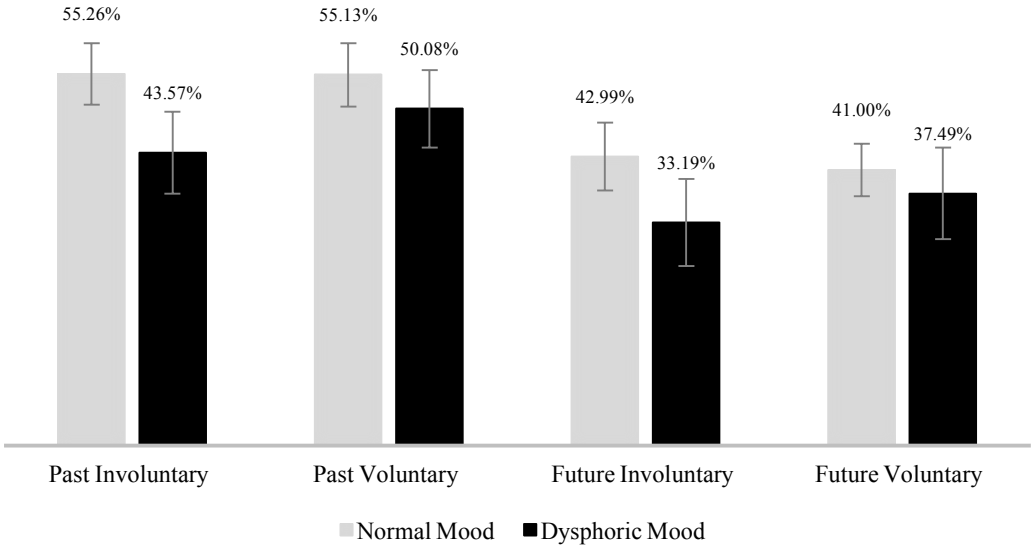


Figure 19. Mean proportions of field perspective MTT events, in accordance with participant group, temporality and type of retrieval. Error bars represent standard errors.

In terms of MTT events viewed from an observer perspective (3rd person perspective), findings yielded a statistically significant main effect of temporality, with future MTT generating superior mean proportions of observer-perspective events when compared to past MTT. There were no statistically significant main effects of participant group or type of retrieval (see Table 13 and Figure 20).

Taken together, the findings supported Hypotheses 5a and 5b.

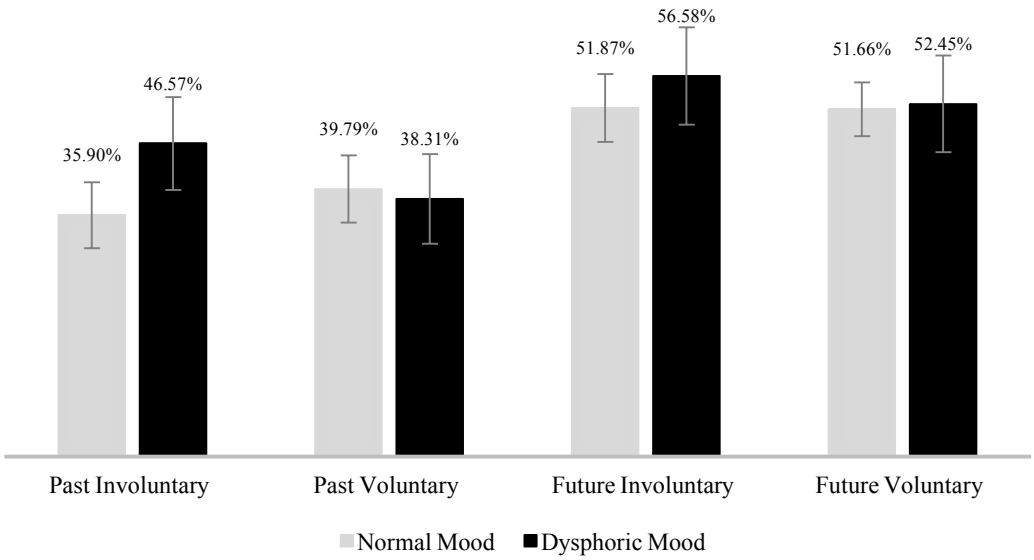


Figure 20. Mean proportions of observer perspective MTT events, in accordance with participant group, temporality and type of retrieval. Error bars represent standard errors.

The results of MTT events viewed from both perspectives (via continuous exchange between field and observer perspectives) and from neither of the aforementioned perspectives, did not reveal any statistically significant effects or interactions (see Table 13).

8.9.2. Mean proportions of different types of visual perspective in specific MTT events

Analyses discriminating the visual perspective of specific MTT events produced results similar to those obtained for all MTT events, the exception being the superior mean proportions of past MTT events viewed from both perspectives comparatively to future MTT events (see Table 13).

8.10. Summary of Hypotheses' Testing Results

Table 14 summarises the results of Study 1 in relation to the five hypotheses. These will be further discussed in the next chapter.

Table 14. Summary of the outcomes of Study 1

Hypothesis Number	Key factor	Dependent Variable	Hypotheses	Outcome
Hypothesis 1a	Type of Retrieval	Spatiotemporal Specificity	Past and future involuntary MTT events will be more specific/less general than their voluntary counterparts regardless of participant group.	Partial support
Hypothesis 1b	Participant Group	Spatiotemporal Specificity	The past and future, voluntary and involuntary MTT events of dysphoric participants will be less specific/more general than the MTT events of normal mood participants.	No support
Hypothesis 1c	Temporality	Specificity	Future voluntary and involuntary MTT events will be less specific/more general than their past counterparts regardless of participant group.	Support
Hypothesis 1d	Interaction between Type of Retrieval and Temporality	Specificity	The difference in specificity between past and future MTT events will be greater in voluntary compared to involuntary retrieval, regardless of participant group.	Support
Hypothesis 2a	Type of Retrieval	Centrality to Life and Centrality to Identity [Self-Relevance]	Past and future involuntary MTT events will be less central to life story and identity than their voluntary counterparts regardless of participant group.	Support
Hypothesis 2b	Temporality	Centrality to Life and Centrality to Identity [Self-Relevance]	Future voluntary and involuntary MTT events will be more central to life story and identity than their past counterparts regardless of participant group.	No Support *
Hypothesis 2c	Interaction between Type of Retrieval and Temporality	Centrality to Life and Centrality to Identity [Self-Relevance]	The difference in centrality to life story and identity between voluntary and involuntary retrieval will be greater in future compared to past MTT, regardless of participant group.	No Support
Hypothesis 3a	Type of Retrieval	Mood Impact and Physical Reactions [Impact]	Past and future involuntary MTT events will cause greater mood impact and physical reactions than their voluntary counterparts regardless of participant group.	No support
Hypothesis 3b	Participant Group	Mood Impact and Physical Reactions [Impact]	The past and future, voluntary and involuntary MTT events of dysphoric participants will cause greater mood and physical impact than the MTT events of normal mood participants.	No support

Hypothesis 3c	Temporality	Mood Impact and Physical Reactions [Impact]	Past voluntary and involuntary MTT events will entail similar mood impact and physical reactions to their future counterparts, regardless of participant group.	Partial support
Hypothesis 3d	Interaction between Type of Retrieval and Temporality	Mood Impact and Physical Reactions [Impact]	The difference in mood impact and physical reactions between voluntary and involuntary retrieval will be similar across past and future MTT, regardless of participant group.	Support
Hypothesis 4a	Type of Retrieval	Valence	Past and future involuntary retrieval will elicit similar mean numbers of negatively valenced MTT events compared to their voluntary retrieval counterparts regardless of participant group.	No support
Hypothesis 4b	Participant Group	Valence	The past and future, voluntary and involuntary MTT events of dysphoric participants will be more negative/less positive than the MTT events of normal mood participants.	Support
Hypothesis 4c	Temporality	Valence	Future voluntary and involuntary MTT events will be more positive/less negative than their past counterparts regardless of participant group.	Support
Hypothesis 4d	Interaction between Temporality and Type of Retrieval	Valence	The difference in valence between past and future MTT events will be greater in voluntary compared to involuntary retrieval regardless of participant group.	No support
Hypothesis 5a	Temporality	Visual Perspective	Any differences between dysphoric and normal mood participants in terms of mean numbers of observer and field perspective events in past MTT will be replicated in future MTT.	Support
Hypothesis 5b	Type of Retrieval	Visual Perspective	Past and future MTT voluntary events will exhibit a similar perspective to that exhibited by their involuntary counterparts regardless of participant group.	Support

Notes. * According to the post-hoc ANCOVA analyses of Section 8.11, Hypothesis 2b is partially supported.

8.11. Post-hoc Analyses: Depressive Symptomatology as a Continuous Variable

Overall the results obtained in post-hoc ANCOVAs suggest these analyses, when compared to mixed-design ANOVAs, had a greater power to detect statistically significant differences (see Section 13.1.3 for a possible rationale).

In what concerns Hypotheses 1a to 1d, the post-hoc ANCOVAs yielded similar results to those of the main analyses. However, whereas in the mixed-ANOVA for mean proportions of specific events Type of Retrieval was not statistically significant, $F(1, 54) = 3.92$, $p = .053$, $\eta_p^2 = .068$, in the ANCOVA analysis Type of Retrieval was statistically significant, $F(1, 54) = 5.64$, $p = .021$, $\eta_p^2 = .095$. The covariate (BDI score), similarly to participant group in mixed-ANOVA, was not statistically significant, $F(1, 54) = 0.14$, $p = .71$, $\eta_p^2 = .003$.

Regarding Hypothesis 2, a different result was obtained from post-hoc ANCOVAs for Hypothesis 2b, as Temporality was found to be a statistically significant main effect, $F(1, 54) = 5.31$, $p = .025$, $\eta_p^2 = .090$, with future events being more Central to Life than past events, as originally hypothesised. Because Temporality was not statistically significant in Centrality to Identity, the changes observed in Centrality to Life meant that Hypothesis 2b was partially supported instead of unsupported. In its respective mixed-design ANOVA, Temporality was not statistically significant, $F(1, 54) = 3.73$, $p = .059$, $\eta_p^2 = .065$. The covariate (BDI score), similarly to participant group in mixed-ANOVA, was also not statistically significant, $F(1, 54) = 0.046$, $p = .83$, $\eta_p^2 = .001$.

In the remaining Hypotheses (3, 4 and 5) similar results were obtained in the ANCOVAs to those of the respective mixed-design ANOVAs. However, an additional

discrepancy further suggested a greater power of the ANCOVAs to detect statistically significant effects. While Hypothesis 4a was not supported by either analysis, in ANCOVA type of retrieval was found to be a statistically significant effect, $F(1, 54) = 4.33$, $p = .042$, $\eta_p^2 = .074$, with involuntary events eliciting more positive events than voluntary, whereas in mixed-design ANOVA this same trend was not statistically significant, $F(1, 54) = 2.13$, $p = .15$, $\eta_p^2 = .038$.

CHAPTER NINE – DISCUSSION OF STUDY 1

This chapter will discuss the results obtained in Study 1 regarding dysphoric vs. normal mood individuals.

9.1. Sociodemographic Variables

The influence of sociodemographic variables on memory has been addressed by several studies. Williams et al. (2007) suggested that variables such as IQ and education years may have an impact on certain dimensions of autobiographical memory, such as specificity level; Irish et al. (2008) claimed the existence of gender differences in the autonoetic experience associated with memory recall; and Pauls, Petermann and Lepach (2013) explored the interrelation between age and gender in episodic memory, finding that gender differences in the performance of several episodic memory tasks were consistent across multiple age groups. Furthermore, the literature regarding the impact of age on executive function (Holland, Ridout, Walford, & Geraghty, 2012) and MTT is well established, ranging from positivity effects in voluntary (Mickley & Kensinger, 2009) and involuntary memories (Schlagman et al., 2009) to diminished specificity levels in remembering the past (Ros et al., 2010) and imagining the future (Gaesser, Sacchetti, Addis, & Schacter, 2011). In Study 1, normal mood and dysphoric mood participants were found to be well matched on age, gender, previous history of psychopathology, and number of successfully completed education years. These allow results to be interpreted without being overly affected by these potential confounding factors.

9.2. Clinical Measures

As expected, dysphoric participants reported more depressive symptoms than normal mood participants. Within-group analyses revealed both groups produced statistically significant higher mean total scores in the BDI-IA and STAIT first session than in the second session.

Although the scoring criteria used to assign participants to the dysphoric mood group (BDI-IA ≥ 10) satisfied the BDI-IA's cut-off scores for mild to moderate depression symptomatology, the mean scores obtained by dysphoric participants in both sessions of the BDI-IA were lower than those obtained in similar studies researching autobiographical memories and dysphoric mood (Dickson & Bates, 2006; Goddard et al., 1997; Holmes et al., 2008; Moulds, Kandris, Williams, & Lang, 2008; Ramponi et al., 2004 being the exception). Nevertheless, the effect size of the differences between dysphoric and normal mood participants was similar to those of the abovementioned studies. The fact that distinct levels of dysphoric intensity may have consequences concerning the phenomenological characteristics of positive future events (Holmes et al., 2008) as well as the likelihood of participants making negative evaluations of positive events (Hetherington & Moulds, 2015), will be addressed in the general discussion (Chapter 13).

Regarding STAIS and STAIT, the higher mean scores obtained by dysphoric participants in both administrations of the questionnaires were expected given the comorbidity between depressive and anxiety symptoms.

9.3. Mean Totals of MTT Events and Semantic Associates

Results showed no groups differences regarding the mean totals of MTT events produced. Furthermore, in both groups, temporality and type of retrieval were found to be statistically significant main effects, with past and involuntary conditions enabling greater production of MTT events. Together, these results suggest both groups experienced similar ease/difficulty completing the notebook task. The higher production of past compared to future events may have been a consequence of the greater cognitive effort required to engage in the anticipation and construction of future scenarios comparatively to the recall of past occurrences (Schacter et al., 2008; Schacter et al., 2012). Congruent with this interpretation are two additional findings: (1) the effect size respecting the difference between past and future conditions was considerably larger when considering only specific MTT events ($\eta_p^2 = 0.65$ and $\eta_g^2 = 0.25$ as opposed to $\eta_p^2 = 0.27$ and $\eta_g^2 = 0.09$ for all MTT events). This result is congruent with the added layers of complexity and cognitive effort required by specific compared to overgeneral MTT events; (2) future conditions in the notebook were also found to elicit a statistically significant higher mean of semantic associates, with a respective effect size of $\eta_p^2 = 0.27$ and $\eta_g^2 = 0.08$. It is possible that these semantic associates emerged as default options in the absence of any eligible MTT events, a product of the greater cognitive effort required by future MTT.

9.4. Temporal Distance and Distribution of MTT Events

The results of Study 1 concerning the temporal distribution of MTT events are consistent with the phenomena of childhood amnesia discussed in Subsection 3.3.1.1. For both voluntary and involuntary retrieval, regardless of participant group, only a small percentage of past MTT events dated back to when participants were between 0-5 years of age. Additionally, results showed that type of retrieval was not a statistically significant main effect for past MTT events, while in future MTT involuntary retrieval privileged the construction/retrieval of recent events and voluntary retrieval favoured the construction/retrieval of more distant future events (in the 61-85 years of age range).

Overall, these results are consistent with research findings (Berntsen, 1998; Berntsen & Hall, 2004) suggesting individuals exhibit similar temporal distributions for voluntarily and involuntarily retrieved MTT events. These similarities are important because they suggest voluntary and involuntary events undergo similar encoding and consolidation processes, which in turn means that whatever differences exist between voluntary and involuntary MTT should be primarily explained by their different retrieval mechanisms. Thus, the value of these analyses was two-fold: It enabled a comparative assessment of Study 1's temporal distribution of MTT events with those described in the literature; and it provided a context for interpreting the Hypotheses of Study 1 wherein differences between voluntary and involuntary MTT suggested close attention should be paid to retrieval processes in detriment of encoding or consolidation processes.

The analyses respecting the temporal distance of past and future MTT events also proved useful, as they enabled comparisons across temporality while accounting for type of retrieval. The analyses discussed above, regarding the temporal distribution of MTT events, were inadequate for this particular assessment because by their very nature past and future MTT events refer to mutually exclusive chronological periods of an individual's life.

The results of Study 1 regarding the temporal distance of MTT events demonstrated that involuntary retrieval, compared to voluntary retrieval, favoured the construction/retrieval of recent future events. Moreover, temporally distant events (between 16-25 years from the present) were predominant in past compared to future MTT, regardless of participant group or type of retrieval. The first set of findings may have been the result of cue-item discriminability processes, that allowed individuals to project themselves into the near future as a result of the near future's greater overlap with immediate concerns and its potential association with a myriad of external and internal cues. The second set of findings is consistent with the results obtained for the temporal distribution of MTT. The additional difficulties and constructive effort required to project oneself into the future, by comparison to the past, would likely be exacerbated for distant future scenarios, where the uncertainty regarding multiple dimensions of an individual's life (e.g., health, employment, family) would make current schematic knowledge largely inadequate as a starting point for simulating one's distant future experiences.

9.5. Hypothesis 1 – Level of Spatiotemporal Specificity in MTT

The results obtained in Study 1 supported Hypotheses 1c and 1d, partially supported Hypothesis 1a but did not support Hypothesis 1b, meaning that temporality, type of retrieval, and their interaction all had a statistically significant impact on the specificity of MTT events, whereas participant group did not.

In what concerns the absence of between-group differences (Hypothesis 1b), framing the results of Study 1 within the available literature implies addressing several methodological aspects that may have impacted the present findings. Unlike Study 1, multiple studies found normal mood participants produced more specific past voluntary events than dysphoric participants (Dickson & Bates, 2006; Debeer et al.'s unpublished data, as cited in Sumner et al., 2010; Goddard et al., 1997; Ramponi et al., 2004). However, there are several differences between these studies and Study 1, namely: (1) Study 1's use of a diary design instead of a cross-sectional design; (2) the fact that, in Study 1, participants were not subject to time constraints when recording their MTT events, nor instructed to favour spatiotemporally specific or self-relevant events; (3) The clinical measures of depression/cut-off scores used for categorising participant groups.

Study 1's diary design allowed for greater ecological validity, as recording events in real-life situations enabled a more natural assessment of the phenomenological characteristics of MTT. Moreover, by eliminating time constraints, Study 1 controlled for their extraneous influence on specificity. Findings suggest that time constraints in voluntary retrieval tasks can lead participants to feel pressured into providing an answer and, consequently, struggle to access specific events (mnemonic

interlock) (Griffith et al., 2012). On the other hand, the lack of direct instructions requiring participants to produce only specific MTT events may have helped increase the number of categoric and extended events produced by both groups (Debeer, Hermans, & Raes, 2009; Raes et al., 2007).

Respecting cut-off scores, with the exception of Ramponi et al. (2004), the previous studies adopted higher cut-off scores than Study 1 for dysphoric participants (BDI ≥15 vs. BDI ≥10). This could have impacted group differences in specifity. The results of the post-hoc analyses covarying BDI scores of Study 1 participants are consistent with this possibility, as are the results of Study 2, where group differences were found (see Section 12.5). Together, the findings suggest Study 1 would require participants with greater depression severity for group differences to occur.

The assessment of MTT specificity in both participant groups was also performed via an analysis of their overgenerality (categoric and extended events produced). Similarly to specific events, there were no statistically significant group differences in the mean proportions of categoric or extended events, which meant that Hypothesis 1b was not supported. There was, however, a small sized effect ($\eta_p^2 = 0.04$) associated with dysphoric participants' greater (not statistically significant) production of categoric events.

A more extensive analysis of the absence of group differences in specificity shows that when the valence of MTT events was considered, dysphoric participants were found to have produced statistically significant less positive specific events. This implies that the absence of group differences in specificity is largely predicated on dysphoric participants producing more neutral specific events. This is consistent with

the literature, as it suggests lower fading affect and positivity biases comparatively to normal mood participants (see Section 9.8 for additional details).

Despite the previously mentioned inconsistencies with research addressing past voluntary MTT, the absence of statistically significant group differences was congruent with the results of Kvavilashvili and Schlagman (2011), whose research assessed past involuntary MTT, and with those of Anderson and Evans (2015), who analysed both past and future voluntary MTT.

One of the strengths of the current thesis was the inclusion of temporality and type of retrieval as contributing factors to between- and within-group differences in MTT characteristics. Regarding within-group differences, although type of retrieval was not a statistically significant main effect, the results of Study 1 showed that the greater specificity of involuntary retrieval was close to statistical significance for specific events (p = .06 and η_p^2 = 0.07), exhibiting a medium-sized effect (Cohen, 1988). Furthermore, post-hoc ANCOVA analyses showed that when depression severity was assessed as a continuous variable, type of retrieval was indeed a statistically significant effect, suggesting that these effects were a function of severity of depressive symptoms rather than categorical differences. In both sets of analyses the findings partially supported Hypothesis 1a by showing that, regardless of participant group, involuntary future MTT events were more specific and less categoric than voluntary future MTT events, with no such differences occurring in past MTT (see Figures 6 and 9 in Section 8.5).

The fact that involuntary retrieval's greater specificity was only manifest in future MTT may have been a consequence of the superior cognitive effort that is often required to produce future compared to past MTT events, as advocated by the

constructive episodic simulation hypothesis. Because past MTT involves "travelling back in time" to events that have already occurred, accessing these events can be relatively straightforward. More so for individuals such as those in Study 1, relatively unconstrained by executive function deficits or avoidance and rumination processes typical of depressed individuals and that often compromise access to specific past events. By contrast, future MTT poses a greater challenge. To "mentally travel into the future", individuals either generate a completely novel future event, whose construction requires considerable cognitive effort and resources, or they access a "memory of the future", that refers to an event that is yet to occur but that has already been constructed and visualised (Jeunehomme & D'Argembeau, 2016). As a consequence of the mechanisms and processes of both voluntary and involuntary retrieval, it is possible that "memories of the future" are often triggered involuntarily, via cue-item discriminability processes privileging specific future events. Voluntary future MTT, on the contrary, may involve more novel events, risking entanglement in the future's more abstract nature and, consequently, leading to more overgeneral and less specific voluntary future MTT events.

These statistically significant interactions between temporality and type of retrieval for specific and categoric events supported Hypothesis 1d, as the difference in specificity between past and future MTT events was greater in voluntary retrieval. This greater difference was manifest in the proportions of both specific and categoric events, partially replicating the results of Berntsen and Jacobsen (2008) who found that, in healthy university students, the transition from voluntary to involuntary conditions was associated with an increase in specificity in both past and future conditions, particularly in the latter. However, in Berntsen and Jacobsen's (2008)

study, both type of retrieval and temporality were statistically significant, whereas in Study 1, only the latter was statistically significant. This meant that in Study 1, and as proposed by Hypothesis 1c, past MTT elicited more specific and less categoric events than future MTT, regardless of type of retrieval or participant group.

This statistical significance of temporality, proposed in Hypothesis 1c, is congruent with the results of similar studies researching either involuntary (Anderson & Dewhurst, 2009), voluntary (Blix & Brennen, 2011; Dickson & Bates, 2006; Rasmussen & Berntsen, 2013) or both voluntary and involuntary retrieval in the generation of MTT events (Berntsen & Jacobsen, 2008). An exception lies with Anderson and Evans (2015), whose study did not find statistically significant differences.

Different explanations have been presented for this effect of temporality. Anderson and Dewhurst (2009) argued that when constructing novel future involuntary events, individuals struggle to directly match a cue to a future occurrence, as unlike past events, future events have not yet occurred. As such, novel future events will likely require additional constructive processes, couched in generativity and the working memory's ability to bind disparate inputs, to produce a future involuntary event. This process, compared to that of past MTT, is more likely to be interrupted at a more general hierarchical level, producing overgeneral events. Dickson and Bates (2006) provide a similar explanation for voluntary MTT, proposing that the anticipation of *unknown* future scenarios likely entails greater cognitive difficulties. Both proposals are congruent with the explanation provided above to interpret the superior specificity exhibited by future MTT events in involuntary compared to voluntary retrieval.

9.6. Hypothesis 2 – Self-Relevance of MTT

The results of Study 1 supported Hypothesis 2a by showing that voluntarily retrieved MTT events were more self-relevant than involuntarily retrieved events, regardless of participant group or temporality. This result is congruent with the existing literature (Jacobsen & Berntsen, 2008; Johannessen & Berntsen, 2010). In voluntary retrieval, the reliance on schema-based search descriptions is believed to underlie the production of higher-valued self-representations, as these search descriptions favour information that is central to existing schemas and, consequently, to the individual (Rubin et al., 2008). Involuntary retrieval, on the other hand, is couched in associative mechanisms that tend to privilege distinctiveness, largely bypassing these informational search constraints (Berntsen, 2009).

Unlike type of retrieval, temporality was not a statistically significant main effect in centrality to life or centrality to identity, hence Hypothesis 2b was not supported. However, it is worth mentioning that in both Centrality to Life and Centrality to Identity superior mean scores for future events were near the threshold for statistical significance ($p = .06$, $\eta_p^2 = 0.07$ for centrality to life; and $p = .09$, $\eta_p^2 = 0.05$ for centrality to identity), exhibiting medium and small-sized effects, and evidencing the same trend as that of the literature (Anderson & Evans, 2015; Berntsen & Bohn, 2010; Ramussen & Berntsen, 2013). Furthermore, in post-hoc ANCOVAs, Temporality was indeed found to be statistically significant for Centrality to Life, which would entail partial support for this hypothesis, suggesting that the initial lack of statistical significance may have been related with a lack of power to detect effects, in part due to the dichotomisation of depression severity into two groups (normal mood

vs. dysphoric). Furthermore, unlike the data of Berntsen and Bohn (2010) and Rasmussen and Berntsen (2013), the future MTT events produced in Study 1 were less temporally distant compared to past MTT events (see Table 7 in Subsection 8.4.1), which may have diminished the impact of temporality. As such, and given that the personal significance of events has been shown to be greater in temporally remote compared to temporally closer future/past events (Addis et al., 2008; D'Argembeau & Van der Linden, 2004), it is possible that the lesser temporal distance of future compared to past events negatively contributed to their self-relevance, thereby also contributing to a lack of support for Hypothesis 2c. This possibility is congruent with the temporal construal theory (Trope & Liberman, 2003), which argues that temporally remote events are more abstract and schema-based than recent events, meaning they will be perceived to be more self-relevant.

9.7. Hypothesis 3 – Mood Impact and Physical Reactions of MTT

The findings of Study 1 did not support Hypotheses 3a, 3b, partially supported Hypothesis 3c and supported Hypothesis 3d. However, support for the latter two occurred under an acceptance-support hypothesis testing framework, which means insufficient statistical power may have contributed to this support. Concerning Hypothesis 3b, dysphoric participants, when compared to normal mood participants, did not produce more mood or physical reactions in response to MTT events. No previous studies have directly compared dysphoric and normal mood participants' mean proportions of mood-impacting MTT events, and only one study compared both groups' physical reactions in response to MTT events (Anderson & Evans, 2015). This

study did not find statistically significant group differences but obtained a statistically significant interaction between temporality and participant group, whereby dysphoric participants registered higher mean scores for physical reactions in the past condition, whereas normal mood participants registered higher mean scores for physical reaction in the future condition.

The absence of statistically significant group differences in Study 1 may have been a consequence of the relatively low threshold (≥ 10 in BDI-IA) used as inclusion criteria for the dysphoric participants of Study 1. It is possible that this low threshold influenced the self-relevance and degree of negativity of the MTT events produced by dysphoric participants, which in turn influenced the number of mood and physical reactions associated with those events. The literature suggests there is a positive association between depressive symptomatology and event self-relevance (see Section 12.6 for details), and between negative events and mood impact (Watson et al., 2012). Consequently, the fact that there were no statistically significant differences in the self-relevance of the events produced by dysphoric and normal mood participants in Study 1, meant both groups produced a similar number of self-relevant events capable of inducing mood or physical reactions. Moreover, the fact there were no statistically significant group differences in the mean proportions of negatively valenced MTT events (see Sections 8.8 and 9.8) meant dysphoric participants did not record more negative events, which are often responsible for inducing mood or physical reactions. Coupled together, both sets of results possibly contributed to the absence of statistically significant group differences concerning mood and physical reactions. This possibility is further strengthened by the results of Study 2, wherein depressed participants' superior production of self-relevant and negative events was

accompanied by a greater production of mood and physical reactions (see Chapter 12 for details).

Regarding Hypothesis 3a, and contrary to what was predicted, it was voluntary retrieval that elicited statistically significant greater proportions of physical and mood reactions. These results were unexpected and it is possible they were influenced by the greater self-relevance of voluntary compared to involuntary MTT events (see Section 9.6 for details). Previous studies, that found involuntary retrieval elicited greater or similar mood and physical reactions to voluntary retrieval, found no differences in the self-relevance of voluntary and involuntary events (Berntsen & Jacobsen, 2008; Berntsen & Hall, 2004), a fact that may have contributed to this discrepancy in results.

Hypothesis 3c was partially supported as the findings involving mood impact, contrary to those concerning physical reactions, showed that temporality was not a statistically significant effect. The results showed that past events elicited more physical reactions than future events, an outcome that may have been related to past events being more negative than future events. It is possible that mood reactions, being of a milder nature, could be triggered by both positive and negative events, whereas physical reactions, elicited in more extreme situations, were predominantly triggered by negative events. This would explain the different effects of temporality in mood and physical reactions, with further well powered studies being necessary to evaluate the nature of the relation between valence and MTT impact. This explanation is consistent with the results obtained in Study 2, wherein the absence of an effect of temporality in the production of negative events may have contributed to the absence of said effect in both mood and physical reactions to MTT events.

Hypotheses 3d was supported by the findings, as no statistically significant interaction occurred between temporality and type of retrieval across mood and physical reactions, suggesting a stable impact of type of retrieval across past and future MTT.

9.8. Hypothesis 4 – Valence of MTT

The findings of Study 1 supported Hypotheses 4b and 4c but not Hypotheses 4a and 4d. Regarding Hypothesis 4b, dysphoric participants' MTT events had statistically significant lower mean valence scores than those of normal mood participants, meaning their MTT events were less positive/more negative. Further analyses showed dysphoric participants produced less positive MTT events than normal mood participants.

This difference between dysphoric and normal mood participants is congruent with the literature. Walker, Skowronski, Gibbons, et al. (2003) found dysphoric mood participants were more negative in their voluntary past MTT events than normal mood participants. Joormann and Siemer (2004) obtained similar results regarding the superior negativity/lower positivity of dysphoric participants, but the design of their study enabled them to attribute this to a lower production of positive voluntary memories by dysphoric participants, similar to that of Study 1. Kvavilashvili and Schlagman (2011) replicated Joormann and Siemer's (2004) findings but for involuntary MTT, and Anderson and Evans (2015) did so for voluntary past and future MTT.

In what concerns future MTT, de Jong-Meyer, Kuczmera, and Tripp (2007) also presented mood congruent results for future voluntary events, as participants induced with a dysphoric mood registered more negative and fewer positive future events, with contrasting results being produced by participants under positive mood inductions. These outcomes are not surprising given that dysphoric individuals were shown to anticipate more negative future events and fewer positive future events than non-dysphoric individuals (Pyszczynski et al., 1987). Stöber (2000) also showed a correlation between dysphoric mood and reduced imageability of positive, but not negative, future events.

The greater negativity/reduced positivity of dysphoric participants has been attributed to several aspects. Walker, Skowronski, Gibbons, et al. (2003) suggested that dysphoria impacts the fading affect bias, promoting greater negativity in dysphoric participants' recollections. Joormann and Siemer (2004) emphasised the differences in the effectiveness of emotion regulation strategies exhibited by dysphoric and normal mood individuals, with rumination affecting the accessibility of positive memories and their subsequent effectiveness in mood regulation. Hetherington and Moulds (2015), having failed to replicate the results of Joormann and Siemer (2004), suggested the mode of processing involved in the recall of memories might be a key aspect of dysphoric individuals' inability to access and effectively use positive autobiographical events.

As for Hypothesis 4a, unlike hypothesised, type of retrieval was found to be a statistically significant main effect, with involuntary retrieval generating MTT events with higher mean valence scores (more positive/less negative) than voluntary retrieval. Additional analyses showed that involuntary retrieval generated a statistically

significant lower proportion of negatively valenced events, which meant involuntary retrieval did not privilege access to negative MTT events. Instead, involuntary retrieval was associated with a greater production of neutral MTT events, which in the case of specific MTT events was constrained to dysphoric participants.

This excess of neutral MTT events is consistent with the previously discussed lower self-relevance of involuntary MTT events in Study 1 (Section 9.6). It suggests that involuntary retrieval's privileging of cue-item distinctiveness, via associative processes, resulted in a greater production/retrieval of routine-like events in detriment of self-relevant (and likelier to be schema-constrained) events. The findings of Study 1 are thus consistent with claims that involuntary retrieval does not constitute a privileged source of access to negative information, and further affirm both types of MTT as routes of access to the same episodic memory system, capable of producing/retrieving both traumatic and routine events (Berntsen, 2012). This suggests that involuntary retrieval may be incorporated into viable therapeutic protocols, as it enables frequent access to positively valenced information that can be used to address dysphoric mood.

While the results of Study 1 supported Hypothesis 4c, as future MTT events were found to be simultaneously more positive and less negative than their past counterparts, they did not support Hypothesis 4d, since the difference in valence between past and future MTT events was similar in voluntary and involuntary retrieval. The support for Hypothesis 4c is consistent with the possibility of cultural life scripts, which refer to schematic representations of culturally expected events, playing a greater role in future MTT, and thereby contributing to a positivity effect given their positively valenced biases (Bohn & Berntsen, 2010; Berntsen & Rubin,

2004). Moreover, the greater reliance of future MTT on schematic structures, as advocated by the constructive episodic simulation hypothesis and supported by the findings of Studies 1 and 2, will likely have contributed to a greater impact of fading affect (Szpunar et al., 2012), self-regulation (Rasmussen & Berntsen, 2013), and imagery biases (Blackwell et al., 2013) favouring positive information.

It is also possible that the different functions underlying past and future MTT may have contributed to participants having a more positive view of their future (Grysman et al., 2013), whereby individuals are encouraged to act in order to achieve their goals and develop social relations (Taylor & Brown, 1988).

9.9. Hypothesis 5 – Visual Perspective of MTT

The results of Study 1 supported Hypotheses 5a and 5b, but their acceptance - support framework requires that special care is taken when extrapolating the results. In what concerns Hypothesis 5a, temporality was found to be a statistically significant effect, but one that did not differentially affect group differences in the mean proportions of observer perspective MTT events, nor in the mean proportions of field perspective MTT events. Consequently, both dysphoric and normal mood individuals exhibited the same effect of temporality in field perspective events and in observer perspective events.

Irrespective of group, participants produced more field perspective events in past compared to future MTT, and more observer perspective events in future compared to past conditions. In the literature, only D'Argembeau and Van der Linden (2006), and more recently McDermott, Wooldridge, Rice, Berg and Szpunar (2016),

have analysed how temporality affects the visual perspective associated with MTT. The results of Study 1 were consistent with those of both studies, as individuals exhibited less observer perspective in voluntary past compared to voluntary future events, possibly as a consequence of the more constructive nature of future MTT.

The findings of Study 1 are important in that they are consistent with the current understanding of the constructive episodic simulation hypothesis, according to which similar processes support past and future MTT (see Subsection 3.2.3.3). One of the premises of this hypothesis is that future MTT is inherently more constructive than past MTT, given the added generativity and cognitive effort required to construct a novel event. The superior constructiveness of future MTT would, in theory, entail a greater use of observer perspective in future compared to past MTT events, as was the case in Study 1 (McDermott et al., 2016).

The results of Study 1 were also consistent with Hypothesis 5b, as type of retrieval was not a statistically significant effect for the mean proportions of field nor observer perspective events, suggesting stability across type of retrieval.

9.10. Conclusion

Study 1 is the first study, to the author's knowledge, to have assessed the characteristics of past and future, voluntary and involuntary MTT in dysphoric individuals. Moreover, it is the first study to have directly compared these characteristics between dysphoric and normal mood individuals. Consequently, its pilot findings provide information that is relevant to multiple theories addressing MTT processes and dysphoric mood characteristics. Among these theories is the

constructive episodic simulation hypothesis (Schacter & Addis, 2007, 2009), supported by the results of Study 1 as past, compared to future MTT, elicited more specific and less general events, with the differences in both specific and categoric events representing large-sized effects. The findings of Study 1 not only supported the constructive episodic simulation hypothesis' portrayal of future MTT as more schematic and intrinsically constructive than past MTT, but they also showed the greater overgenerality of future compared to past MTT extended to involuntary retrieval. This is a novel finding that can help advance our understanding of the nature of the mechanisms operating across type of retrieval for the formation of future scenarios. A greater knowledge of individuals' limits and tendencies regarding future MTT can help shed light upon their reasoning and decision making process (Spzunar & Radvansky, 2016), an aspect of further therapeutic relevance.

The findings of Study 1 also partially supported the CaR-FA-X model's proposal that involuntary retrieval might limit the overgeneral retrieval style of dysphoric and depressed individuals, as a consequence of its retrieval mechanisms (Williams et al., 2007). Regardless of participant group, involuntary future MTT was found to be more specific and less categoric than voluntary future MTT, a finding that might have been associated with the greater involvement of schematic knowledge and processes in the creation of voluntary future MTT events (see Section 9.5 for details).

The possibility that involuntary retrieval may limit dysphoric and depressed individuals' overgeneral retrieval style stems from proposed differences in the mechanisms underlying voluntary and involuntary retrieval (Berntsen, 2009). The findings of Study 1 are consistent with these different mechanisms, as voluntary retrieval was found to produce more self-relevant events, a finding consistent with

voluntary retrieval's proposed schematic nature, valuing schema-relevant/self-relevant events, in detriment of involuntary retrieval's more associative processes, privileging cue-item distinctiveness. The results also suggest that the differences in voluntary and involuntary mechanisms are constant across temporality, a finding that is congruent with recent results showing that future and past MTT events exhibit similarities across their voluntary and involuntary retrieval processes (Jeunehomme & D'Argembeau, 2016). Therefore, the results of Study 1 provide relevant information by suggesting strong similarities in how the different types of retrieval processes operate across temporality, leading to their similar impact upon past and future MTT events.

These findings regarding temporality and its interaction with type of retrieval have considerable potential therapeutic implications. As discussed by Debus (2016), there is great value in imagining future scenarios, not only because these may serve as a source of motivation but also because, under the right circumstances, they can help individuals to plan and implement behaviours conducing to said future scenarios becoming a reality. The fact that involuntary retrieval, when compared to voluntary retrieval, provides greater access to specific information, and the fact that future MTT was shown to be more positive than past MTT, suggests involuntary future MTT may constitute an important therapeutic tool, enabling access to positively valenced specific events that may help diminish dysphoric cycles. Furthermore, and as studied by Szpunar and Schacter (2013), a repeated simulation of future MTT events may help increase their perceived plausibility, as repetition can lead to increases in ease of simulation, event detail, and arousal. Consequently, by providing positively valenced material, involuntary future MTT can be paired with voluntary future MTT to

implement positive MTT cycles that, eventually, lead to positive behaviours and greater well-being (Quoidbach, Wood & Hansenne, 2009).

Study 1 also addressed the lack of studies directly comparing the valence of future MTT events (voluntary and involuntary) between dysphoric and normal mood individuals, while being only the second study to perform such comparisons for involuntary past MTT (Kvavilashvili & Schlagman, 2011). The results, as expected, showed dysphoric individuals produced fewer positive events than normal mood individuals, a finding that extended from past to future MTT. Furthermore, in both groups, there was a predominance of positively valenced future MTT events over past events, consistent with the literature (Berntsen & Jacobsen, 2008; D'Argembeau et al., 2012; D'Argembeau & Van der Linden, 2006).

The next chapters are devoted to Study 2, which was designed to help consolidate/challenge the results of Study 1, while addressing gaps in knowledge and providing relevant pilot findings involving clinically depressed patients.

CHAPTER TEN – METHODOLOGY OF STUDY 2

The methodology used in Study 2 is similar to that of Study 1 (see Chapter 7). This chapter will outline the methodological issues specific to Study 2.

10.1. Research Design

Study 2 was a quasi-experimental study with a 2 x (2 x 2) mixed factorial design. Temporality (past vs. future) and type of retrieval (voluntary vs. involuntary) were within-subjects' independent variables whereas participant group (depressed vs. never-depressed) was a between-subjects' variable. There were four possible forms of MTT, the result of the intersection between the orthogonal dimensions of temporality and type of retrieval.

10.2. Participants

10.2.1. Inclusion and exclusion criteria

Two types of inclusion and exclusion criteria were used: General criteria, applied to all participants irrespective of their group, and group specific criteria involving either depressed or never-depressed participants.

General inclusion criteria included age ($\geq$ 18 and $\leq$ 64), the ability to read, write, and physically and cognitively perform the required tasks without help.

Inclusion criteria for the depressed group consisted of a current diagnosis of Major Depressive Disorder (MDD). This diagnostic assessment was made by a psychiatrist, while following DSM-IV-TR criteria (see Appendix 11), and corroborated by the participant's clinical psychologist before the study's screening process began. The inclusion criteria for the control group were the absence of past or present history of psychopathology, based on self-report.

General exclusion criteria were the refusal to provide a signed informed consent or the existence of memory problems. The latter was assessed by asking the participants for any history of memory problems/conditions during the initial contact (see Figure 21 in Subsection 10.2.3).

10.2.2. Recruitment

Recruitment began on the 11th of February 2013 and ended on the 26th of February 2014. To recruit the depressed group, the PI presented the study to the staff of the Department of Psychiatry of the Centro Hospitalar Barreiro Montijo E.P.E. This presentation and subsequent informal briefings with staff members were designed to provide the staff with information that enabled them to conduct preliminary screenings of eligible participants amongst the inpatients and outpatients of the psychiatry department. Whenever a patient fit the criteria and expressed an interest to participate in the study, the staff informed the PI who then met with the participant to explain the study and deliver the information sheet. Participants were given a minimum of 24 hours to decide and those interested then met with the PI to schedule the first session.

The recruitment of participants for the never-depressed group only started when 26 of the 32 depressed group participants had already completed the study. This

was necessary to match the age and gender of the never-depressed participants with the depressed participants. Participants were recruited from the Centro Hospitalar Barreiro Montijo E.P.E, from the ISPA-IU staff and using a snowball sampling technique, involving friends and acquaintances, and following the matching variables and inclusion and exclusion criteria. In the beginning of this recruitment process, the PI directly approached prospective participants in ISPA-IU and hospital staff members for eligible participants. Those who fit the study's criteria were provided with information about the study.

10.2.3. Sample size

Given feasibility concerns, including the need to recruit a clinical sample, multiple face-to-face sessions, a diary-notebook task protracting throughout a minimum of 14 days, and time and financial constraints, no *a priori* power analyses were conducted.

Figure 21 below shows the recruitment process involving both depressed and never-depressed individuals. Of the total of 63 depressed patients of the Department of Psychiatry of the Centro Hospitalar Barreiro Montijo E.P.E that were initially approached by staff members, seven declined to participate or were deemed ineligible for participation given the inclusion and exclusion criteria provided to the staff. Of the remaining 56 participants who attended a first session, 11 were excluded. Among these, five participants were excluded because they were unable to comprehend the notebook task, two were excluded because they were incapable of performing the tasks required, and four decided to leave the study (reporting that it would be too time consuming. This meant that only 45 participants attended the first individual session

with the PI, completed the questionnaires, and took the Three Step Diary Questionnaire notebook with them. Of these, 13 never completed the diary notebook, leaving the study before the second and final session occurred. Among the reasons cited were a lack of available time, illness, an unwillingness to relive negative memories and incapacity to produce future representations. Hence, of the 62 participants originally contacted by the psychiatry department staff, a total of 32 completed the study.

For the never-depressed group, a matched-subjects sampling procedure was used, with age and gender as matching variables because of the impact they have in MTT processes (Holland et al., 2012; Ros & Latorre, 2010). Based on this sampling technique, the objective was to collect a sample of 32 participants, all matched with the depressed participants. For this purpose, a total of 43 subjects were directly contacted by the PI and briefed about the study (see Figure 21). Of these 43 subjects, six declined to participate, all claiming time constraints, and 37 were scheduled for a first session. Of the 37 participants that underwent a first session, five were unable to finish due to a lack of time or loss of the notebook. A total of 32 participants completed the study.

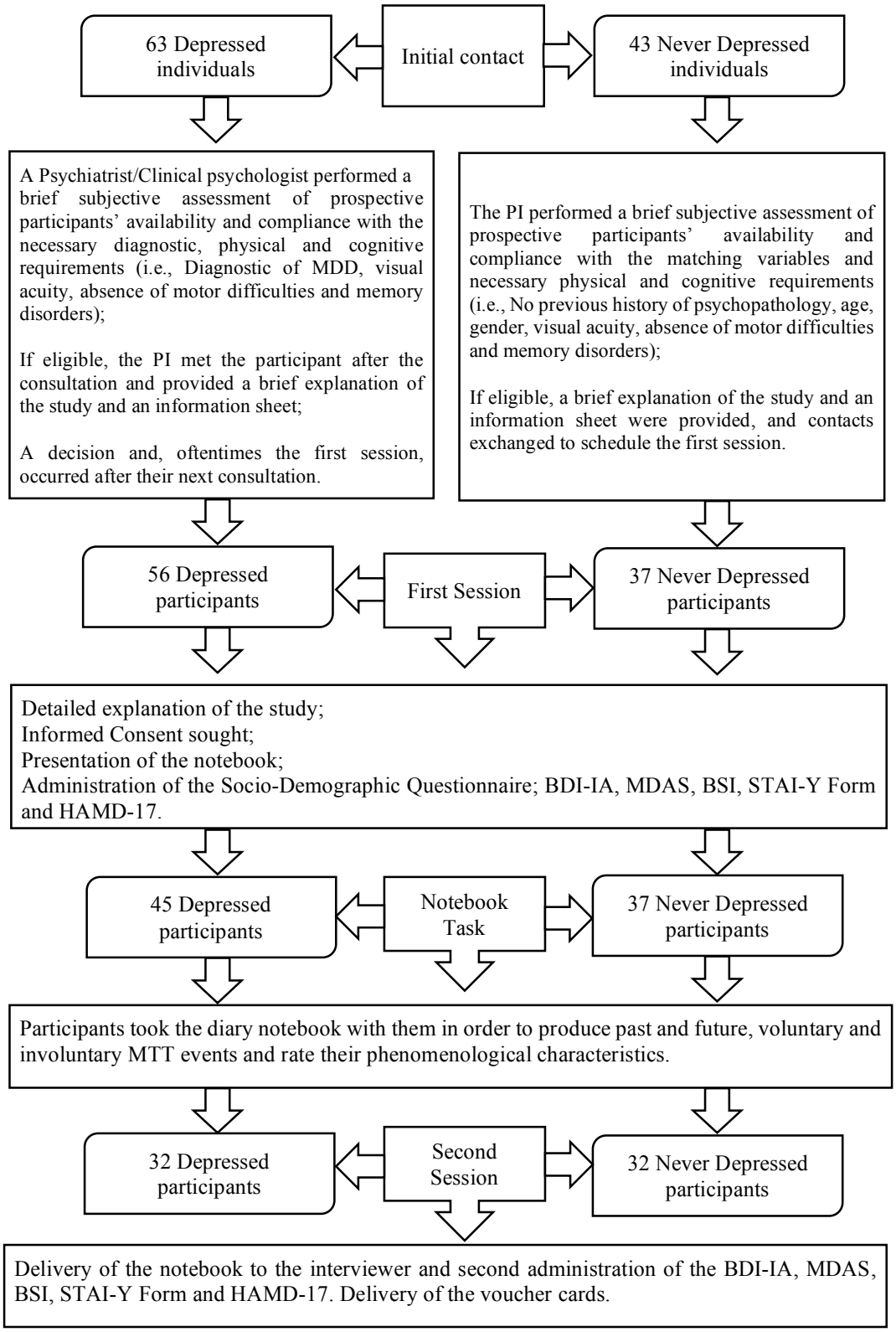


Figure 21. Flowchart of the data collection process in Study 2

10.3. Setting and Procedure

10.3.1. Depressed group

After participants agreed to participate in the study they were scheduled for a first session involving a face-to-face meeting with the PI. Unlike Study 1, in Study 2 all first and second sessions were individual meetings, which occurred in the offices of the department of psychiatry. The first session followed a structure similar to that in Study 1 (see Section 7.3) with a few exceptions: (a) feedback was collected verbally during the second session rather than a feedback form; and (b) a total of six instruments were used in the following order: sociodemographic questionnaire, BDI-IA, Multi-Dimensional Depression Assessment Scale (MDAS), Brief Symptom Inventory (BSI), STAI-Y Form and Hamilton Depression Rating Scale (HAMD-17). The first session lasted between 45 and 90 minutes.

After that, participants left and took the notebook with them to start the next stage of the study, the completion of the Three Step Diary Questionnaire notebook. The procedure for this stage replicates that of Study 1 (see Subsection 7.4.4).

After participants completed the Three Step Diary Questionnaire, they met with the PI for the second session, which occurred at least 15 days after the first session. During this meeting, the PI checked the notebook to confirm the task had been completed and administered the same instruments of the first session with the exception of the sociodemographic questionnaire.

10.3.2. Never-depressed group

Similarly to the depressed participants, once the never-depressed subjects agreed to participate they were scheduled a first session. All first and second sessions

consisted of individual meetings with the PI, often held at ISPA-IU's facilities or in one of the offices of the Department of Psychiatry of the Centro Hospitalar Barreiro Montijo E.P.E. There were exceptions where either or both sessions were held in the participants' home, but always under the necessary conditions of privacy.

Apart from the setting, all other aspects of the data collection procedure for control participants were identical to those of the depressed participants.

10.4. Measures

The seven instruments used in Study 2 are found in the Appendices section (Appendices 3, 4, 5, 6, 12, 13, 14)

10.4.1. Sociodemographic questionnaire

This instrument is described in Subsection 7.4.1.

10.4.2. Beck Depression Inventory (BDI-IA)

The history and characteristics of this instrument are described in Subsection 7.4.2. The psychometric properties of the BDI-IA in Study 2 (N = 64) showed good internal consistency, with Cronbach $\alpha = 0.91$ and 0.92 for the first and second session, respectively. Test-retest reliability, involving measurements separated by a mean interval of 27 days, were conducted as a further analysis of reliability, and the result was good $r = 0.88$ ($p < .001$).

For the clinical sample, other instruments such as the Center for the Epidemiologic Studies of Depression Scale (CES-D) or the Hospital Anxiety and Depression Scale (Zigmond & Snaith, 1983), which have been translated and validated

for the Portuguese population (Gonçalves & Fagulha, 2004; Pais-Ribeiro et al., 2007, respectively), could have been used because they are valid alternatives for measuring depressive symptomatology. However, and replicating the argument provided in Study 1 (see Subsection 7.4.2), the fact that several studies with similar objectives and methodology used the BDI (Johannessen & Berntsen, 2010; Sumner et al., 2010), meant its use would facilitate comparisons between the findings of this study and previous research.

10.4.3. Multidimensional Depression Assessment Scale (MDAS)

The Multidimensional Depression Assessment Scale is a self-report questionnaire recently developed (Cheung & Power, 2012) to address a limitation of existing depression measurement instruments: the lack of focus on interpersonal deficits in depression. This instrument has a total of 52 items that evaluate subjects' feelings and behaviours for the past two weeks (see Appendix 12). The 52 items refer to four different dimensions, emotional, cognitive, somatic and interpersonal. Respondents are instructed to rate each item on a five-point Likert scale ranging from 1 (*not at all*) to 5 (*all the time*). Total scores vary between a minimum of 52 and a maximum of 260 and the instrument's presentation time oscillates between 10 and 15 minutes (Cheung & Power, 2012).

Regarding its psychometric properties, the MDAS registered a high Cronbach alpha ($\alpha = 0.87$), which suggests high internal consistency, with each of its four subscales also exhibiting good Cronbach alpha values, namely $\alpha = 0.87$ for the emotional subscale, $\alpha = 0.88$ for the cognitive subscale, $\alpha = 0.83$ for the somatic subscale and $\alpha = 0.89$ for the interpersonal subscale. It showed good convergent

validity with the BDI-II and its discriminant validity allowed for distinctions between dysphoric and non-dysphoric groups of students. Factorial validity analyses indicated the presence of four factors, each corresponding to one of the subscales (Cheung & Power, 2012).

A three step process of back translation was used to translate the MDAS into Portuguese. Initially, three PhD students, PI included, individually performed a forward translation of the scale to Portuguese. Then, once unanimous agreement was reached about a final version of the Portuguese translation, a back translation into English was performed by a fourth PhD student. The English version obtained was near identical to the original and, as such, was approved by the Research Collaborator. This translated version of the instrument was then validated for a community sample (N = 281) with results showing a high Cronbach alpha for both the scale overall (α = 0.96) and its respective subscales (α = 0.91 for the Emotional subscale, α = 0.90 for the Cognitive Subscale, α = 0.87 for the Somatic Subscale and α = 0.88 for the Interpersonal Subscale). The translated version showed convergent validity with the BDI-IA version used in the present studies (r = 0,594, p < .01) and its discriminant validity allowed for the distinction (p < .001) between dysphoric (n = 46) and non-dysphoric groups (n = 235). Regarding factorial validity, a KMO of 0.94 was obtained, superb for factor extraction (Hutcheson & Sofroniou, 1999), which later showed a possible four factor fit (Pereira, 2012).

Further analyses exploring the psychometric properties of the instrument in Study 2 (N = 64), replicated good internal consistency, with a high Cronbach alpha, α = 0.97, for both sessions. Test-retest reliability, involving measurements separated by a mean interval of 27 days, was also good, r = 0.81 (p < .001).

10.4.4. Hamilton Depression Rating Scale (HAMD-17)

The HAMD-17 is a clinician rated measure that has been extensively used to assess the severity of depression and its changes over time (Trajković et al., 2011). It is comprised of 17 items measured on five-point or three-point Likert-type scales (Hamilton, 1960) that measure the symptomatology of the past week (see Appendix 13). The total score is obtained by summing the score of each item, from 0–4 (symptom is absent, mild, moderate, or severe) or 0–2 (absent, slight or trivial, clearly present). Scores range from 0 to 54, with higher values indicating more severe levels of depression (Cusin, Yang, Yeung &, Fava, 2009). A recent meta-analysis has suggested cut-off scores of 0-7 for None or Minimal Depression; 8-16 for Mild Depression; 17-23 for Moderate Depression; and ≥ 24 for Severe Depression (Zimmerman, Martinez, Young, Chelminski, & Dalrymple, 2013).

A different meta-analysis, regarding the psychometric properties of the original version, showed the HAMD-17 possesses good internal consistency, as a Cronbach α = 0.789 was obtained from a pooled mean in random effects model (Trajković et al., 2011). The HAMD-17 has also shown convergent validity, via its correlation with several depression measuring scales, and discriminant validity, via its ability to distinguish between healthy and depressed individuals (Bagby, Ryder, Schuller, & Marshall, 2004). It is a multidimensional instrument as factor analyses have exhibited two to eight factors (Bagby et al., 2004).

In the current study we used the Portuguese version, translated and adapted by Guerreiro and Góis in 1996, and applied it using a structured interview (Williams, 1988). The ability to correctly apply it was confirmed by the Research Collaborator. The analysis of the psychometric properties of the HAMD-17 in the current study (N

= 64) showed good levels of internal consistency, with a Cronbach α = 0.87 in both the first and second sessions. Test-retest reliability, involving measurements separated by a mean interval of 27 days, was good, with $r = 0.88$ ($p < .01$).

10.4.5. Brief Symptom Inventory (BSI)

This instrument was designed to identify self-reported clinically relevant psychological symptoms (Derogatis & Melisaratos, 1983). It consists of 53 items covering the nine symptom dimensions of Somatization, Obsession-Compulsion, Interpersonal Sensitivity, Depression, Anxiety, Hostility, Phobic Anxiety, Paranoid Ideation and Psychoticism (see Appendix 14). It also encompasses three global indices of distress: the Global Severity Index, Positive Symptom Distress Index, and Positive Symptom Total. These global indices assess, respectively, present or past levels of symptomatology, intensity of symptoms, and number of reported symptoms (Derogatis & Melisaratos, 1983). The BSI's items were derived from the SCL-R-90, which measures the same factors but is more extensive and thus time consuming, whereas the BSI takes 8-12 minutes to be applied (Derogatis & Melisaratos, 1983). Respondents rank each item on a 5-point scale that ranges from 0 (not at all) to 4 (extremely). Rankings characterise the intensity of distress during the past seven days.

The psychometric properties of the original version showed good internal consistency for the nine dimensions, with Cronbach alphas ranging from α = 0.71, on the dimension of Psychoticism, to α = 0.85 on Depression. Test-retest reliability values oscillated between $r = 0.68$, for the Somatic dimension, and $r = 0.91$ for Phobic Anxiety (Derogatis & Melisaratos, 1983). The Global Severity Index registered a test-restest value of $r = 0.90$ whereas the Positive Symptoms Distress Index and the

Positive Symptom Total registered $r = 0.87$ and $r = 0.80$ respectively. Concerning the instrument's convergent validity, Derogatis and Melisaratos (1983) found $r \geq 0.30$ in all nine dimensions when correlating the BSI with the MMPI. Factorial validity analyses showed that in spite of minor differences between the empirical factor structure and the dimensional structure intended, nine factors, each corresponding to the nine dimensions, were found (Derogatis & Melisaratos, 1983).

For the present study we used the BSI version, translated and validated for the Portuguese psychiatric and nonpsychiatric population by Canavarro (2003). The Portuguese translation showed relatively good internal consistency, with the Cronbach alphas of the nine dimensions varying between $\alpha = .62$ and $\alpha = .80$. Adequate results for test-retest reliability, $r = 0.63$ and $r = .81$, $p < .001$, were obtained for testing periods involving three and six weeks respectively (Canavarro, 2003). The translated version exhibited convergent validity with the Portuguese version of the Emotional Assessment Scale and discriminant validity in its ability to discriminate between individuals with and without emotional disorders. The authors proposed a cut-off point ≥ 1.7 in the Positive Symptom Distress Index to indicate emotional disorders (Canavarro, 2003).

The psychometric properties of this instrument were assessed for the current sample (N = 64), indicating good internal consistency, as the Cronbach alpha values for the instrument's nine dimensions oscillated between $\alpha = 0.70$ and $\alpha = 0.88$ for the first session, and between $\alpha = 0.74$ and $\alpha = 0.90$ for the second session. Test-retest reliability, involving measurements separated by a mean interval of 27 days, showed adequate values for the nine dimensions, ranging between $r = 0.60$, $p < .01$ and $r = 0.83$ $p < .01$.

10.4.6. State-Trait Anxiety Inventory (STAI) – Y Form

The history and characteristics of this instrument are described in Subsection 7.4.3. The analysis of the psychometric properties of this instrument in Study 2 (N = 64) showed good internal consistency as Cronbach alphas of $\alpha = 0.91$ and $\alpha = 0.92$ were obtained for the S-Anxiety's first and second sessions. Test-retest reliability of the S-Anxiety, involving measurements separated by a mean interval of 27 days, was adequate, with $r = 0.71$ ($p < .01$). Good internal consistency was also exhibited for the T-Anxiety, with high results obtained in both the first and second session – $\alpha = 0.92$ and $\alpha = 0.95$, respectively. Test-retest reliability, with a mean interval of 27 days, was good, as $r = 0.81$ ($p < .01$).

10.4.7. Three Step Structured Diary Questionnaire

The history and characteristics of this instrument are described in Subsection 7.4.4.

10.5. Ethical Considerations

Prior to data collection, ethical issues were considered and addressed. The study was approved by the Research Ethics Committee of the School of Health in Social Sciences of the University of Edinburgh and by the Ethics Committee of the Centro Hospitalar Lisboa Norte, E.P.E, the Hospital Garcia de Orta, E.P.E and the Centro Hospitalar Barreiro Montijo, E.P.E (see Appendix 15). After approval, the PI met with the directors of the psychiatry departments of two of the three hospitals, staff meetings were held where the PI presented the study, and individual briefings with

staff members occurred. Due to time and availability constraints from the staff at the Centro Hospitalar Lisboa Norte, E.P.E and at the Hospital Garcia de Orta, E.P.E, no data collection occurred at these hospitals.

All participants were provided with a clear and detailed document of informed consent as well as an information sheet (see Appendixes 16 and 17). All eligible subjects had a minimum of 24 hours to decide upon participation. Confidentiality was ensured by following the exact same procedures of Study 1, described in Section 7.5.

Before data collection began it was established that all participants who successfully finished Study 2 would receive a 50 euros gift card, whereas those who did not would receive no compensation. The purpose of this measure was to limit the high levels of experimental mortality expected, particularly for the depressed group, and to reward the participants' involvement in a study lasting a minimum of two weeks. Information about the gift card and its associated conditions was provided both verbally, before and during the first session, and in writing, via the information sheet.

Participants were repeatedly informed, both during the initial approach and the first session, that could end their participation at any moment. They were given the full contact details of the PI, the research collaborator and the primary supervisor. They were encouraged to contact the PI whenever doubts arose and whenever any problems, related with the study, unfolded. Depressed participants who scored high on items of self-harm or suicidal intentions were flagged to their respective psychologist, as they had given permission for this information to be shared.

10.6. Statistical Procedures

Study 2 used the same statistical procedures as Study 1 (see Section 7.6 and its corresponding subsections). However, it bears mentioning that, unlike in Study 1, the figures of the missing values' data for Hypotheses 2 and 4 of Study 2 were 1.33% and 1.18%, respectively.

CHAPTER ELEVEN – RESULTS OF STUDY 2

In this chapter the results of Study 2, assessing MTT in never-depressed vs. depressed participants, are presented. The statistical procedures previously described in Section 7.6 are applied throughout this chapter, as Study 2 follows a statistical and organisational framework similar to that of Study 1.

In the ensuing sections the sociodemographic characteristics of Study 2 participants are described (Section 11.1), followed by their scores on clinical measures (11.2). The mean totals of MTT events, semantic associates, and omissions are presented (11.3), followed by analyses of the temporal distribution of the MTT events produced (11.4), and of their temporal distance in relation to the participants' age at the time of notebook completion (11.4.1). These preliminary analyses antecede those testing Study 2's hypotheses (Sections 11.5 – 11.9), with Section 11.10 providing a summary of the hypotheses' testing in a table format. Section 11.11 summarises the findings by the post-hoc ANCOVAs.

11.1. Sociodemographic Variables

The following variables are presented and analysed in Table 15: age, gender, number of successfully completed education years. While both participant groups were well matched on age and gender, never-depressed participants reported more education years than depressed participants.

Table 15. Demographic characteristics of Study 2 (means and standard deviations)

	Depressed group n = 32	Never-depressed group n = 32	Statistical tests	C.I 95% BCa	Effect Size and respective 95% C.I.
Age (years)	47.72 (9.04)	45.41 (7.17)	t= 1.13 n.s	[-1.77, 6.39]	h= 0.28 [-0.21, 0.78]
Gender (male/female)	10/22 [b]	10/22 [b]	χ= 0 n.s	n.a	V= 1
Education years [a]	10.72 (4.00)	16.22 (3.52)	t=-5.85 ***	[-7.24, -3.64]	h= -1.44 [-2.01, -0.90]

Notes.
[a] Refers to the number of successfully completed school years.
[b] Number of participants.
n.s = not statistically significant; n.a = non-applicable. *** $p < .001$

11.2. Clinical Measures

The BDI-IA, MDAS, HAMD-17, BSI, and STAI-Y scores registered in the two sessions (pre- and post-notebook completion) are described in Table 16. As expected, depressed participants showed statistically significantly higher levels of psychopathology in all the clinical measures. Time was a statistically significant main effect for the BDI-IA, with higher mean scores having been produced in the first session compared with the second – a result similar to that obtained in Study 1.

Table 16. Results of the clinical measures applied in Study 2 (means and standard deviations)

	Depressed group n = 32		Never-depressed group n = 32		Main Effects and Effect Sizes		Interaction
	1st Session	2nd Session	1st Session	2nd Session	Participant Group	Time (Session)	Group*Time
BDI-IA	22.88 (7.91)	20.41 (9.05)	6.13 (4.87)	4.72 (4.66)	$F = 103.98$ *** $\eta_p^2 = 0.63$ $\eta_g^2 = 0.59$	$F = 8.52$** $\eta_p^2 = 0.12$ $\eta_g^2 = 0.0083$	$F = 0.64$ n.s $\eta_p^2 = 0.010$ $\eta_g^2 < 0.001$
MDAS	141.81 (31.62)	132.47 (30.06)	86.53 (21.11)	86.81 (22.09)	$F = 69.82$ *** $\eta_p^2 = 0.53$ $\eta_g^2 = 0.48$	$F = 2.62$ n.s $\eta_p^2 = 0.041$ $\eta_g^2 = 0.0039$	$F = 2.95$ n.s $\eta_p^2 = 0.045$ $\eta_g^2 = 0.0043$
HAMD-17	13.72 (4.38)	12.56 (4.29)	2.00 (1.83)	1.84 (2.08)	$F = 230.28$ *** $\eta_p^2 = 0.79$ $\eta_g^2 = 0.74$	$F = 2.69$ n.s $\eta_p^2 = 0.042$ $\eta_g^2 = 0.0025$	$F = 1.56$ n.s $\eta_p^2 = 0.025$ $\eta_g^2 = 0.0015$
BSI	1.39 (0.48)	1.29 (0.55)	0.33 (0.23)	0.37 (0.41)	$F = 108.35$ *** $\eta_p^2 = 0.64$ $\eta_g^2 = 0.57$	$F = 0.33$ n.s $\eta_p^2 = 0.0053$ $\eta_g^2 < 0.001$	$F = 1.75$ n.s $\eta_p^2 = 0.028$ $\eta_g^2 = 0.0029$
STAIS	40.69 (9.58)	41.06 (9.92)	29.16 (6.39)	31.53 (8.80)	$F = 28.56$ *** $\eta_p^2 = 0.32$ $\eta_g^2 = 0.27$	$F = 2.02$ n.s $\eta_p^2 = 0.032$ $\eta_g^2 = 0.0046$	$F = 1.07$ n.s $\eta_p^2 = 0.017$ $\eta_g^2 = 0.0024$
STAIT	53.44 (9.93)	53.91 (9.78)	33.91 (7.85)	33.28 (8.36)	$F = 100.92$ *** $\eta_p^2 = 0.62$ $\eta_g^2 = 0.56$	$F = 0.006$ n.s $\eta_p^2 < 0.001$ $\eta_g^2 < 0.001$	$F = 0.27$ n.s $\eta_p^2 = 0.004$ $\eta_g^2 < 0.001$

Notes. n.s = not statistically significant. ** $p < .01$; *** $p < .001$.

11.3. Mean Totals of MTT Events, Semantic Associates and Omissions

The mean totals of MTT events produced in the notebook task are presented in Table 17 below. Congruent with the rationale presented in Subsection 7.6.4 and followed throughout Study 1, two different sets of MTT events are analysed in Table 17, one involving all MTT events produced by participants and the other restricted to spatiotemporally specific MTT events. Similar to Section 8.3 of Study 1, the mean totals of semantic associates and omissions were analysed and subsequently excluded from all additional analyses performed in Study 2.

Three factor 2 x (2 x 2) mixed-design ANOVAs were used to perform the analyses described in Table 17. Results show that when accounting for all MTT events, temporality was a statistically significant main effect, qualified by an interaction with participant group, $F(1, 62) = 5.24$, $p = .026$, $\eta_p^2 = 0.078$, $\eta_g^2 = 0.026$. Post hoc analyses showed that depressed participants, comparatively to never-depressed participants, produced higher mean numbers of past MTT events. Furthermore, depressed participants recorded more past than future MTT events.

In the case of exclusively specific MTT events, temporality was a statistically significant effect qualified by an interaction with type of retrieval, $F(1, 62) = 18.43$, $p < .001$, $\eta_p^2 = 0.23$, $\eta_g^2 = 0.032$. Subsequent post hoc analyses revealed that, regardless of participant group and type of retrieval, more specific MTT events were produced in past compared to future MTT. However, while the transition from involuntary to voluntary retrieval resulted in an increase of the mean number of specific past MTT events, a decrease was observed for specific future MTT events.

Table 17. Mean totals and standard deviations of all MTT events (specific, categoric, and extended), exclusively specific MTT events, semantic associates, and omissions, in accordance with participant group, temporality, and type of retrieval

	Depressed group n = 32				Never-depressed group n = 32				Main Effects and effect sizes		
	Past		Future		Past		Future		Participant Group	Temporality	Type of Retrieval
	IV	V	IV	V	IV	V	IV	V			
All MTT	9.50 (2.78)	9.60 (2.82)	7.41 (1.97)	7.19 (2.48)	8.19 (2.24)	8.03 (2.18)	7.41 (1.93)	7.34 (1.96)	$F = 2.18$ n.s ♣ $\eta_p^2 = 0.034$ $\eta_g^2 = 0.021$	$F = 20.31$ ***♣ $\eta_p^2 = 0.25$ $\eta_g^2 = 0.092$	$F = 1.29$ n.s $\eta_p^2 = = 0.020$ $\eta_g^2 < 0.001$
Specific MTT	5.25 (2.31)	5.56 (2.33)	3.91 (2.26)	2.78 (1.88)	5.03 (1.98)	5.81 (2.42)	3.78 (2.38)	2.84 (1.90)	$F = 0.000$ n.s $\eta_p^2 < 0.001$ $\eta_g^2 < 0.001$	$F = 47.60$ ***♠ $\eta_p^2 = 0.43$ $\eta_g^2 = 0.19$	$F = 2.71$ n.s♠ $\eta_p^2 = 0.042$ $\eta_g^2 = 0.0031$
Semantic Associates	0.25 (0.67)	0.28 (0.73)	0.81 (1.45)	0.94 (1.22)	0.094 (0.30)	0.031 (0.18)	0.22 (0.49)	0.28 (0.68)	$F = 8.51$ ** $\eta_p^2 = 0.12$ $\eta_g^2 = 0.058$	$F = 11.94$ ** $\eta_p^2 = 0.16$ $\eta_g^2 = 0.051$	$F = 0.39$ n.s $\eta_p^2 = 0.006$ $\eta_g^2 < 0.001$
Omissions	0.063 (0.25)	0.031 (0.18)	0.19 (0.59)	0.22 (0.61)	0.031 (0.18)	0.094 (0.30)	0.031 (0.18)	0.031 (0.18)	$F = 1.70$ n.s $\eta_p^2 = 0.012$ $\eta_g^2 = 0.027$	$F = 1.22$ n.s $\eta_p^2 = 0.019$ $\eta_g^2 = 0.0078$	$F = 0.39$ n.s $\eta_p^2 = 0.006$ $\eta_g^2 < 0.001$

Notes.
All MTT = Includes all MTT events, namely specific, categoric, and extended MTT events.
Specific MTT = Includes only specific MTT events.
Semantic Associates = Representations that are either non-autobiographical or lack autonoetic re- and pre-experience.
Omissions = Blank responses/missing values.
Temporality = Past vs. Future; Type of Retrieval = Involuntary vs. Voluntary Retrieval; IV = Involuntary Retrieval; V = Voluntary Retrieval.
n.s = not statistically significant; ** $p < .01$, *** $p < .001$.
♣ $p < .05$ for the interaction involving the factors signalled; ♠ $p < .001$ for the interaction involving the factors signalled;

11.4 Temporal Distribution of MTT Events

The temporal distribution of the MTT events registered by depressed and never-depressed participants was assessed through multiple 2 x (2) mixed-design ANOVAs, with type of retrieval as the within-group factor (see Appendix 18 for all results). Figure 22 demonstrates that in the temporal distribution of past MTT events, type of retrieval was a statistically significant main effect only for events dating back to when participants were 11-15 years of age, $F(1, 62) = 4.74$, $p = .033$, $\eta_p^2 = 0.071$ and $\eta_g^2 = 0.018$, as more events from this time period were produced via involuntary retrieval. As for participant group, it was only a statistically significant main effect for events from the 36-40 years of age period, $F(1, 62) = 5.12$, $p = .027$, $\eta_p^2 = 0.076$ and $\eta_g^2 = 0.051$ with depressed participants registering higher mean proportions of past MTT events from when they were 36-40 years of age than never-depressed participants.

In what concerns the temporal distribution of future MTT events, type of retrieval was a statistically significant main effect only for MTT events from the 61-85 years of age category, $F(1, 61) = 14.11$, $p < .001$, $\eta_p^2 = 0.19$ and $\eta_g^2 = 0.037$, with voluntary retrieval eliciting higher mean proportions of future MTT events from this age period when compared to involuntary retrieval – see Appendix 18 for all results and Figure 23 for details. This finding was congruent with the results of Study 1, which pointed to involuntary retrieval privileging the construction/retrieval of recent in detriment of distant future MTT events.

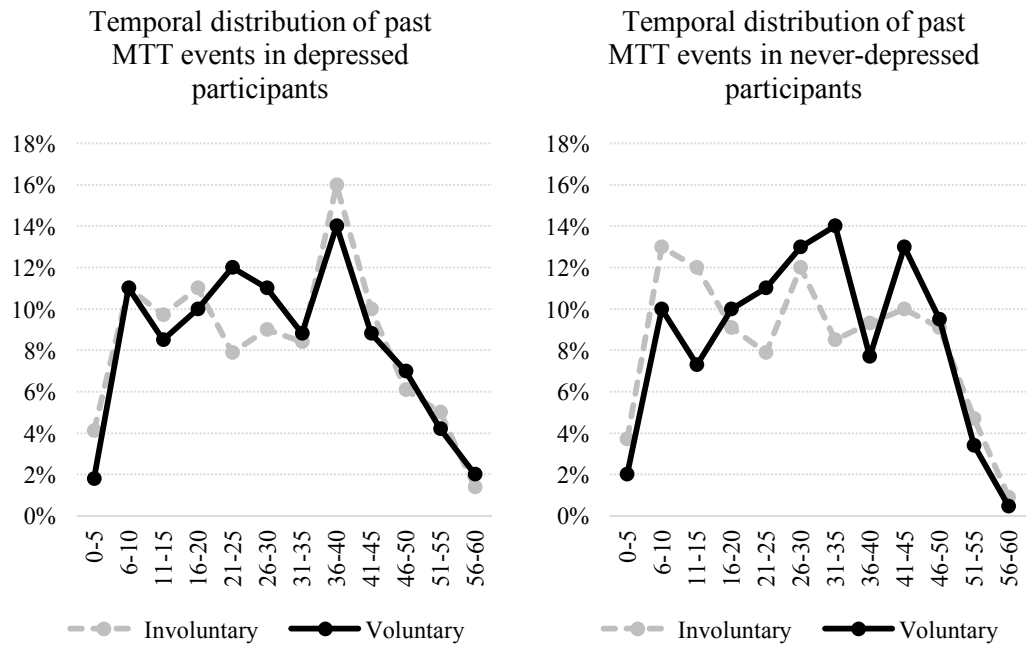


Figure 22. Temporal distribution of past MTT events (mean proportions of events from each age category) in depressed and never-depressed participants according to type of retrieval

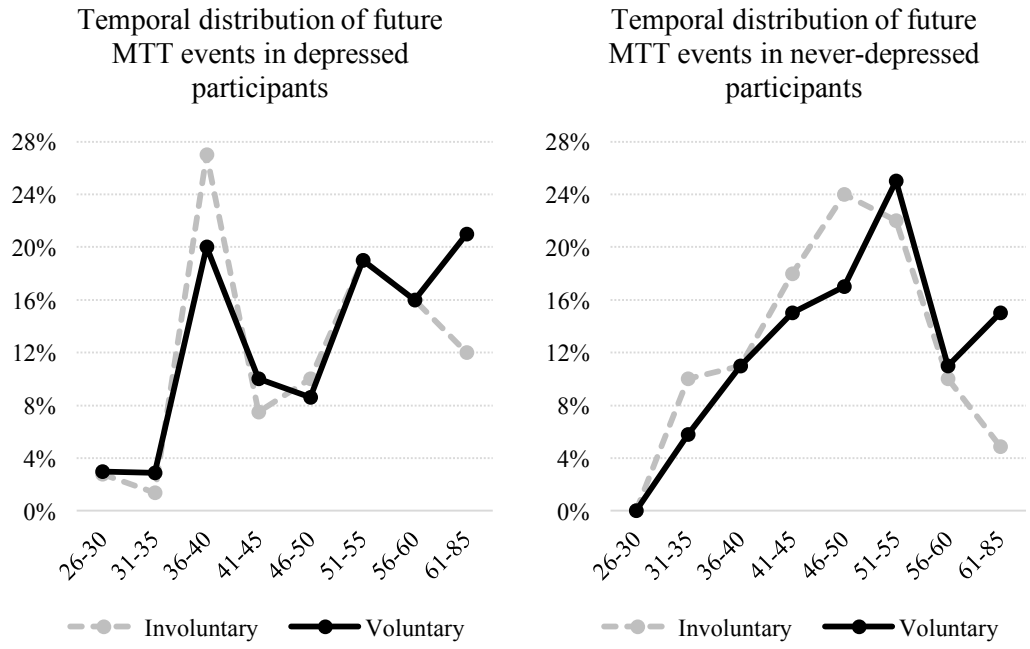


Figure 23. Temporal distribution of future MTT events (mean proportions of events from each age category) in depressed and never-depressed participants according to type of retrieval

11.4.1 Temporal distance of MTT events

The timeframe intervals used to study temporal distance in Study 1 (see Subsection 8.4.1) were also used in Study 2. Multiple 2 x (2 x 2) mixed-design ANOVAs were performed, using the mean proportions of MTT events from each timeframe as dependent variables (see Table 18). Findings respecting recent (same year) MTT events showed that temporality was a statistically significant main effect qualified by an interaction with type of retrieval, $F(1, 61) = 37.40$, $p < .001$, $\eta_p^2 = 0.38$, $\eta_g^2 = 0.044$. Subsequent post hoc analyses demonstrated that regardless of type of retrieval, higher mean proportions of recent events were produced for future compared to past MTT, and that within future MTT more recent events were elicited by involuntary compared to voluntary retrieval. These results, being congruent with those of Study 1, once more suggested the possibility that in future MTT the involuntary retrieval of events privileges access to recent (same year) experiences.

The findings of Study 2, similarly to Study 1, also showed that participants produced more events from a distant past (>15 years) than from a distant future. This was demonstrated by the fact that temporality was a statistically significant main effect in temporal distance timeframes that were at least 15 years distant from the moment of the notebook's completion.

Table 18. Mean proportions and standard deviations of the temporal distance of MTT events in accordance with participant group, temporality, and type of retrieval

	Depressed group n = 31 [a]				Never-depressed group n = 32				Main Effects and effect sizes		
Temporal distance	Past		Future		Past		Future		Participant Group	Temporality	Type of Retrieval
	IV	V	IV	V	IV	V	IV	V			
Same year	0.14 (0.15)	0.14 (0.15)	0.73 (0.32)	0.58 (0.32)	0.17 (0.17)	0.16 (0.13)	0.79 (0.25)	0.53 (0.34)	$F = 0.12$ n.s $\eta_p^2 = 0.002$ $\eta_g^2 = 0.001$	$F = 195.31$ ***♠ $\eta_p^2 = 0.76$ $\eta_g^2 = 0.53$	$F = 33.29$ ***♠ $\eta_p^2 = 0.35$ $\eta_g^2 = 0.049$
Between 2-5 years	0.13 (0.12)	0.14 (0.11)	0.16 (0.23)	0.21 (0.19)	0.13 (0.11)	0.17 (0.17)	0.11 (0.18)	0.18 (0.21)	$F = 0.32$ n.s $\eta_p^2 = 0.005$ $\eta_g^2 = 0.0019$	$F = 1.19$ n.s $\eta_p^2 = 0.019$ $\eta_g^2 = 0.0055$	$F = 7.08$* $\eta_p^2 = 0.10$ $\eta_g^2 = 0.018$
Between 6-10 years	0.11 (0.10)	0.14 (0.14)	0.053 (0.12)	0.072 (0.13)	0.093 (0.10)	0.085 (0.12)	0.034 (0.072)	0.098 (0.18)	$F = 1.28$ n.s $\eta_p^2 = 0.020$ $\eta_g^2 = 0.0051$	$F = 5.87$ * $\eta_p^2 = 0.088$ $\eta_g^2 = 0.031$	$F = 2.93$ n.s $\eta_p^2 = 0.046$ $\eta_g^2 = 0.010$
Between 11-15 years	0.14 (0.16)	0.069 (0.096)	0.029 (0.061)	0.066 (0.12)	0.094 (0.12)	0.15 (0.12)	0.032 (0.085)	0.048 (0.075)	$F = 0.12$ n.s ↔ $\eta_p^2 = 0.002$ $\eta_g^2 < 0.001$	$F = 22.13$ *** ↔ $\eta_p^2 = 0.27$ $\eta_g^2 = 0.087$	$F = 0.64$ n.s ↔ $\eta_p^2 = 0.010$ $\eta_g^2 = 0.0019$
Between 16-20 years	0.076 (0.10)	0.089 (0.095)	0.014 (0.057)	0.058 (0.13)	0.083 (0.10)	0.043 (0.073)	0.019 (0.064)	0.056 (0.099)	$F = 0.48$ n.s $\eta_p^2 = 0.008$ $\eta_g^2 = 0.0024$	$F = 7.17$ * ♣ $\eta_p^2 = 0.11$ $\eta_g^2 = 0.037$	$F = 2.19$ n.s ♣ $\eta_p^2 = 0.035$ $\eta_g^2 = 0.0056$
Between 21-25 years	0.072 (0.073)	0.075 (0.097)	0	0	0.099 (0.12)	0.11 (0.14)	0.0097 (0.038)	0.039 (0.074)	$F = 5.05$ * $\eta_p^2 = 0.076$ $\eta_g^2 = 0.025$	$F = 37.40$ *** $\eta_p^2 = 0.38$ $\eta_g^2 = 0.17$	$F = 1.37$ n.s $\eta_p^2 = 0.022$ $\eta_g^2 = 0.0034$
Over 25 years	0.34 (0.26)	0.35 (0.23)	0.0046 (0.026)	0.017 (0.045)	0.33 (0.21)	0.29 (0.21)	0.0089 (0.035)	0.055 (0.096)	$F = 0.041$ n.s $\eta_p^2 = 0.001$ $\eta_g^2 < 0.001$	$F = 131.41$ *** $\eta_p^2 = 0.68$ $\eta_g^2 = 0.46$	$F = 0.13$ n.s $\eta_p^2 = 0.002$ $\eta_g^2 < 0.001$

Notes.

[a] One participant failed to provide the age of the future events' occurrence. n.s = not statistically significant. * $p < .05$, *** $p < .001$; ♣ $p < .05$ for the interaction involving the factors signalled, ↔ $p < .01$ for the interaction involving the factors signalled, ♠ $p < .001$ for the interaction involving the factors signalled;

11.5. Hypothesis 1 – Level of Spatiotemporal Specificity

Hypothesis 1 tests the level of spatiotemporal specificity exhibited by depressed and never-depressed participants. This testing was performed via four sub-hypotheses: Hypothesis 1a stated that past and future involuntary MTT events would be more specific/less general than their voluntary counterparts regardless of participant group; Hypothesis 1b proposed that the past and future, voluntary and involuntary MTT events of depressed participants would be less specific/more general than the MTT events of never-depressed participants; Hypothesis 1c stated that future voluntary and involuntary MTT events would be less specific/more general than their past counterparts regardless of participant group; Hypothesis 1d proposed that the difference in specificity between past and future MTT events would be greater in voluntary compared to involuntary retrieval, regardless of participant group.

Similarly to Hypothesis 1 of Study 1 (Section 8.5), 2 x (2 x 2) mixed-design ANOVAs were performed using the mean proportions of specific, extended and categoric MTT events as dependent variables. The rationale underlying the use of the mean proportions of events produced in detriment of their mean total numbers follows that of Study 1 (see Section 7.6).

11.5.1. Mean proportions of specific MTT events

In what concerns the mean proportions of specific MTT events, analyses showed a statistically significant main effect of temporality, whereby future MTT events were less specific than past events regardless of type of retrieval and participant group – a result consistent with Hypothesis 1c. This main effect of temporality was

qualified by an interaction with type of retrieval, $F(1, 62) = 20.59$, $p < .001$, $\eta_p^2 = 0.25$, $\eta_g^2 = 0.047$ (see Figure 24).

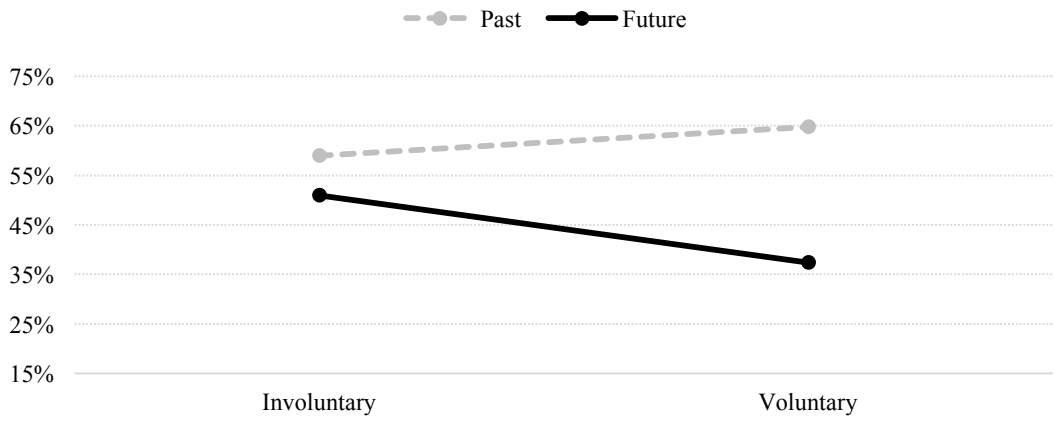


Figure 24. Interaction between temporality and type of retrieval showing the mean proportions of specific MTT events regardless of participant group

Post hoc analyses revealed statistically significant higher mean proportions of specific events produced in past compared to future MTT in both voluntary and involuntary retrieval, although differences in specificity between past and future were greater for voluntarily retrieved events regardless of group – thus supporting Hypothesis 1d. Additionally, whereas in past MTT there were less specific involuntary compared to voluntary events, the opposite occurred for future MTT, wherein there were more specific involuntary than voluntary events (see Figures 25 and 26, and Table 19).

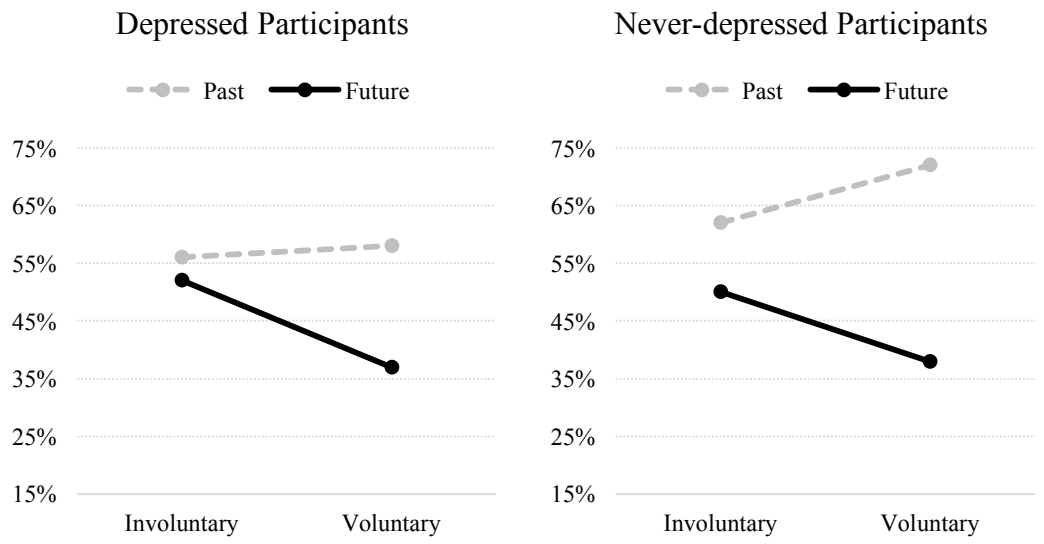


Figure 25. Interaction between temporality and type of retrieval regarding mean proportion of specific MTT events produced by both participant groups

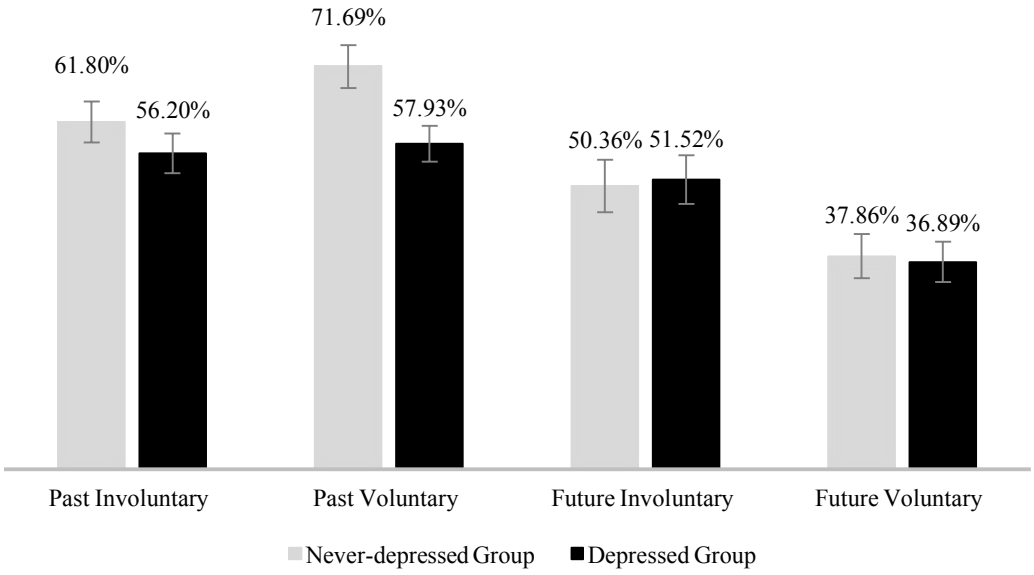


Figure 26. Mean proportions of specific MTT events in accordance with participant group, temporality and type of retrieval. Error bars represent standard errors.

Thus, although the transition from an involuntary to a voluntary type of retrieval in future MTT produced a decrease in the participants' specificity levels, an increase occurred for past MTT. This meant that the results for future MTT supported Hypothesis 1a but those for past MTT did not. Consequently, even though type of

retrieval was a statistically significant main effect, the hypothesised superior specificity of involuntary compared to voluntary events only occurred in future MTT, meaning partial support for Hypothesis 1a.

As evidenced in Table 19 and Figure 26, participant group was not a statistically significant main effect, which meant that Hypothesis 1b was not supported. Unlike hypothesised, never-depressed participants did not produce more specific MTT events than depressed participants.

Table 19. Mean proportions and standard deviations of specific, extended, and categoric MTT events, in accordance with participant group, temporality and type of retrieval.

	Depressed group n = 32				Never-depressed group n = 32				Main Effects and effect sizes		
Specificity Level	Past		Future		Past		Future		Participant Group	Temporality	Type of Retrieval
	IV	V	IV	V	IV	V	IV	V			
Specific	.56 (.20)	.58 (.18)	.52 (.25)	.37 (.20)	.62 (.21)	.72 (.21)	.50 (.27)	.38 (.22)	$F = 1.61$ n.s. $\eta_p^2 = 0.025$ $\eta_g^2 = 0.012$	$F = 39.78$***♠ $\eta_p^2 = 0.39$ $\eta_g^2 = 0.14$	$F = 4.63$*♠ $\eta_p^2 = 0.070$ $\eta_g^2 = 0.0078$
Extended	.10 (.13)	.11 (.10)	.10 (.11)	.051 (.08)	.095 (.14)	.11 (.15)	.12 (.15)	.16 (.17)	$F = 2.33$ n.s. ♣ $\eta_p^2 = 0.036$ $\eta_g^2 = 0.015$	$F = 0.074$ n.s. $\eta_p^2 = 0.001$ $\eta_g^2 < 0.001$	$F = 0.097$ n.s. ♣ $\eta_p^2 = 0.002$ $\eta_g^2 < 0.001$
Categoric	.34 (.20)	.32 (.16)	.38 (.17)	.58 (.22)	.29 (.19)	.17 (.15)	.38 (.26)	.46 (.20)	$F = 5.48$ *↔ $\eta_p^2 = 0.081$ $\eta_g^2 = 0.035$	$F = 36.77$***♠ $\eta_p^2 = 0.37$ $\eta_g^2 = 0.14$	$F = 3.10$ n.s.♠↔ $\eta_p^2 = 0.048$ $\eta_g^2 = 0.0066$

Notes.
n.s = not statistically significant. * $p < .05$, *** $p < .001$.
♣ $p < .05$ for the interaction involving the factors signalled, ↔ $p < .01$ for the interaction involving the factors signalled, ♠ $p < .001$ for the interaction involving the factors signalled.

11.5.2. Mean proportions of extended MTT events

In what concerns extended MTT events, no statistically significant main effects were found, but a statistically significant interaction occurred between participant group and type of retrieval, $F(1, 62) = 4.41$, $p < .040$, $\eta_p^2 = 0.066$, $\eta_g^2 = 0.012$. Subsequent post hoc analyses showed that depressed participants, compared to never-depressed participants, registered lower mean proportions of extended MTT events in voluntary retrieval (see Figure 27).

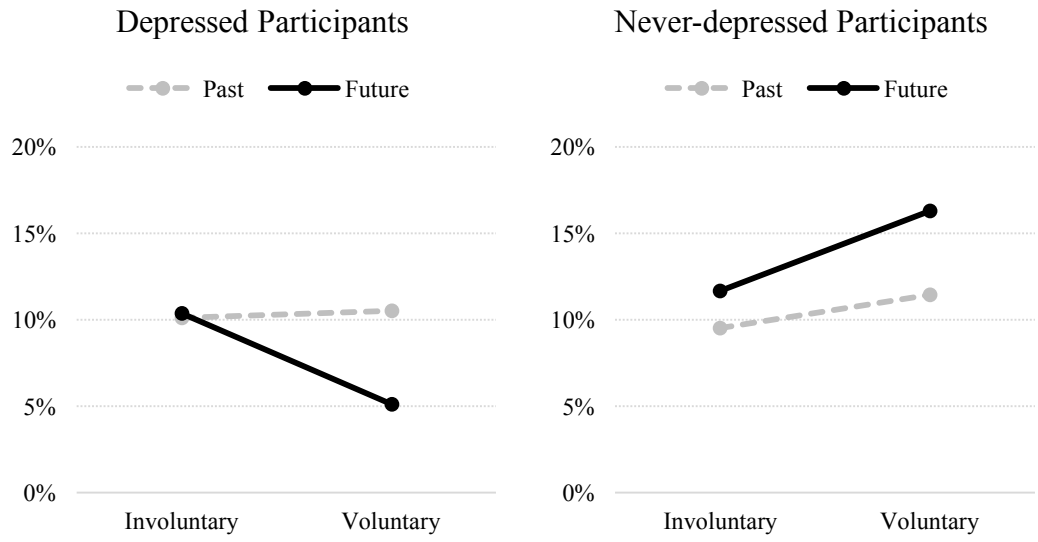


Figure 27. Interaction between temporality and type of retrieval regarding mean proportion of extended MTT events produced by both participant groups

These results did not support Hypotheses 1a, 1b, 1c or 1d. Temporality was not a statistically significant effect, the transition from an involuntary to a voluntary type of retrieval did not elicit a statistically significant increase in the participants overgenerality levels, and depressed participants were not more overgeneral in their extended events than never-depressed participants (see Figure 28 and Table 19).

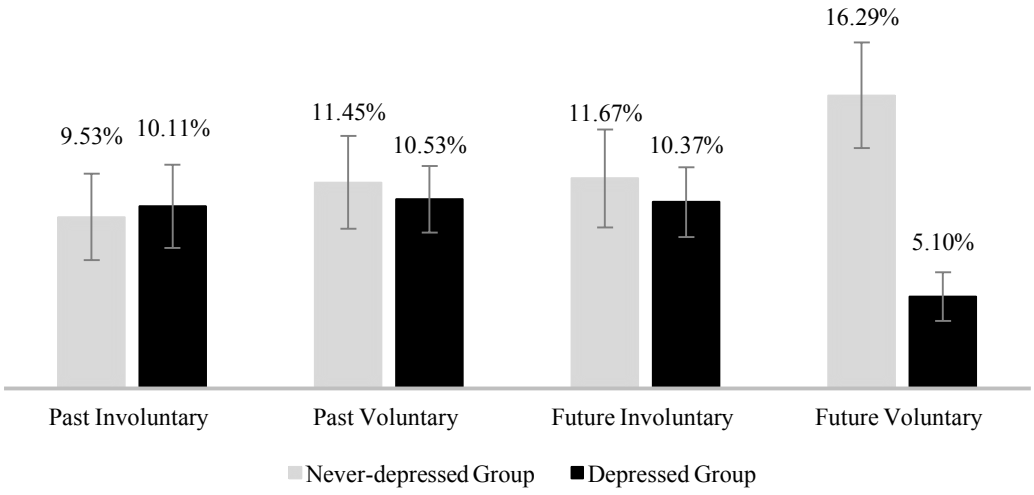


Figure 28. Mean proportions of extended MTT events in accordance with participant group, temporality and type of retrieval. Error bars represent standard errors.

11.5.3. Mean proportions of categoric MTT events

Regarding the mean proportions of categoric MTT events analyses showed statistically significant main effects of temporality and participant group, each qualified by different interactions (see Figures 29 and 30, and Table 19). There was an interaction between type of retrieval and temporality, $F(1, 62) = 27.78$, $p < .001$, $\eta_p^2 = 0.31$ and $\eta_g^2 = 0.057$, which showed that, regardless of participant group, voluntary retrieval elicited more categoric events in future compared to past MTT – a finding consistent with Hypothesis 1d. This interaction meant that future MTT, when compared to past MTT, only entailed more categoric events when these were voluntarily retrieved, thereby partially supporting Hypothesis 1c. Furthermore, as participants transitioned from involuntary to voluntary retrieval, there was an increase in the proportion of categoric events produced in the future condition (consistent with

Hypothesis 1a), but a decrease in the past condition (inconsistent with Hypothesis 1a). Consequently, the results for categoric MTT events partially supported Hypothesis 1a

When considered together, the results of specific and categoric events were partially consistent with Hypothesis 1a, despite the fact that only for specific MTT events was type of retrieval a statistically significant main effect, and were consistent with Hypotheses 1c (due to the results involving specific events) and 1d.

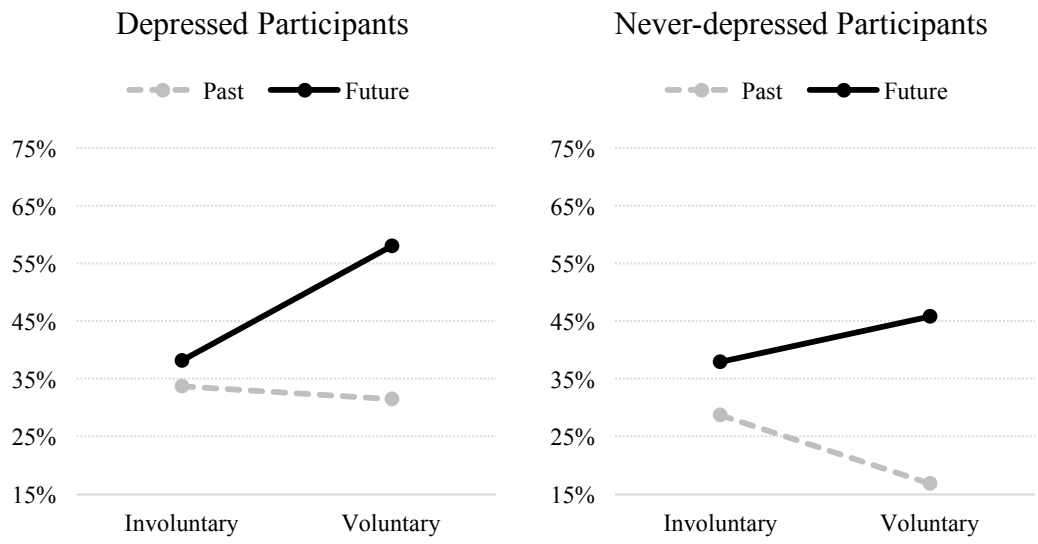


Figure 29. Interaction between temporality and type of retrieval regarding mean proportion of categoric MTT events produced by both participant groups

Another statistically significant interaction occurred between participant group and type of retrieval, $F(1, 62) = 7.61$, $p = .008$, $\eta_p^2 = 0.11$ and $\eta_g^2 = 0.016$ (see Figure 30). Post hoc analyses showed that only in voluntary retrieval did depressed participants produce more categoric events than never-depressed participants, and that within the depressed participants' group, more categoric events were produced in voluntary compared to involuntary retrieval. These results are only partially consistent with Hypothesis 1b because the differences in mean proportions of categoric MTT

produced by depressed and never-depressed participants followed the hypothesised trend solely for voluntary retrieval (see Figure 31).

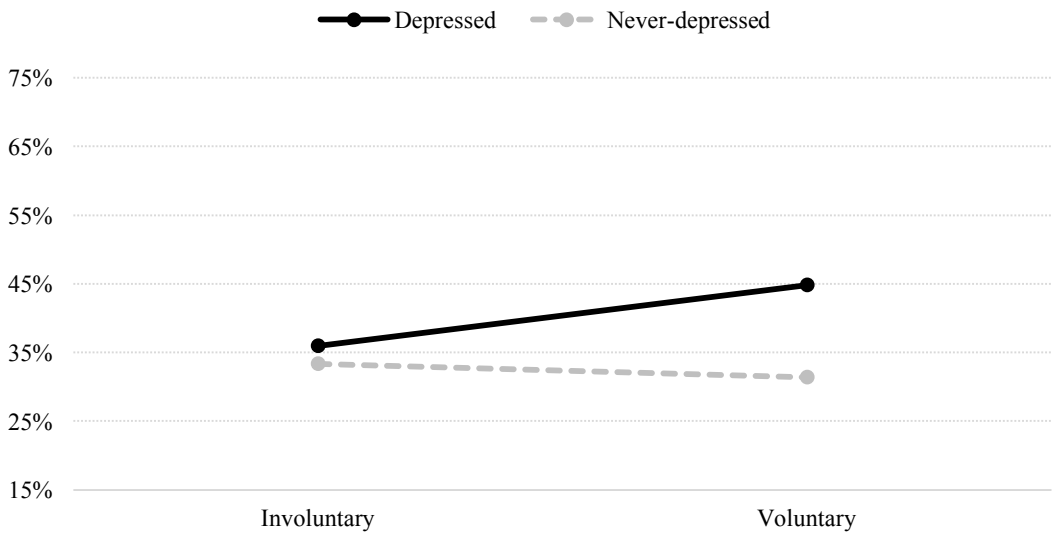


Figure 30. Interaction between participant group and type of retrieval showing the mean proportions of categoric MTT events regardless of temporality

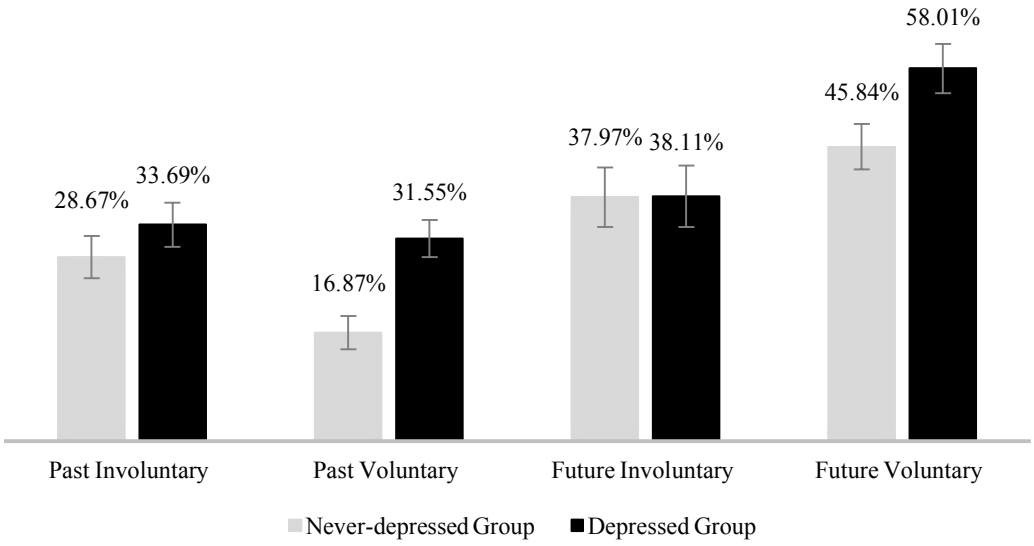


Figure 31. Mean proportions of categoric MTT events in accordance with participant group, temporality and type of retrieval. Error bars represent standard errors.

When coupled with the results of specific and extended MTT, the findings of Study 2 partially support Hypothesis 1b, as the differences found between depressed and never-depressed participants' categoric events were qualified by type of retrieval.

11.6. Hypothesis 2 – Self-Relevance

To assess self-relevance, Hypothesis 2a proposed that regardless of temporality and participant group, individuals would consider involuntary MTT events as less central to their identity and life story than voluntary MTT events. Hypothesis 2b proposed that future voluntary and involuntary MTT events would be more central to identity and life story than their past counterparts regardless of participant group, while Hypothesis 2c claimed that the difference in centrality to identity and life story between voluntary and involuntary retrieval would be greater in future compared to past MTT, regardless of participant group. Self-relevance was measured by mean ratings involving the 1-5 Likert type scales in the notebook for the variables "Centrality to Life" and "Centrality to Identity". To test this hypothesis, and similarly to Study 1, 2 x (2 x 2) mixed-design ANOVAs were performed using the mean scores of centrality to life and centrality to identity of MTT events as dependent variables. These analyses were then performed for specific MTT events, following the rationale presented in Subsection 7.6.4.

11.6.1. Centrality to Life of all MTT events

Table 20 exhibits a statistically significant main effect of type of retrieval, qualified by an interaction with participant group, $F(1, 62) = 10.67$, $p = .002$, $\eta_p^2 =$

0.15, $\eta_g^2 = 0.019$. Subsequent post hoc analyses showed that while both depressed and never-depressed participants registered higher mean ratings of centrality to life in voluntary compared to involuntary events – a result consistent with Hypothesis 2a – the involuntary MTT events of depressed participants had higher mean ratings than those of never-depressed participants (see Figures 32 and 33).

Temporality was not a statistically significant main effect, which meant Hypothesis 2b was not supported. Moreover, as demonstrated in Figure 33, although the difference between voluntary and involuntary retrieval's centrality to life was greater in future compared to past MTT, this difference was couched in never-depressed participants' ratings. Consequently, Hypothesis 2c was not supported.

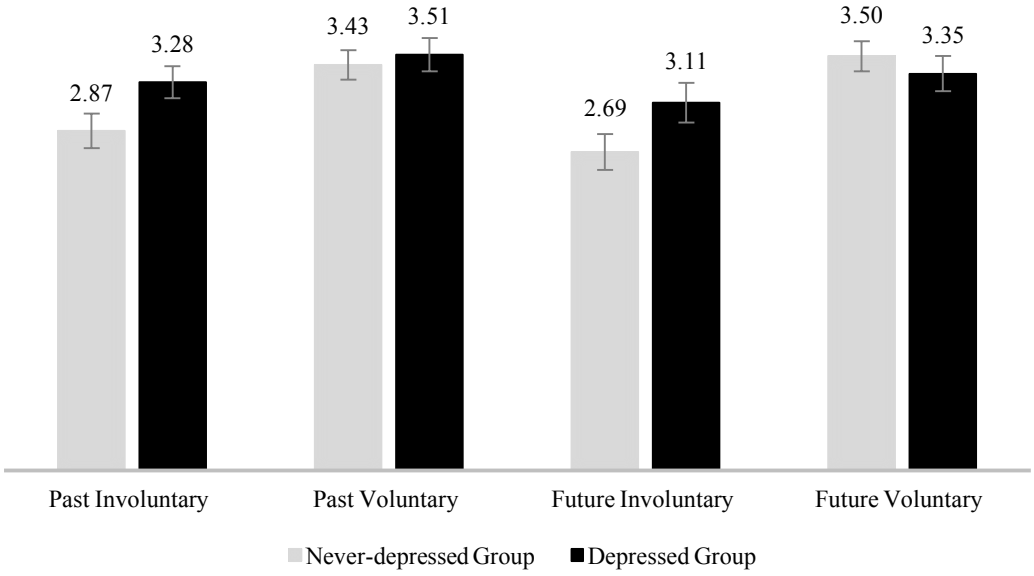


Figure 32. Mean scores for centrality to life of all MTT events, in accordance with participant group, temporality and type of retrieval. Error bars represent standard errors.

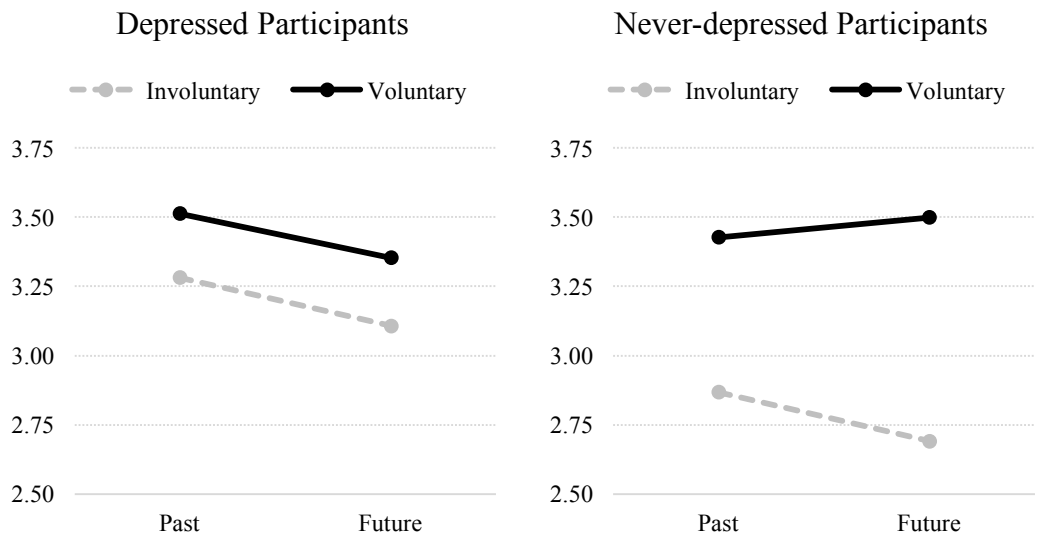


Figure 33. Interaction between temporality and type of retrieval regarding mean scores of centrality to life in the MTT events of both participant groups

Table 20. Mean scores (1 to 5) and standard deviations of the centrality to identity and centrality to life of all MTT events and of exclusively specific MTT events, in accordance with participant group, temporality, and type of retrieval

	Depressed group n = 32 [a]				Never-depressed group n = 32 [b]				Main Effects and effect sizes		
	Past		Future		Past		Future		Participant Group	Temporality	Type of Retrieval
	IV	V	IV	V	IV	V	IV	V			
Centrality Life All MTT	3.28 (0.78)	3.51 (0.80)	3.11 (0.96)	3.35 (0.85)	2.87 (0.82)	3.43 (0.70)	2.69 (0.86)	3.50 (0.73)	$F = 1.30$ n.s ↔ $\eta_p^2 = 0.021$ $\eta_g^2 = 0.014$	$F = 1.95$ n.s $\eta_p^2 = 0.030$ $\eta_g^2 = 0.0045$	$F = 45.68$ *** ↔ $\eta_p^2 = 0.42$ $\eta_g^2 = 0.074$
Centrality Life specific MTT	3.10 (1.00)	3.24 (0.95)	3.04 (1.18)	3.36 (1.17)	2.73 (0.97)	3.50 (0.79)	2.54 (1.04)	3.60 (1.06)	$F = 0.20$ n.s ♠ $\eta_p^2 = 0.004$ $\eta_g^2 = 0.0021$	$F = 0.007$ n.s $\eta_p^2 < 0.001$ $\eta_g^2 < 0.001$	$F = 45.89$ *** ♠ $\eta_p^2 = 0.46$ $\eta_g^2 = 0.071$
Centrality Identity All MTT	2.92 (0.91)	3.24 (0.92)	2.89 (0.97)	3.11 (0.88)	2.50 (0.88)	3.04 (0.90)	2.31 (0.90)	2.92 (0.93)	$F = 3.48$ n.s ♣ $\eta_p^2 = 0.053$ $\eta_g^2 = 0.039$	$F = 2.48$ n.s $\eta_p^2 = 0.038$ $\eta_g^2 = 0.0051$	$F = 35.49$ *** ♣ $\eta_p^2 = 0.36$ $\eta_g^2 = 0.047$
Centrality Identity specific MTT	2.86 (1.04)	2.96 (1.03)	2.91 (1.16)	3.16 (1.23)	2.27 (1.00)	3.02 (0.94)	2.21 (1.11)	2.99 (1.18)	$F = 2.07$ n.s ↔ $\eta_p^2 = 0.036$ $\eta_g^2 = 0.025$	$F = 0.14$ n.s $\eta_p^2 = 0.002$ $\eta_g^2 < 0.001$	$F = 27.30$ *** ↔ $\eta_p^2 = 0.33$ $\eta_g^2 = 0.045$

Notes.

[a] Only 29 depressed participants provided data regarding the centrality of specific MTT events.

[b] Only 28 never-depressed participants provided data regarding the centrality of specific MTT events.

n.s = not statistically significant. *** $p < .001$. ♣ statistically significant interaction at the .05 level between the two factors with the ♣ symbol; ↔ statistically significant interaction at the .01 level between the two factors with the ↔ symbol; ♠ statistically significant interaction at the .001 level between the two factors with the ♠ symbol.

11.6.2. Centrality to Life of specific MTT events

Performing similar analyses in specific MTT events, retrieval was once more found to be a statistically significant effect qualified by an interaction with participant group, $F(1, 55) = 16.83$, $p < .001$, $\eta_p^2 = 0.23$, $\eta_g^2 = 0.028$. However, unlike the aforementioned findings, there were no between-group differences for either type of retrieval, and only never-depressed participants registered higher centrality to life in voluntary compared to involuntary specific events, thereby not supporting Hypothesis 2a (see Table 20 for results).

11.6.3. Centrality to Identity of all MTT events

The findings presented in Table 20 demonstrate that type of retrieval was a statistically significant main effect for the centrality to identity of MTT events, qualified by an interaction with participant group, $F(1, 62) = 6.09$, $p = .016$, $\eta_p^2 = 0.089$, $\eta_g^2 = 0.0084$. Post hoc analyses produced similar results to those of centrality to life, as depressed and never-depressed participants registered higher mean ratings of centrality to identity in voluntary compared to involuntary events, with the involuntary events of depressed participants registering higher mean ratings than those of never-depressed participants (see Figures 34 and 35). Consequently, Hypothesis 2a was supported, as there were higher mean ratings of centrality to identity in voluntary compared to involuntary MTT. Furthermore, paralleling Centrality to Life, Hypotheses 2b and 2c were not supported.

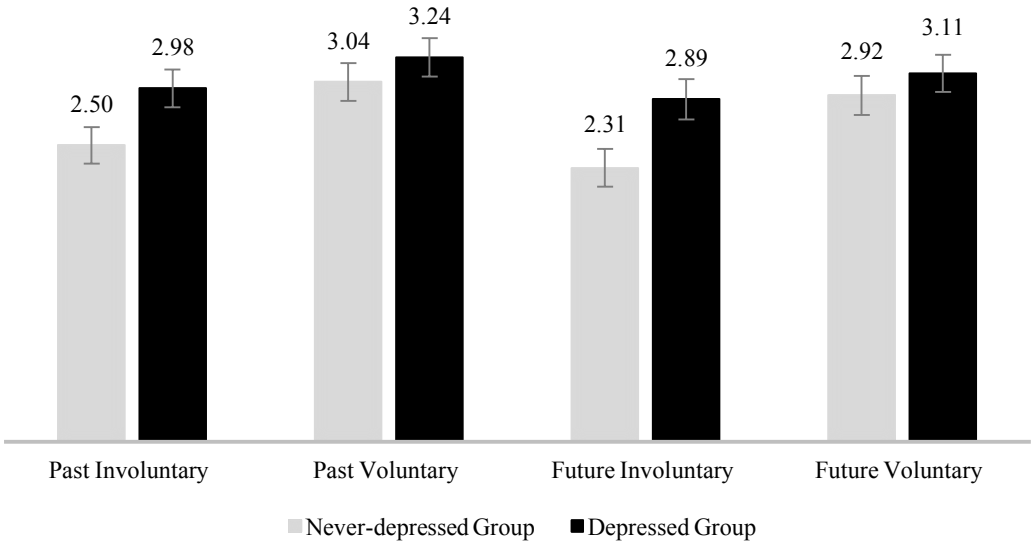


Figure 34. Mean scores for centrality to identity of all MTT events, in accordance with participant group, temporality and type of retrieval. Error bars represent standard errors.

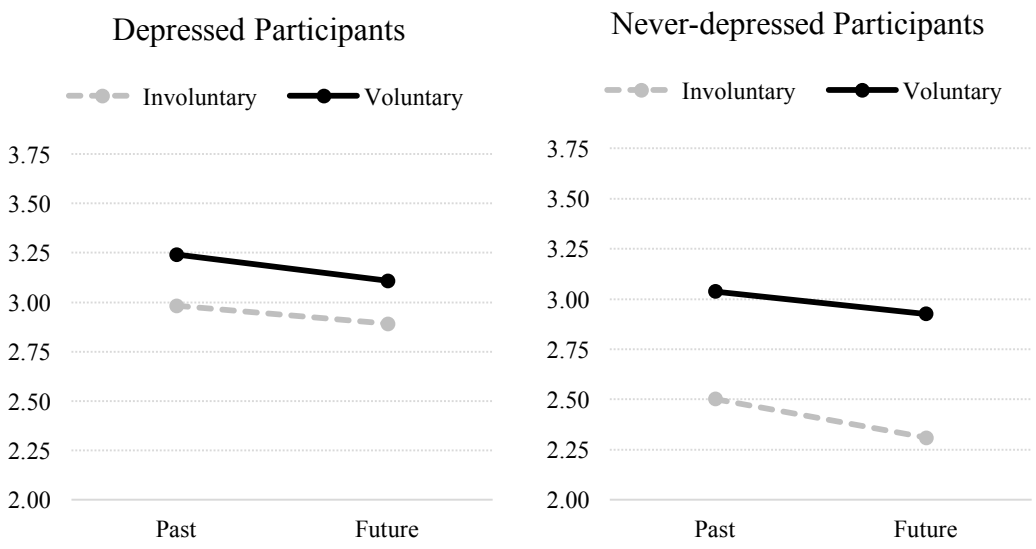


Figure 35. Interaction between temporality and type of retrieval regarding mean scores of centrality to identity in the MTT events of both participant groups

11.6.4. Centrality to Identity of specific MTT events

In specific MTT events type of retrieval was a statistically significant main effect qualified by an interaction with participant group, $F(1, 55) = 10.63$, $p = .002$, $\eta_p^2 = 0.16$, $\eta_g^2 = 0.018$. As with the analyses above, the involuntary events of depressed participants had higher mean ratings than those of never-depressed participants, but unlike before, only never-depressed participants registered higher centrality to identity in voluntary compared to involuntary specific events, thus not supporting Hypothesis 2a (see Table 20).

11.7. Hypothesis 3 – Mood Impact and Physical Reactions

Hypothesis 3 tested the physical and mood impact of the MTT events produced by depressed and never-depressed participants. This testing was further divided into four sub-hypotheses: Hypothesis 3a stated that past and future involuntary MTT events would cause more physical reactions and mood impact than their voluntary counterparts regardless of participant group; Hypothesis 3b proposed that past and future, voluntary and involuntary MTT events of depressed participants would cause more physical reactions and mood impact than the MTT events of never-depressed participants. Hypothesis 3c proposed past voluntary and involuntary MTT events would entail similar physical reactions and mood impact to that of their future counterparts, regardless of participant group; Hypothesis 3d stated the difference in physical reactions and mood impact between voluntary and involuntary retrieval would be similar across past and future MTT, regardless of participant group.

To assess the level of impact, similarly to Study 1, mixed-design 2 x (2 x 2) ANOVAs were performed using the mean proportions of MTT events with associated physical reactions and with associated mood impact as dependent variables. Similar analyses were also performed for exclusively specific MTT events. The rationale underlying the choice of mean proportions in detriment of mean total numbers was described in Section 7.6.

11.7.1. Physical Reactions in response to all MTT events

In what regards the mean proportions of physical reactions to MTT events, analyses revealed statistically significant main effects of participant group and type of retrieval (see Table 21). More physical reactions were produced by depressed compared to never-depressed participants, and more physical reactions were elicited in voluntary compared to involuntary MTT (see Figure 36). Consequently, the results did not support Hypothesis 3a, as involuntary retrieval did not elicit higher mean proportions of physical reactions.

By contrast, and congruent with Hypothesis 3b, depressed participants did produce higher mean proportions of physical reactions in response to MTT events when compared with never-depressed participants. Moreover, temporality was not a statistically significant effect, meaning the proportion of reactions to past and future events was similar, a result consistent with Hypothesis 3c. However, the gap between the physical reactions elicited by voluntary and involuntary retrieval was not similar across past and future, as a statistically significant difference existed between both types of retrieval for future but not past events. Consequently, Hypothesis 3d was not supported.

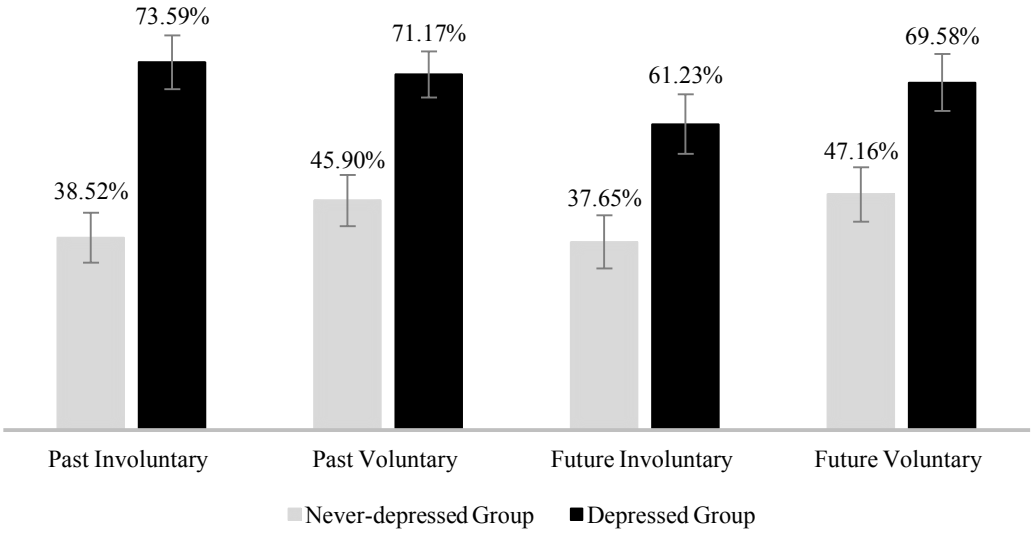


Figure 36. Mean proportions of physical reactions to all MTT events, in accordance with participant group, temporality and type of retrieval. Error bars represent standard errors.

11.7.2. Physical Reactions in response to specific MTT events

As for specific MTT events, although participant group was, once more, a statistically significant main effect evidencing the trend manifest in all MTT events, type of retrieval was qualified by an interaction with temporality, $F(1, 51) = 4.96$, $p = .030$, $\eta_p^2 = 0.089$, $\eta_g^2 = 0.0072$ (see Table 21 below for details). Post hoc analyses demonstrated that within future MTT voluntary specific events elicited more physical reactions than involuntary specific events.

Table 21. Mean proportions and standard deviations of the physical reactions and mood impact associated with all MTT events and with exclusively specific MTT events, in accordance with participant group, temporality, and type of retrieval

	Depressed group n = 32 [a]				Never-depressed group n = 32 [b]				Main Effects and effect sizes		
	Past		Future		Past		Future		Participant Group	Temporality	Type of Retrieval
	IV	V	IV	V	IV	V	IV	V			
Physical Reactions All MTT	.74 (.39)	.71 (.25)	.61 (.33)	.70 (.32)	.39 (.29)	.46 (.29)	.38 (.24)	.47 (.30)	F = 16.61 *** η_p^2 = 0.22 η_g^2 = 0.17	F = 1.75 n.s η_p^2 = 0.028 η_g^2 = 0.0028	F = 7.29 ** η_p^2 = 0.11 η_g^2 < 0.001
Physical Reactions specific MTT	.76 (.27)	.73 (.29)	.61 (.33)	.75 (.35)	.41 (.31)	.49 (.33)	.38 (.34)	.52 (.39)	F = 14.05 *** η_p^2 = 0.22 η_g^2 = 0.14	F = 0.61 n.s ♣ η_p^2 = 0.012 η_g^2 = 0.0020	F = 5.60 * ♣ η_p^2 = 0.099 η_g^2 = 0.013
Mood Impact All MTT	.91 (.17)	.88 (.17)	.86 (.19)	.91 (.14)	.78 (.21)	.81 (.26)	.76 (.23)	.83 (.21)	F = 5.48 * η_p^2 = 0.081 η_g^2 = 0.055	F = 0.03 n.s ♣ η_p^2 < 0.001 η_g^2 < 0.001	F = 4.62 * ♣ η_p^2 = 0.069 η_g^2 = 0.0056
Mood Impact specific MTT	.90 (.18)	.86 (.20)	.86 (.21)	.94 (.14)	.81 (.27)	.82 (.27)	.76 (.26)	.85 (.27)	F = 2.98 n.s η_p^2 = 0.051 η_g^2 = 0.032	F = 0.01 n.s ♣ η_p^2 < 0.001 η_g^2 < 0.001	F = 3.76 n.s ♣ η_p^2 = 0.064 η_g^2 = 0.0048

Notes.

[a] Only 31, 26, and 29 depressed participants provided data regarding physical reactions to all MTT, physical reactions to specific MTT and Mood Impact to specific MTT respectively.

[b] Only 31, 27, and 28 never-depressed participants provided data regarding physical reactions to all MTT, physical reactions to specific MTT and Mood Impact to specific MTT respectively.

n.s = not statistically significant. * $p < .05$, ** $p < .01$, *** $p < .001$.

♣ statistically significant interaction at the .05 level between the two factors with the ♣ symbol.

11.7.3. Mood Impact of all MTT events

Concerning the mean proportions of MTT events that caused mood impact, analyses show participant group and type of retrieval were statistically significant main effects, the latter qualified by an interaction with temporality (see Table 21). In the case of participant group, and consistent with Hypothesis 3b, depressed participants registered higher mean proportions of mood-impacting MTT events than never-depressed participants (see Figure 37). Coupled with the findings for physical reactions, both sets of results support Hypothesis 3b.

Regarding the interaction between type of retrieval and temporality, $F(1, 62) = 4.68$, $p = .034$, $\eta_p^2 = 0.070$, $\eta_g^2 = 0.0058$, because future MTT voluntary events elicited greater mood impact than involuntary events, Hypothesis 3a was not supported (see Figure 38), as it predicted a superior mood impact of involuntary MTT.

Similar to the findings involving physical reactions, temporality was not a statistically significant main effect, thus supporting the similarities proposed by Hypothesis 3c, and the gap between the mood reactions elicited by voluntary and involuntary retrieval was greater for future events, thus failing to support Hypothesis 3d.

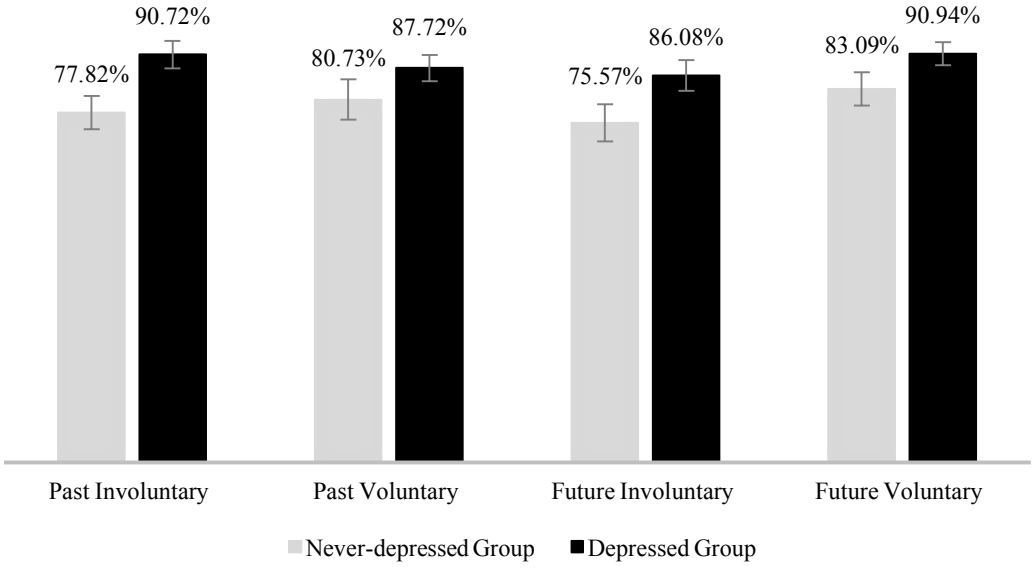


Figure 37. Mean proportions of mood reactions to all MTT events, in accordance with participant group, temporality and type of retrieval. Error bars represent standard errors.

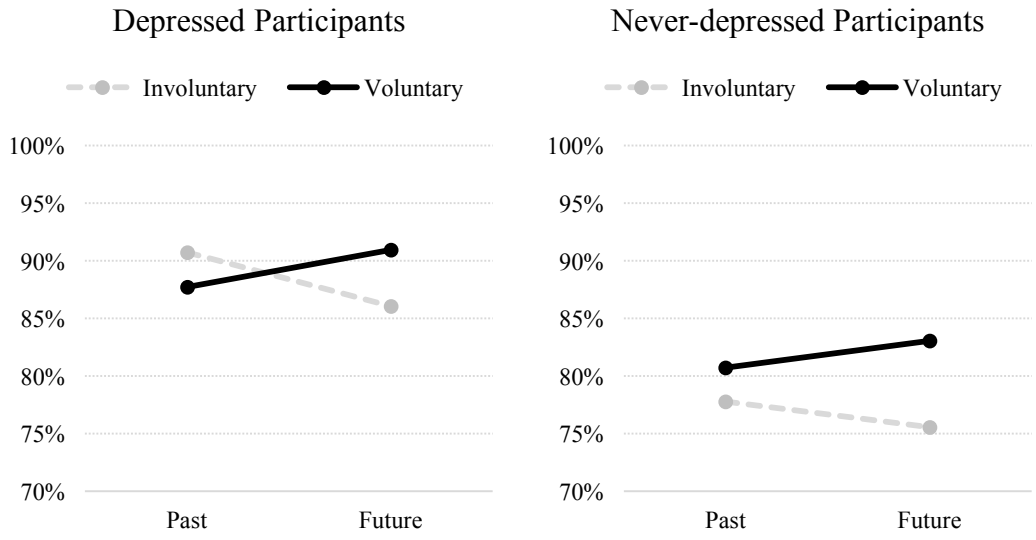


Figure 38. Interaction between temporality and type of retrieval regarding mean proportions of mood reactions to MTT events in both participant groups

11.7.4. Mood impact of specific MTT events

In the analyses of the mean proportions of mood-impacting specific MTT events, none of the three factors under study was statistically significant. However, a statistically significant interaction did occur between temporality and type of retrieval, $F(1, 55) = 6.65$, $p = .013$, $\eta_p^2 = 0.11$ and $\eta_g^2 = 0.011$, with post hoc analyses revealing that, within future MTT, voluntary specific events elicited greater mood impact than involuntary specific events (see Table 21).

11.8. Hypothesis 4 – Valence

Hypothesis 4 tested the valence of MTT events with four sub-hypotheses: Hypothesis 4a stated that past and future involuntary MTT would exhibit similar mean numbers of negative events when compared to their voluntary counterparts, regardless of participant group; Hypothesis 4b proposed that, regardless of temporality or type of retrieval, depressed participants would generate less positive/more negative MTT events than never-depressed participants; Hypothesis 4c proposed future voluntary and involuntary MTT events would be more positive/less negative than their past counterparts, regardless of participant group; Hypothesis 4d stated the difference in valence between past and future MTT events would be greater in voluntary compared to involuntary events regardless of participant group.

Similarly to Study 1, two separate 2 x (2 x 2) mixed-design ANOVAs were performed. The first set of analyses employed mean valence scores as a dependent variable, and the second set employed the mean proportions of positive, neutral and negative MTT events.

11.8.1. Mean valence of all MTT events

The analyses of the mean valence of MTT events showed statistically significant main effects of temporality, type of retrieval, and participant group (see Table 22 and Figure 39). Involuntary MTT events had higher (more positive) mean scores than voluntary events, and future MTT also registered higher mean scores compared to past MTT – thus supporting Hypothesis 4c; never-depressed participants produced higher (more positive) mean scores than depressed participants, a result consistent with Hypothesis 4b; and the superior difference in valence between past and future voluntary compared to involuntary events was only manifest in never-depressed individuals – thus not supporting Hypothesis 4d.

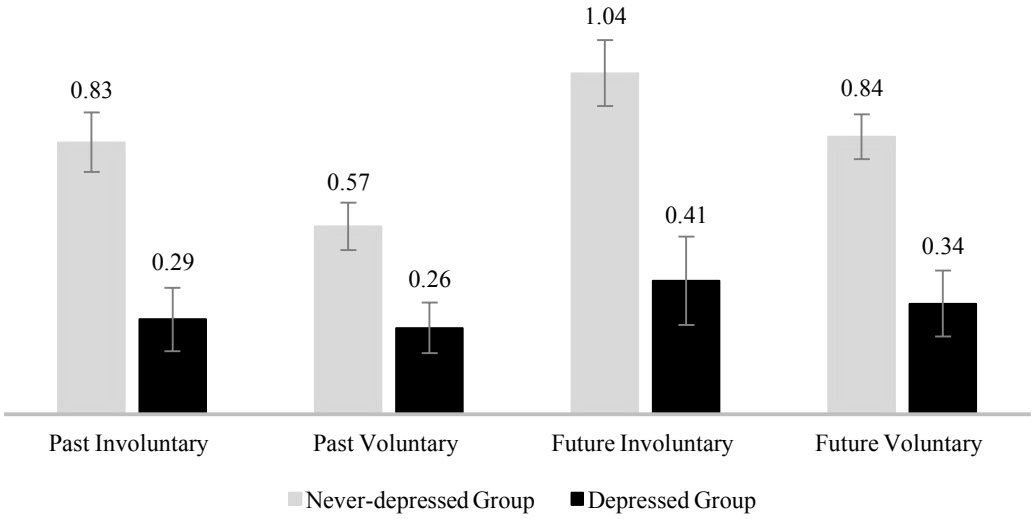


Figure 39. Mean valence scores for all MTT events, in accordance with participant group, temporality and type of retrieval. Error bars represent standard errors.

Table 22. Mean valence scores (-2 to +2) and standard deviations of all MTT events and of exclusively specific MTT events, in accordance with participant group, temporality, and type of retrieval

	Depressed group n = 32 [a]				Never-depressed group n = 32 [b]				Main Effects and effect sizes		
	Past		Future		Past		Future		Participant Group	Temporality	Type of Retrieval
	IV	V	IV	V	IV	V	IV	V			
All MTT	0.29 (0.54)	0.26 (0.44)	0.41 (0.76)	0.34 (0.57)	0.83 (0.51)	0.57 (0.40)	1.04 (0.57)	0.84 (0.38)	$F = 35.48$ *** $\eta_p^2 = 0.36$ $\eta_g^2 = 0.18$	$F = 5.48$ * $\eta_p^2 = 0.081$ $\eta_g^2 = 0.020$	$F = 5.17$ * $\eta_p^2 = 0.077$ $\eta_g^2 = 0.013$
Specific MTT	.046 (0.75)	0.32 (0.60)	0.56 (0.98)	0.77 (0.94)	0.53 (0.68)	0.55 (0.66)	1.08 (0.53)	1.00 (1.02)	$F = 11.36$ ** $\eta_p^2 = 0.17$ $\eta_g^2 = 0.053$	$F = 18.63$ *** $\eta_p^2 = 0.25$ $\eta_g^2 = 0.086$	$F = 0.98$ n.s $\eta_p^2 = 0.018$ $\eta_g^2 = 0.0043$

Notes.
[a] Only 29 depressed participants provided data regarding the valence of specific MTT events.
[b] Only 28 never-depressed participants provided data regarding the valence of specific MTT events.
n.s = not statistically significant. * $p < .05$, ** $p < .01$, *** $p < .001$.

11.8.2. Mean valence of specific MTT events

The analyses of specific MTT experiences also showed statistically significant main effects of temporality and participant group, with future MTT eliciting higher mean scores than past MTT and depressed participants registering lower mean scores in specific MTT events compared to never-depressed participants. Unlike the analyses for all MTT events, type of retrieval was not a statistically significant main effect.

11.8.3. Mean proportions of negative, neutral, and positive MTT events

Regarding negative MTT, results demonstrated statistically significant main effects of participant group and type of retrieval, with depressed participants producing higher mean proportions of negative MTT events compared to never-depressed participants – a result consistent with Hypothesis 4b. Voluntary retrieval was found to elicit more negative events than involuntary retrieval (see Figure 40 and Table 23). Since type of retrieval was a statistically significant main effect, Hypothesis 4a was not supported.

Hypothesis 4c was not supported as temporality was not a statistically significant main effect. Furthermore, results were also inconsistent with Hypothesis 4d, since the difference in valence between past and future MTT events was similar across voluntary and involuntary events.

Table 23. Mean proportions and standard deviations of all MTT events and exclusively specific MTT events in accordance with valence, participant group, temporality, and type of retrieval.

	Depressed group n = 32 [a]				Never-depressed group n = 32 [b]				Main Effects and effect sizes		
	Past		Future		Past		Future		Participant Group	Temporality	Type of Retrieval
	IV	V	IV	V	IV	V	IV	V			
All Negative MTT	.31 (.16)	.35 (.12)	.27 (.23)	.32 (.18)	.17 (.15)	.28 (.12)	.13 (.17)	.23 (.13)	$F = 21.65$ *** $\eta_p^2 = 0.26$ $\eta_g^2 = 0.11$	$F = 3.26$ n.s $\eta_p^2 = 0.050$ $\eta_g^2 = 0.014$	$F = 15.91$ *** $\eta_p^2 = 0.20$ $\eta_g^2 = 0.045$
Specific Negative MTT	.38 (.22)	.31 (.17)	.23 (.28)	.21 (.29)	.27 (.24)	.29 (.20)	.092 (.14)	.23 (.28)	$F = 3.92$ n.s $\eta_p^2 = 0.066$ $\eta_g^2 = 0.018$	$F = 11.62$ ** $\eta_p^2 = 0.17$ $\eta_g^2 = 0.063$	$F = 0.23$ n.s $\eta_p^2 = 0.004$ $\eta_g^2 = 0.001$
All Neutral MTT	.14 (.15)	.15 (.15)	.14 (.18)	.17 (.18)	.14 (.15)	.13 (.16)	.11 (.14)	.094 (.13)	$F = 1.12$ n.s $\eta_p^2 = 0.018$ $\eta_g^2 = 0.0093$	$F = 0.56$ n.s $\eta_p^2 = 0.009$ $\eta_g^2 = 0.0018$	$F = 0.03$ n.s $\eta_p^2 < 0.001$ $\eta_g^2 < 0.001$
Specific Neutral MTT	.15 (.18)	.20 (.20)	.12 (.19)	.11 (.22)	.15 (.20)	.15 (.18)	.11 (.18)	.078 (.14)	$F = 0.52$ n.s $\eta_p^2 = 0.009$ $\eta_g^2 = 0.0042$	$F = 7.02$ * $\eta_p^2 = 0.11$ $\eta_g^2 = 0.023$	$F = 0.00$ n.s $\eta_p^2 < 0.001$ $\eta_g^2 < 0.001$
All Positive MTT	.55 (.20)	.50 (.16)	.59 (.24)	.52 (.20)	.69 (.21)	.59 (.16)	.76 (.21)	.68 (.15)	$F = 20.81$ *** $\eta_p^2 = 0.25$ $\eta_g^2 = 0.12$	$F = 4.56$ * $\eta_p^2 = 0.069$ $\eta_g^2 = 0.017$	$F = 11.89$ ** $\eta_p^2 = 0.16$ $\eta_g^2 = 0.032$
Specific Positive MTT	.47 (.22)	.49 (.21)	.65 (.29)	.68 (.32)	.58 (.26)	.56 (.23)	.79 (.24)	.70 (.31)	$F = 4.53$ * $\eta_p^2 = 0.076$ $\eta_g^2 = 0.028$	$F = 25.97$ *** $\eta_p^2 = 0.32$ $\eta_g^2 = 0.10$	$F = 0.19$ n.s $\eta_p^2 = 0.004$ $\eta_g^2 < 0.001$

Notes.

[a] Only 29 depressed participants provided data regarding the valence of specific MTT events.

[b] Only 28 never-depressed participants provided data regarding the valence of specific MTT events.

n.s = not statistically significant. * $p < .05$, ** $p < .01$, *** $p < .001$.

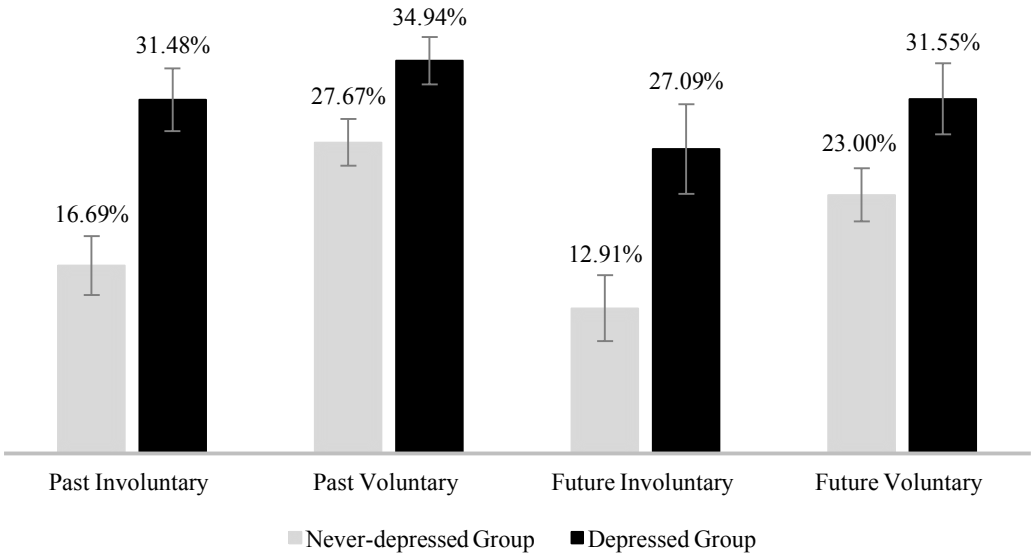


Figure 40. Mean proportions of negative MTT events, in accordance with participant group, temporality and type of retrieval. Error bars represent standard errors.

As for neutral MTT events (see Figure 41 and Table 23), neither participant group, temporality, or type of retrieval reached statistical significance.

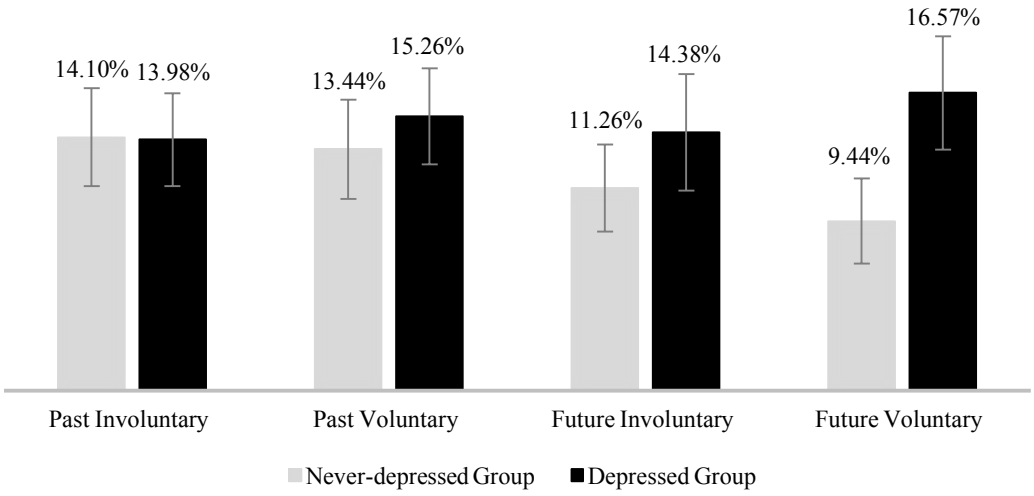


Figure 41. Mean proportions of neutral MTT events, in accordance with participant group, temporality and type of retrieval. Error bars represent standard errors.

In what concerns positive MTT events (see Figure 42 and Table 23), participant group, temporality, and type of retrieval were all statistically significant main effects. Never-depressed participants produced higher mean proportions of positively valenced MTT events compared to depressed participants, thereby supporting Hypothesis 4b. Additionally, future MTT generated more positive events than past MTT, a result consistent with Hypothesis 4c, and involuntary retrieval elicited more positive events than voluntary retrieval. The difference in valence between past and future MTT events was similar across voluntary and involuntary events, thereby not supporting Hypothesis 4d.

Overall, when coupled with the results of negative MTT events, the findings support Hypotheses 4b and 4c but do not support Hypotheses 4a and 4d.

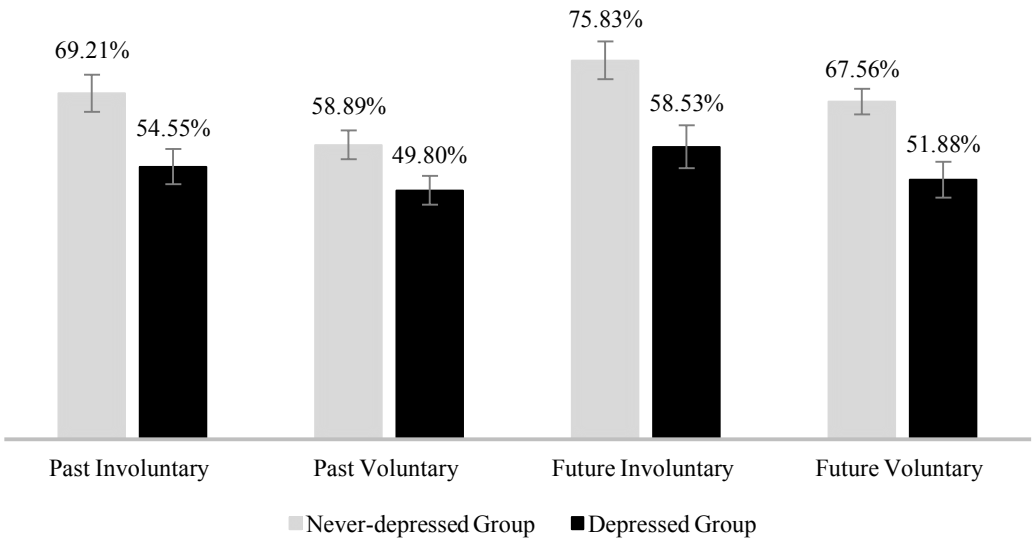


Figure 42. Mean proportions of positive MTT events, in accordance with participant group, temporality and type of retrieval. Error bars represent standard errors.

11.8.4. Mean proportions of negative, neutral, and positive specific MTT events

Analyses of the valence of specific MTT events produced different results from those obtained for all MTT events. For negatively valenced specific MTT events, only temporality was statistically significant, with past MTT eliciting more specific negative events than future MTT, a result consistent with Hypothesis 4c. For positively valenced specific MTT events, participant group and temporality were both statistically significant effects, exhibiting the same trends as those manifest in all MTT events, but type of retrieval was not statistically significant.

11.9. Hypothesis 5 – Visual Perspective

Hypothesis 5 was divided into two sub-hypotheses: Hypothesis 5a stated that any between-group differences in terms of mean numbers of observer and field perspective in past MTT would be replicated in future MTT; Hypothesis 5b proposed past and future MTT voluntary events will exhibit a similar perspective to that exhibited by their involuntary counterparts regardless of participant group. To test these hypotheses, 2 x (2 x 2) mixed-design ANOVAs were performed using the mean proportions of MTT events with field, observer, no perspective, and both perspectives' as dependent variables. Similar analyses were performed on exclusively specific MTT events.

11.9.1. Mean proportions of different types of visual perspective in all MTT events

For MTT events viewed from a field perspective (1st person perspective), results showed no statistically significant main effects of participant group, temporality, or type of retrieval (see Table 24 and Figure 43).

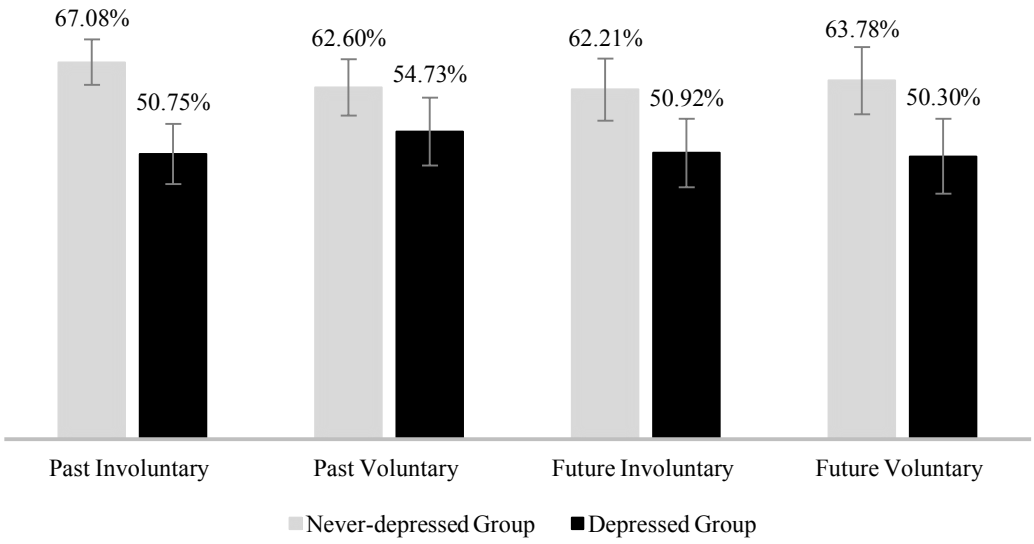


Figure 43. Mean proportions of field perspective MTT events, in accordance with participant group, temporality and type of retrieval. Error bars represent standard errors.

Table 24. Mean proportions and standard deviations of the visual perspective associated with all MTT events and with exclusively specific MTT events in accordance with participant group, temporality, and type of retrieval

	Depressed group n = 32				Never-depressed group n = 32				Main Effects and effect sizes		
	Past		Future		Past		Future		Participant Group	Temporality	Type of Retrieval
	IV	V	IV	V	IV	V	IV	V			
Field (All MTT)	.51 (.30)	.55 (.34)	.51 (.35)	.50 (.38)	.67 (.23)	.63 (.29)	.62 (.31)	.64 (.34)	$F = 3.33$ n.s $\eta_p^2 = 0.051$ $\eta_g^2 = 0.036$	$F = 0.37$ n.s $\eta_p^2 = 0.006$ $\eta_g^2 < 0.001$	$F = 0.003$ n.s $\eta_p^2 < 0.001$ $\eta_g^2 < 0.001$
Field (Specific MTT)	.53 (.34)	.61 (.34)	.56 (.38)	.53 (.45)	.67 (.26)	.70 (.31)	.67 (.35)	.64 (.41)	$F = 2.29$ n.s $\eta_p^2 = 0.041$ $\eta_g^2 = 0.025$	$F = 0.49$ n.s $\eta_p^2 = 0.009$ $\eta_g^2 < 0.001$	$F = 0.27$ n.s $\eta_p^2 = 0.005$ $\eta_g^2 < 0.001$
Observer (All MTT)	.40 (.31)	.37 (.33)	.41 (.34)	.40 (.34)	.30 (.24)	.31 (.28)	.33 (.29)	.33 (.34)	$F = 1.61$ n.s $\eta_p^2 = 0.025$ $\eta_g^2 = 0.017$	$F = 0.56$ n.s $\eta_p^2 = 0.010$ $\eta_g^2 = 0.0019$	$F = 0.26$ n.s $\eta_p^2 = 0.004$ $\eta_g^2 < 0.001$
Observer (Specific MTT)	.41 (.34)	.31 (.32)	.35 (.36)	.43 (.44)	.30 (.27)	.24 (.33)	.29 (.35)	.33 (.40)	$F = 1.44$ n.s $\eta_p^2 = 0.026$ $\eta_g^2 = 0.015$	$F = 0.62$ n.s $\eta_p^2 = 0.011$ $\eta_g^2 = 0.0024$	$F = 0.16$ n.s $\eta_p^2 = 0.003$ $\eta_g^2 < 0.001$
Both Perspectives (All MTT)	.054 (.16)	.060 (.16)	.054 (.19)	.072 (.22)	.015 (.04)	.020 (.06)	.017 (.055)	.0052 (.029)	$F = 2.23$ n.s $\eta_p^2 = 0.035$ $\eta_g^2 = 0.029$	$F = 0.00$ n.s $\eta_p^2 < 0.001$ $\eta_g^2 < 0.001$	$F = 0.75$ n.s. $\eta_p^2 = 0.012$ $\eta_g^2 < 0.001$
Both Perspectives (Specific MTT)	.014 (.052)	.041 (.099)	.045 (.19)	.043 (.19)	.0036 (.02)	.0095 (.036)	.031 (.10)	0	$F = 1.06$ n.s ♣ $\eta_p^2 = 0.019$ $\eta_g^2 = 0.013$	$F = 0.74$ n.s ♣ $\eta_p^2 = 0.013$ $\eta_g^2 = 0.0033$	$F = 0.00$ n.s ♣♣ $\eta_p^2 < 0.001$ $\eta_g^2 < 0.001$
No Perspective (All MTT)	.040 (.078)	.026 (.074)	.022 (.073)	.022 (.069)	.019 (.061)	.047 (.11)	.028 (.071)	.032 (.070)	$F = 0.08$ n.s $\eta_p^2 = 0.001$ $\eta_g^2 < 0.001$	$F = 0.59$ n.s $\eta_p^2 = 0.009$ $\eta_g^2 = 0.002$	$F = 0.38$ n.s $\eta_p^2 = 0.006$ $\eta_g^2 = 0.005$
No Perspective (Specific MTT)	.041 (.092)	.039 (.10)	.041 (.19)	0	.023 (.074)	.050 (.12)	.016 (.059)	.022 (.069)	$F = 0.03$ n.s $\eta_p^2 = 0.001$ $\eta_g^2 < 0.001$	$F = 1.81$ n.s $\eta_p^2 = 0.032$ $\eta_g^2 = 0.0084$	$F = 0.04$ n.s $\eta_p^2 = 0.001$ $\eta_g^2 < 0.001$

Notes. [a] Only 28 depressed participants provided data regarding the perspective of specific MTT representations. [b] Only 28 control participants provided data regarding the perspective of specific MTT representations. n.s = not statistically significant. ♣ statistically significant interaction at the .05 level between the two factors with the ♣ symbol.

The analyses involving MTT events viewed from an observer perspective (3rd person perspective) evidenced similar results to those of field perspective MTT events, as once again none of the factors being studied was statistically significant (see Figure 44 and Table 24).

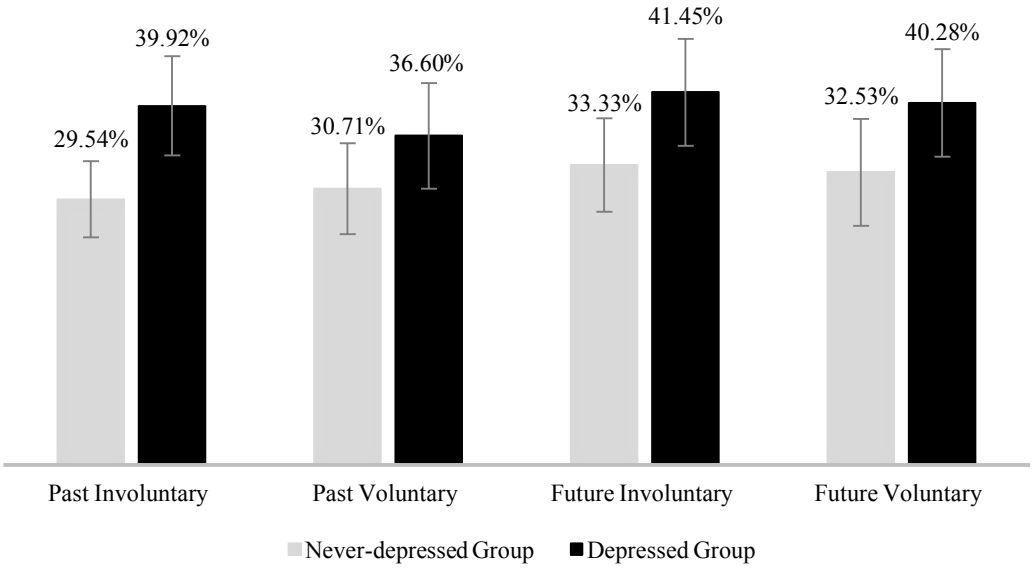


Figure 44. Mean proportions of observer perspective MTT events, in accordance with participant group, temporality and type of retrieval. Error bars represent standard errors.

Considered together, these findings support Hypotheses 5a and 5b. The way participants visualised their MTT events was not significantly impacted by temporality, thereby suggesting a continuity between past and future MTT regarding both field and observer perspective events. This same continuity was extended across type of retrieval.

The results of MTT events viewed from both perspectives (meaning participants experienced a continuous exchange between field and observer perspectives) and of MTT events lacking either perspective, exhibited no statistically significant main effects or interactions (see Table 24 for details).

11.9.2. Mean proportions of different types of visual perspective in specific MTT events

Analyses discriminating the visual perspective of specific MTT events produced, in their majority, results similar to those obtained for all MTT events. The exceptions were two interactions involving MTT events viewed simultaneously from a field and an observer perspective (see Table 24).

11.10. Summary of Hypotheses' Testing Results

Table 25 frames the results of Study 2 in relation to the hypotheses tested. All relevant results of Study 2 are discussed in the next chapter (Chapter 12).

Table 25. Summary of the outcomes of Study 2

Hypothesis Number	Key factor	Dependent Variable	Hypotheses	Outcome
Hypothesis 1a	Type of Retrieval	Spatiotemporal Specificity	Past and future involuntary MTT events will be more specific/less general than their voluntary counterparts regardless of participant group.	Partial support
Hypothesis 1b	Participant Group	Spatiotemporal Specificity	The past and future, voluntary and involuntary MTT events of depressed participants will be less specific/more general than the MTT events of never-depressed participants.	Partial support *
Hypothesis 1c	Temporality	Specificity	Future voluntary and involuntary MTT events will be less specific/more general than their past counterparts regardless of participant group.	Support
Hypothesis 1d	Interaction between Temporality and Type of Retrieval	Specificity	The difference in specificity between past and future MTT events will be greater in voluntary compared to involuntary retrieval, regardless of participant group.	Support
Hypothesis 2a	Type of Retrieval	Centrality to Life and Centrality to Identity [Self-Relevance]	Past and future involuntary MTT events will be less central to life story and identity than their voluntary counterparts regardless of participant group.	Support
Hypothesis 2b	Temporality	Centrality to Life and Centrality to Identity [Self-Relevance]	Future voluntary and involuntary MTT events will be more central to life story and identity than their past counterparts regardless of participant group.	No support
Hypothesis 2c	Interaction between Type of Retrieval and Temporality	Centrality to Life and Centrality to Identity [Self-Relevance]	The difference in centrality to life story and identity between voluntary and involuntary retrieval will be greater in future compared to past MTT, regardless of participant group.	No support
Hypothesis 3a	Type of Retrieval	Mood Impact and Physical Reactions [Impact]	Past and future involuntary MTT events will cause greater mood impact and physical reactions than their voluntary counterparts regardless of participant group.	No support
Hypothesis 3b	Participant Group	Mood Impact and Physical Reactions [Impact]	The past and future, voluntary and involuntary MTT events of depressed participants will cause greater mood and physical impact than the MTT events of never-depressed participants.	Support
Hypothesis 3c	Temporality	Mood Impact and Physical Reactions [Impact]	Past voluntary and involuntary MTT events will entail similar mood impact and physical reactions to their future counterparts, regardless of participant group.	Support
Hypothesis 3d	Interaction between Type of Retrieval and Temporality	Mood Impact and Physical Reactions [Impact]	The difference in mood impact and physical reactions between voluntary and involuntary retrieval will be similar across past and future MTT, regardless of participant group.	No support

Hypothesis 4a	Type of Retrieval	Valence	Past and future involuntary retrieval will elicit similar mean numbers of negatively valenced MTT events compared to their voluntary retrieval counterparts regardless of participant group.	No support
Hypothesis 4b	Participant Group	Valence	The past and future, voluntary and involuntary MTT events of depressed participants will be more negative/less positive than the MTT events of never-depressed participants.	Support
Hypothesis 4c	Temporality	Valence	Future voluntary and involuntary MTT events will be more positive/less negative than their past counterparts regardless of participant group.	Support
Hypothesis 4d	Interaction between Temporality and Type of Retrieval	Valence	The difference in valence between past and future MTT events will be greater in voluntary compared to involuntary retrieval regardless of participant group.	No support
Hypothesis 5a	Temporality	Visual Perspective	Any differences between depressed and never-depressed participants in terms of mean numbers of observer and field perspective events in past MTT will be replicated in future MTT.	Support
Hypothesis 5b	Type of Retrieval	Visual Perspective	Past and future MTT voluntary events will exhibit a similar perspective to that exhibited by their involuntary counterparts regardless of participant group.	Support

Notes. * According to the post-hoc ANCOVA analyses of Section 11.11, Hypothesis 1b is fully supported.

11.11. Post-hoc Analyses: Depressive Symptomatology as a Continuous Variable

Similarly to Study 1, the results obtained in Study 1 with post-hoc ANCOVAs suggest these analyses, when compared to mixed-design ANOVAs, had a greater power to detect statistically significant differences (see Section 13.1.3 for possible rationale).

In what concerns Hypothesis 1, ANCOVA analyses registered important differences involving the covariate BDI score. Whereas mixed-design ANOVAs did not find statistically significant group differences involving the mean proportions of specific events, $F(1, 54) = 1.61$, $p = .21$, $\eta_p^2 = .025$, the covariate BDI score was significantly related to the mean proportions of specific events, $F(1, 54) = 4.23$, $p = .044$, $\eta_p^2 = .064$, suggesting the greater the severity of BDI scores the lower the proportion of specific events produced.

As a consequence, full support was obtained for Hypothesis 1b, which contrasted with the partial support provided by mixed-design ANOVAs – and which was based on the mean proportions of categorical, not specific, events. The greater power associated with measuring depression severity continuously likely contributed to the detection of this difference, while the remaining analyses involving extended and categorical events provided similar results to those previously obtained in the main analyses.

Regarding Hypothesis 2, although no relevant changes were introduced by ANCOVAs, the covariate BDI score was significantly related to events' mean ratings of Centrality to Life, $F(1, 54) = 8.17$, $p = .006$, $\eta_p^2 = .12$, and Centrality to Identity, $F(1, 54) = 9.57$, $p = .003$, $\eta_p^2 = .13$, indicating that the greater the severity of BDI

scores the higher the self-relevance of events. In the mixed-design ANOVAs, participant group was not found to be a statistically significant effect for Centrality to Life, $F(1, 54) = 1.30$, $p = .26$, $\eta_p^2 = .02$, nor to Centrality to Identity, $F(1, 54) = 3.48$, $p = .067$, $\eta_p^2 = .053$.

Finally, and as in Study 1, the results produced by ANCOVAs for the remaining Hypotheses (3, 4 and 5) were similar to those that had been obtained in the respective mixed-design ANOVAs.

CHAPTER TWELVE – DISCUSSION OF STUDY 2

Throughout this chapter, the results of Study 2 regarding depressed vs. never-depressed individuals are discussed in the context of the relevant literature. This includes a discussion of pertinent findings involving sociodemographic variables, clinical instruments, mean totals, temporal distribution and temporal distance of the MTT events produced, and hypotheses under testing.

12.1. Sociodemographic Variables

Participant groups were matched by age and gender in order to reduce potential confounding factors. However, since there was no matching for the number of successfully completed school years, never-depressed participants were found to have completed statistically significant more education years than depressed participants. This discrepancy, the result of sampling and time constraints, may have been relevant for differences in the level of specificity exhibited by both participant groups' MTT events, as previous studies found educational level to correlate positively with the specificity of autobiographical memories (Arntz, Meeren, & Wessel, 2002; Boelen, Huntjens, van Deursen, & van den Hout, 2010; Heidenreich, Junghanns-Royack, & Stangier, 2007). Underlying this relation may be the positive association between the years of formal education and performance on tasks of verbal fluency (Brickman et al., 2005). Verbal fluency, as a measure of executive control, has been found to mediate the relationship between mood and the specificity levels of autobiographical memories (Dalgleish et al., 2007), with such a mediating role being congruent with the

importance attributed to executive functions in their influence over the specificity levels exhibited by participants in studies of autobiographical memory (Williams et al., 2007).

12.2. Clinical Instruments

As anticipated, depressed participants, when compared to never-depressed participants, registered statistically significant higher mean totals in the first and second administrations of the clinical measures assessing the severity of depression, namely the BDI-IA, the MADS, and the HAMD-17. Regarding the STAIS, STAIT, and the BSI, statistically significant higher mean scores were also obtained by depressed participants in both administrations of the questionnaires, an expected outcome due to the comorbidity between depressive and anxiety symptoms, and depression and psychopathology overall.

12.3. Mean Totals of MTT events and Semantic Associates

Results showed that even though never-depressed participants took, on average, twice as many days to complete the notebook task, there were no statistically significant differences between groups regarding the mean totals of MTT events produced. This delay by never-depressed participants may have been influenced by the fact that, unlike what occurred with depressed participants, they were not in frequent contact with the principal investigator, nor was their second session and respective notebook collection scheduled accordingly with consultations at the psychology

department. These additional interactions in a structured environment may have helped motivate depressed participants to deliver their notebooks and complete the study within the initial and mutually agreed upon timeframes.

Concerning the mean numbers of MTT events produced, temporality was a statistically significant effect qualified by an interaction with participant group. This meant that depressed participants, when compared to never-depressed participants, produced more past MTT events, regardless of type of retrieval. This interaction, being absent for exclusively specific MTT events, evidences a role of overgeneral events in the surplus of past events produced by depressed comparatively to never-depressed participants.

The greater number of past compared to future MTT was also observed in Study 1, but for both participant groups (see Section 9.3). It is possible that similarly to Study 1, the decreased number of future MTT events may have been a consequence of the greater cognitive effort necessary to anticipate and construct future scenarios (Schacter et al., 2008; Schacter et al., 2012). This possibility is strengthened by findings demonstrating that the effect size of temporality was considerably larger when considering only specific MTT events ($\eta_p^2 = 0.43$ and $\eta_g^2 = 0.32$ as opposed to $\eta_p^2 = 0.25$ and $\eta_g^2 = 0.09$ for all MTT events). This is congruent with the possibility that cognitive effort may have contributed to the statistical significance of temporality, as the additional layers of complexity and cognitive effort required by specific compared to general MTT events should warrant greater effort. Furthermore, the fact that future conditions in the notebook elicited a statistically significant superior mean of semantic associates, with an effect size of $\eta_p^2 = 0.16$ and $\eta_g^2 = 0.05$, may have been a consequence of participants using them as an outlet to avoid greater cognitive effort.

12.4. Temporal Distance and Distribution of MTT Events

The temporal distribution of the events recorded in Study 2 is consistent with the phenomena of childhood amnesia and reminiscence bump discussed in Section 3.3.1.1. For both voluntary and involuntary retrieval, regardless of participant group, only a small percentage of past MTT events dated back to when participants were 0-5 years old, and a considerable proportion of events (≈ 40%) was concentrated in adolescence/young adulthood, more specifically in the period between 10 and 30 years of age. Additionally, results showed that type of retrieval was only a statistically significant effect for past events dating back to the participants' 11-15 years of age, as more events from this period were retrieved involuntarily than voluntarily; and for future MTT events dating forward to the participants' 61-85 years of age, whereby more events of this period were constructed/retrieved voluntarily rather than involuntarily.

Overall, these results are consistent with research findings (Berntsen, 1998; Berntsen & Hall, 2004) suggesting individuals exhibit similar temporal distributions for voluntarily and involuntarily retrieved MTT events. These similarities are important because they suggest voluntary and involuntary events undergo similar encoding and consolidation processes, which in turn means that whatever differences exist between voluntary and involuntary MTT may be primarily explained by their different retrieval mechanisms. Thus, the value of these analyses was two-fold: They enabled comparisons between Study 2's temporal distribution of MTT events and those described in the literature; they assessed the relevance of retrieval processes when interpreting the results of Study 2.

The analyses of the temporal distance of past and future events also proved useful, as they enabled comparisons across MTT temporality while accounting for type of retrieval.

The results of Study 2 regarding the temporal distance of the MTT events produced were consistent with those of Study 1, suggesting that involuntary retrieval, comparatively to voluntary retrieval, elicited more temporally close future events. Moreover, temporally distant events (dating further than 16 years from the present) were more predominant in past compared to future MTT, regardless of participant group or type of retrieval.

The first set of findings may have been the result of cue-item discriminability processes, that allowed individuals to project themselves into the near future given their compatibility with more immediate concerns and a myriad of external and internal cues related to them. The second set of findings suggests that the additional difficulties and constructive effort required to project oneself into the future, by comparison to the past, would likely be exacerbated for distant future scenarios, where the uncertainty regarding multiple dimensions of an individual's life (e.g., health, employment, family) would make current schematic knowledge more inadequate as a starting point for simulating one's distant future experiences.

12.5. Hypothesis 1 – Level of Spatiotemporal Specificity in MTT

Multiple studies have compared the specificity of MTT events produced by depressed individuals with that of never-depressed or nondepressed individuals (see Liu, Li, Xiao, Yang, & Jiang, 2013; Sumner et al., 2010; Van Vreeswijk et al, 2004;

and Williams et al., 2007 for a synthesis). However, most group comparisons have been restricted to past voluntary MTT, with only one study directly comparing past voluntary and involuntary MTT (Watson et al., 2013) and no studies directly comparing the specificity levels of future MTT.

The results of Study 2, which addressed past and future, voluntary and involuntary MTT, partially supported the premise that depressed individuals' MTT events are less specific than those of never-depressed individuals (Hypothesis 1b). Although there were no statistically significant group differences in the mean proportions of specific events, there were differences involving categoric events, and the fact that these were qualified by type of retrieval meant that partial, not full support, was obtained. However, it bears mentioning that when post-hoc ANCOVAs were performed, full support for Hypothesis 1b was obtained, as not only were similar differences found involving categoric events, but the analyses also showed that BDI scores were significantly related to the mean proportions of specific events produced, with higher scores being associated with fewer specific events, as anticipated.

In both sets of analyses depressed individuals produced more categoric MTT events, thereby being more overgeneral and, consequently, less specific than never-depressed individuals, a difference that corresponded to a medium-sized effect (η_p^2 =0.08). However, depressed participants' greater overgenerality was constrained by the way events were retrieved, as only voluntarily retrieved MTT events (past and future) were found to be more categoric when compared to those of never-depressed individuals (see Figure 30 in Subsection 11.5.3).

These results, like those of Watson et al. (2013), support the CaR-FA-X model's proposal that impairments in memory specificity may be minimised through

involuntary retrieval (Williams et al., 2007). In Watson et al. (2013) this proposal was supported by results indicating that statistically significant differences between depressed and never-depressed participants' MTT specificity occurred only for voluntary events, being absent in involuntary ones. In Study 2, the partial support of Hypothesis 1b meant that involuntary retrieval could limit impairments in specificity via reduced proportions of categoric events in both past and future MTT, although no such contribution was apparent for exclusively specific events, given post hoc ANCOVAs' results.

These findings of Study 2 are also congruent with the constructive episodic simulation hypothesis (Schacter & Addis, 2009), as the similarities in the impact of type of retrieval across both temporal dimensions of MTT are consistent with claims that past and future MTT share informational contents and processes.

Study 2, like Study 1, supported Hypothesis 1c, as temporality was found to be a statistically significant main effect, with future events being less specific than past ones, regardless of participant group. Moreover, and similarly to Study 1, this main effect of temporality was qualified by a statistically significant interaction with type of retrieval in both specific and categoric events that was consistent with Hypothesis 1d, as differences in specificity between past and future were superior in voluntary compared to involuntary events.

In the case of specific events, type of retrieval was a statistically significant effect, and its interaction with temporality provided partial support to Hypothesis 1a, as involuntarily retrieved events were more specific than voluntarily retrieved ones for future MTT, irrespective of participant group (see Figure 24 in Subsection 11.5.1). The opposite trend was manifest in categoric events, with involuntary future events being

less categoric than voluntary future events, regardless of participant group (see Figure 29). Thus, only future MTT events, not past, were consistent with Hypothesis 1a.

To interpret these results, it is relevant to consider the rationale underlying the CaR-FA-X model's proposal: voluntary retrieval, when compared to involuntary retrieval, is considered to exhibit an overreliance on schematic information and on the ability to mobilise executive resources. As seen in Section 5.1 and Subsection 2.3.1.1, respectively, both these aspects are heavily influenced by depressive processes, exposing individuals to a risk of reduced specificity/greater overgenerality. Moreover, the fact that in involuntary retrieval there is an emphasis on sensory-perceptual information and cue item discriminability (see Subsection 3.3.6.2), is likely to oppose the likelihood of reduced specificity/superior overgenerality.

The fact that involuntary future MTT exhibited the ability to minimise the production of categoric MTT events, coupled with the finding that involuntary future events were more specific than voluntary future events, is congruent with the proposal that involuntary retrieval may assume an important role in minimising overgenerality/increasing specificity of MTT, while suggesting that future MTT can be a driving force behind such a role. Such a possibility is consistent with the findings of Study 1 and their proposed explanation (see Section 9.5).

In light of the importance of an overgeneral retrieval style to depression, research has begun focusing on the development of therapeutic techniques/protocols that increase the level of specificity of both past and future MTT (Eigenhuis et al., 2016; Jing, Madore, & Schacter, 2016; Madore & Schacter, 2016) with the purpose of promoting well-being. The results of Study 1 and 2 make a contribution to the existing literature as they suggest that future involuntary retrieval may constitute a potential

avenue of research for health care professionals and researchers seeking to maximise the specificity of depressed individuals' MTT. This possibility is congruent with multiple findings in the literature pointing to the impact of involuntary MTT in mental health and well-being (Brewin et al., 2010; Clark et al., 2013; Holmes & Mathews, 2010; Starr & Moulds, 2006).

12.6. Hypothesis 2 – Self-Relevance of MTT

The findings of Study 2 supported Hypothesis 2a, which proposed that regardless of participant group, both past and future voluntary MTT events would be more self-relevant than their involuntary counterparts as a consequence of voluntary retrieval's greater reliance on schema-based search descriptions (Berntsen, 2012) and involuntary retrieval's privileging of novel and distinctive events (Berntsen, 2009). However, and unlike Study 1, there was a statistically significant interaction between type of retrieval and participant group whereby depressed participants, when compared to never-depressed participants, registered higher self-relevance scores for involuntarily retrieved events (see Figures 33 and 35 in Section 11.6). These findings are partially consistent with those of Watson et al. (2012), which found depressed individuals attributed higher self-relevance scores to their MTT events when compared to never-depressed individuals, and with the those of Berntsen and Rubin (2006a, 2007) and Boals (2010), who found a positive association between depressive symptomatology and the self-relevance of events. Moreover, when considering the results obtained via post-hoc ANCOVAs, there was full support for the aforementioned association. This association is consistent with the results of Studies 1

and 2, as the mean scores of dysphoric participants were inferior to those of depressed participants across all MTT conditions, and in Study 1 there were none of the aforementioned group differences. This superior access of depressed participants to self-relevant events is also consistent with claims that, in depression, highly stressful experiences may become points of reference in an individual's life (Berntsen & Bohn, 2010). It is possible that, by comparison, dysphoric participants are less often exposed to highly stressful experiences, which would account for the lack of group differences in Study 1.

The findings of Study 2 regarding the self-relevance of MTT events are consistent with the aforementioned possible therapeutic impact of involuntary MTT across both past and future MTT (see Section 12.5). Although voluntarily retrieved events were more self-relevant to both participant groups, the fact that the involuntary past and future MTT events of depressed participants had higher self-relevance ratings than those of never-depressed participants suggests that, in depression, both past and future involuntary retrieval can function as an important source of access to self-relevant events.

The results also showed that temporality was not a statistically significant main effect, meaning Hypothesis 2b was not supported. In lieu of the rationale presented in Section 9.6, the fact that past events were more temporally distant than future events may have also contributed to an absence of support for Hypothesis 2c.

12.7. Hypothesis 3 – Mood Impact and Physical Reactions of MTT

The findings of Study 2 supported Hypotheses 3b and 3c and did not support Hypotheses 3a and 3d, although the acceptance-support framework of Hypotheses 3c and 3d implies they may be particularly susceptible to low statistical power. Thus, results should be interpreted with caution until replicated by a larger sample. Depressed participants, compared to never-depressed participants, produced greater proportions of physical and mood reactions in association with their MTT events. These findings were consistent with Watson et al. (2012), who found a superior physical impact associated with the past MTT events of depressed compared to never-depressed participants and between-group differences involving the mood impact of these past events. Watson et al. (2012) explained the greater impact of MTT in depressed individuals with their superior production of negative events comparatively to never-depressed individuals (a result corroborated in Study 2 – see Section 12.8). This role of negative events in the generation of mood and physical impact is consistent with the results of involuntary memory research (Kvavilashvili & Schlagman, 2011; Newby & Moulds, 2011b), as well as with the proposal that individuals with higher levels of psychopathology display a general bias towards negative information and intense emotional and physical reactions (Rubin et al., 2008; Rubin, Dennis & Beckham, 2011). This possible influence of degree of psychopathology is congruent with the absence of statistically significant group differences in Study 1, as dysphoric participants, compared to the depressed participants of Study 2, evidenced lower levels of depressive symptomatology and considerably lower mean proportions of mood and physical reactions.

Regarding the influence of type of retrieval on the impact of MTT events, the findings did not support Hypothesis 3a. Unlike initial predictions, voluntary, but not involuntary events, elicited statistically significant greater proportions of physical and mood reactions. In the case of mood reactions, this difference was qualified by an interaction with temporality, whereby it were the future voluntary events, not the past ones, that elicited significantly more reactions than their involuntary counterparts – a fact that led to Hypothesis 3d not being supported. These results may have been the consequence of two factors: first, as seen in the previous section and consistent with the findings of Study 1 (Section 9.7), voluntary events were more self-relevant than involuntary ones; second, as addressed in Section 12.8, more negative events were produced in voluntary compared to involuntary MTT. Taken together, it is possible that the superior self-relevance and negativity of voluntary events underlay their greater mood and physical impact when compared to involuntary events. This would also be consistent with the interaction between temporality and type of retrieval found for mood reactions, as involuntary future events, across all MTT conditions, registered the lower means of self-relevance and negative valence.

The fact that temporality was not a statistically significant effect meant Hypothesis 3c was supported. This finding was consistent with the rationale presented in Section 9.7 regarding the valence of events in Study 2 – see Section 12.8 below. However, given the added relevance of statistical power considerations for this hypothesis' structure, additional studies, adequately powered, need to be conducted before extrapolations can be made.

12.8. Hypothesis 4 – Valence of MTT

The results of Study 2 did not support Hypotheses 4a and 4d but supported Hypotheses 4b and 4c. Concerning Hypothesis 4b, depressed participants produced MTT events with statistically significant lower mean valence scores than those of never-depressed participants. Additional analyses showed depressed participants produced fewer positive and more negative MTT events than never-depressed participants.

These findings were congruent with Watson et al. (2012), who studied past MTT events, and with MacLeod et al.'s (1997), who stated that group differences involving depressed individuals would be upheld irrespective of temporality. However, and unlike MacLeod et al. (1997), in Study 2 the statistically significant group differences were not restricted to positively valenced MTT events, but extended to negatively valenced events, for both the past and future MTT.

The fact that group differences occurred regardless of temporality was consistent with Miloyan et al.'s (2014) review of foresight systems, which proposed that past and future voluntary MTT are susceptible to similar biases. This review further proposed that, in depressed individuals, foresight systems are affected by an excess of negative future MTT and a deficit in positive future MTT. The findings of Study 2 are also consistent with both the tripartite model of anxiety and depression (Clark & Watson, 1991), which proposed elevated negative affect and reduced positive affect in depressed individuals, and with the cognitive-content specificity hypothesis (Clark, Beck, & Brown, 1989), according to which there is a marked negativity towards the future in depressed individuals. This negative bias echoed previous

findings that depressed individuals not only exhibit a tendency to anticipate negative events, but also believe future events will trigger negative outcomes (Miranda & Mennin, 2007). Hoerger, Quirk, Chapman, and Duberstein (2012) also suggested that such biases held for future events at multiple points in time.

As for the reduced positivity bias of future MTT, it was proposed to derive from depressed individuals' greater difficulty in accessing mental representations of future positive experiences, as these experiences are likely incongruent with their current mood (MacLeod & Salaminiou, 2001).

Concerning Hypothesis 4a, type of retrieval was found to be a statistically significant main effect, as involuntary retrieval generated MTT events with statistically significant higher mean valence scores (more positive/less negative) than voluntary retrieval. Additional analyses showed statistically significant lower proportions of negatively valenced involuntary MTT events, which coupled with a statistically significant superior proportion of positively valenced involuntary events, meant involuntary retrieval privileged the access to less negative/more positive events overall. These results were consistent with those of Study 1 (Section 9.8) and of Watson et al. (2013). Hence, not only did the findings of this thesis support the CaR-FA-X model's prediction that involuntary retrieval can minimise impairments in memory specificity, but they are also the first to suggest this ability to minimise depression-related impairments may extend to the valence of past and future MTT.

Temporality was also found to be a statistically significant main effect, with Hypothesis 4c being supported as future MTT elicited statistically significant superior mean proportions of positive events. This is consistent with a stronger fading affect bias for future MTT (Szpunar et al., 2012), and with imagery (Blackwell et al., 2013;

Rasmussen & Berntsen, 2013), and self-regulatory (Rasmussen & Berntsen, 2013) biases present in future MTT (see Subsection 5.2.2.2). Similarly to Study 1, Hypothesis 4d was not supported.

When comparing the valence of exclusively specific MTT events with that of all MTT events, temporality was also found to be a statistically significant effect for specific negative MTT events, showing that, when considering only specific MTT episodes, future MTT produced a better ratio of positive-to-negative events than past MTT. Moreover, when analysing the valence of all MTT events as opposed to exclusively specific MTT events, the findings showed that, within the constraints of a depressive state, involuntary retrieval provided an easier access to more positive overgeneral MTT events, while future MTT provided an easier access to more positive specific MTT episodes.

Overall, two important conclusions can be drawn from the results of Study 2: (a) similarly to Study 1, the findings of Study 2 provide valuable pilot information showing that, regardless of temporality and participant group, involuntary MTT is not a source of preferential access to negative information. What is more, additional research is required to assess whether involuntary MTT may help address negativity biases in depression; (b) in both depressed and never-depressed participants, the greater positivity and diminished negativity of future MTT warrants additional research assessing the benefits of future-oriented therapeutic techniques in counteracting the negativity biases of depressed participants. The results of Study 2 are congruent with the literature suggesting a positivity effect of healthy individuals toward the future (Berntsen & Bohn, 2010; D'Argembeau et al., 2012; Shao, Yao, Ceci & Wang, 2010), and fit the findings of MacLeod et al. (1997) and Dalgleish, Hill,

Golden, Morant, and Dunn, 2011, who showed negativity biases were attenuated in future MTT.

12.9. Hypothesis 5 – Visual Perspective of MTT

The findings of Study 2 supported Hypotheses 5a and 5b by showing that temporality did not affect group differences regarding the visual perspective of MTT events, and that type of retrieval was not a statistically significant effect regarding the mean proportions of observer and field perspective events. Results showed no group differences in the mean proportions of field perspective MTT events produced in past and future MTT. Consequently, temporality was not a factor when comparing both groups' field perspective MTT. Similar results were obtained for observer perspective, with no group differences in the proportions of past and future observer MTT.

Watson et al. (2012), when analysing the visual perspective of past MTT in depressed and never-depressed individuals, did not find statistically significant main effects of group or type of retrieval for observer and field perspective MTT events. Consequently, Study 2 sought to analyse whether this absence of between- and within-group differences involving field and observer perspective extended to future MTT, which the results confirmed. Unlike Study 1, however, there was not a statistically significant greater proportion of observer perspective MTT events in future compared to past MTT, as would be expected based on the constructive episodic simulation hypothesis. This seemed to be a consequence of both participant groups in Study 2, when compared to Study 1, producing greater mean proportions of field perspective

MTT and lower mean proportions of observer perspective MTT, particularly for future MTT.

As in Study 1, the results were once again consistent with Hypothesis 5b, with type of retrieval not being a statistically significant effect regarding the mean proportions of field and observer perspective events. Together, both findings suggest the stability of visual perspective across type of retrieval.

As addressed in Section 9.9, the literature assessing the impact of temporality on the visual perspective of MTT events is limited (D'Argembeau & Van der Linden, 2006; McDermott et al., 2016). Studies 1 and 2 therefore set out to provide pilot findings important to assess the constructive episodic simulation hypothesis, but also to establish a baseline for future research. Such research is fundamental given the sample size limitations of the current studies and their accept-support framework in analysing visual perspective.

12.10. Conclusion

To the author's knowledge, Study 2 is the first study to have assessed the characteristics of past and future, voluntary and involuntary MTT in depressed individuals. Moreover, it is the first study to have directly compared these characteristics between depressed and never depressed individuals. Consequently, and similarly to Study 1, its pilot findings provide relevant information to theories addressing MTT processes and their impact on depression.

As in Study 1, the results of Study 2 were consistent the possibility that the mechanisms underlying voluntary and involuntary retrieval are constant across

temporality, and with the premises of the constructive episodic simulation hypothesis (Schacter & Addis, 2009) and the CaR-FA-X model (Williams et al., 2007). Regarding the constructive episodic simulation hypothesis, future events were found to be more overgeneral and less specific than past events, with both differences representing large-sized effects and being more evident in voluntary retrieval.

As for the compatibility of the results of Study 2 with the CaR-FA-X model, the findings showed that depressed individuals recorded more categoric events than never-depressed individuals. However, this superior production of categoric events was restricted to voluntarily retrieved past and future events. In involuntary retrieval there were no group differences involving categoric events, which suggests a role of involuntary retrieval in minimising the overgenerality/increasing the specificity of MTT events in depressed individuals – a finding consistent with the CaR-FA-X model.

Overall, the findings of Study 2 were similar to those of Study 1, which further strengthens the possibility that involuntary and future MTT may provide an important means to disrupt negativity in depression by promoting access to positively valenced future events, particularly those triggered via involuntary processes. Such a therapeutic focus may help challenge several negative biases characteristic of depressed individuals and, in the process, also allow for alternative interpretations of past events. As new and more positive information about one's prospects and future self is targeted via future MTT, relevant details of past MTT events, neglected due to their incompatibility with predominant negative modes of information processing, may become more plausible, allowing for different and more realistic interpretations of the same events (Kensinger, 2015).

Despite the evident similarities between the results of Studies 1 and 2, there were also differences. The greater severity in the psychopathology of depressed compared to dysphoric individuals may have motivated group differences in Study 2 that were not observed in Study 1, a possibility further emphasised by post-hoc ANCOVAs. Among these differences were the overgeneral retrieval style of depressed compared to never-depressed participants, coupled with depressed individuals' greater production of negative MTT events and greater mood/physical impact as a consequence of the MTT events re- and pre-experienced.

In the next chapter, a general discussion of the findings of Studies 1 and 2 is presented, followed by their limitations and implications for future research. A brief conclusion is also provided.

CHAPTER THIRTEEN – GENERAL DISCUSSION

The results of Studies 1 and 2, when considered together, suggest both temporality and type of retrieval are important dimensions of MTT, that influence and are influenced by dysphoria and MDD. In the present thesis, this influence, as measured via a set of phenomenological characteristics of MTT, was consistent with the dimensional nature of depressive mood disorders discussed in Chapter 4. As hypothesised, when compared to never-depressed participants, depressed individuals' MTT events were less specific/more overgeneral, less positive/more negative, causing superior mood impact and eliciting more physical reactions. By contrast, dysphoric participants' MTT events diverged from those of normal mood participants solely in terms of their specificity and positivity, while registering smaller effect sizes than those obtained in Study 2.

This incremental contrast from Study 1 to Study 2 is consistent with the theoretical models presented in the Introduction, namely the SMS (Conway, 2005) and the CaR-FA-X model (Williams et al., 2007). The SMS's insistence on a dynamic balance between an individual's need for self-coherence and the need for MTT to depict reality would imply more negative working- and conceptual-self biases in depressed compared to dysphoric individuals. The greater severity of these biases would then further impact the phenomenological experience of MTT, a possibility the results of this thesis seem to confirm.

According to the CaR-FA-X model, and similarly to the SMS model, depressed individuals would be expected to exhibit a greater predominance of information processing biases in their MTT. These biases, less severe in dysphoric or healthier

individuals, would negatively condition depressed individuals into favouring more schematic and, consequently, overgeneral/negative events in MTT, whereas their influence on dysphoric individuals would be less evident – a premise corroborated by the findings of Studies 1 and 2.

Hence, the fact that both dysphoric and depressed individuals were assessed was one of the current thesis' strengths, as it enabled a comparison of how mood differentially impacted both populations' MTT processes, with said comparison performed via both mixed-design ANOVAs (using cut-off scores to determine allocation to both groups) and ANCOVAs (using BDI scores as a covariate).

Studies 1 and 2 also provided relevant and novel information regarding the impact that both temporality and type of retrieval have on MTT. Concerning temporality, several exploratory findings were consistent with the constructive episodic simulation hypothesis, thereby not only portraying future MTT as more schematic and intrinsically constructive than past MTT but suggesting this greater constructiveness extends across type of retrieval and depressive disorders, as aspect of potential relevance in therapeutic contexts.

The greater constructiveness of future compared to past MTT, as evidenced by the former's reduced spatiotemporal specificity in Studies 1 and 2 across all participant groups (and BDI scores' post-hoc analyses), is congruent with the proposal that MTT, which requires past information to be flexibly extracted, recombined, and reassembled into pre-experienced events, is a particularly demanding process when it comes to future events (Suddendorf & Redshaw, 2013). Whereas there is a greater degree of confidence about the details that constitute a past MTT event, on account of available contextually situated and historical information due to events having already occurred,

future MTT events entail greater uncertainty, as they require creativity and reconstruction of prototypical information (Kane et al., 2012; Martin et al., 2011). Furthermore, instead of being able to access location, distance, order-based processes, as occurs in past events, in future events individuals will be resorting only to location-based processes (Friedman, 2005), as no temporal order has yet been imposed on the future, and no subjective feeling of how long ago they have occurred can be applied – "memories of the future" may be an exception to this. Consequently, in order to generate future MTT events, individuals need to be able to entertain and construct different possible future scenarios (Suddendorf & Corballis, 1997) via recursion and open-ended generativity (Hauser et al., 2002). Such recursive processing is cognitively demanding, as offline manipulation of temporal and spatial information must be maintained . Thus, not only are future MTT events expected to be more cognitively demanding (Baird et al., 2011; Smallwood et al., 2009), but the impact of such cognitive demands is, in theory, likelier to be experienced by depressed individuals. One of the important contributions of Studies 1 and 2 is that they provide novel and exploratory evidence that helps support both theorisations.

Through this thesis' analysis of the phenomenological similarities and differences across different MTT conditions, new information has been made available regarding these conditions' prototypical characteristics, which in turn can foster a better understanding of their underlying processes. Thus, the congruency found between the results of Studies 1 and 2 and the premises of the SMS and CaR-FA-X models can be a first step to the development of theoretical models of future MTT and to an understanding of the mechanisms underlying the generation of "memories of the future" vs. novel events, for therapeutic application. With regard to both these forms

of future MTT, the results of Studies 1 and 2 are consistent with the possibility that "memories of the future" were predominant in involuntary retrieval, being triggered via cue-item discriminability processes that, according to the CaR-FA-X model, privilege specificity. As for novel events, and consistent with the SMS (Conway, 2009), these may have been impacted by the considerable influence of goal-related processing in future MTT, with event construction processes fundamental to future MTT frequently becoming "locked" at a more general level due to the aforementioned greater cognitive resources necessary to access spatiotemporaly specific details for novel future events.

As for type of retrieval, both Studies 1 and 2 were consistent with claims that involuntary retrieval is not a privileged mean of access to negatively valenced information (Berntsen, 2009). In fact, the results of this thesis suggest that involuntary retrieval and future-oriented MTT may come to constitute important "tools" in helping depressed individuals circumvent their biases. Recent findings seem to point in a similar direction, by emphasising the importance of voluntary and involuntary future MTT in the optimisation of goal-directed cognition and behaviour (Cole & Berntsen, 2016). What is more, several studies have now shown that not only is it is possible to address specificity and negativity biases in past and future, voluntary and involuntary MTT (Blackwell et al., 2013; Dalgleish & Werner-Seidler, 2014; Lee et al., 2015; Madore & Schacter, 2016), but also that there is promise in techniques attempting to increase the subjective plausibility of positive future events (Szpunar & Schacter, 2013).

As a consequence of the influence that biases favouring negative events and limiting access to positive information and to one's personal past have on the onset

and course of depression, several memory therapeutics have begun being developed (Dalgleish & Werner-Seidler, 2014). These consist of clinical techniques, translated from basic research, that target memory difficulties in individuals with emotional disorders. From techniques seeking to strengthen individuals' recollection of positive events, to those devised to enhance event specificity, several new promising avenues for research have emerged in recent years, all exploring the potential contributions of past and future MTT to mental health and well-being (Dalgleish & Werner-Seidler, 2014). Recent research suggests that, by increasing the specificity of MTT events, it is possible to increase the number of relevant steps and internal details that are generated in problem solving, helping increase the individual's perceived ability to cope with problematic situations, and decrease anxiety (Madore & Schacter, 2016). Rathbone and Steel (2015), on the other hand, addressed the benefits of helping individuals easily access positive events, in order to weaken prevalent pathways to negative MTT events and a negative self-image, and strengthen a more positive view of the self.

In light of the therapeutic potential of MTT and existing gaps in knowledge regarding some of its key phenomenological characteristics and influencing factors, the present thesis constituted an attempt to provide a relevant contribution to the field, by exploring past and future, voluntary and involuntary MTT in dysphoric, depressed, normal mood, and never-depressed individuals.

13.1. Limitations and Strengths

13.1.1. Clinical measures used in Studies 1 and 2

Some of the clinical measures administered in Studies 1 and 2 have limitations that may have impacted the results. The BDI-IA is known to present several item-related issues, from the wording used, to the order and weight attributed to the different items, together with high item difficulties (Hagen, 2007). There is a lack of representative norms that promotes doubts about the objectivity of interpretation, there is an instability of scores over short time intervals, poor discriminant validity against anxiety, and the predominance of a cognitive behavioural perspective at the expense of interpersonal factors (Hagen, 2007; Richter et al., 1998). Furthermore, despite the fact that the Portuguese version administered in both studies is used in the assessment of depression at several Portuguese hospitals, no validity studies for its performance with a psychiatric sample have been performed. These exist only for its Portuguese/Brazilian counterpart.

Another relevant aspect involves the reliability of the BDI, with Ahava, Lannone, Grebstein and Schirling (1998) proposing that once two or more months have elapsed since its administration to non-clinical samples the reliability of the scores becomes questionable. This was addressed in this thesis by administering the BDI-IA twice (near the beginning and end of the three step diary questionnaire task), and by setting stringent threshold scores that involved both administrations as inclusion criteria in Study 1.

In what respects the STAI-Y form, despite its improvement in relation to the STAI-X, there are still limitations. Among these are questions concerning its

discriminant validity, particularly the ability of the STAI Trait subscale to distinguish between depressed and anxious individuals (Julian, 2011).

Regarding Study 2, the use of the MDAS sought to complement the information provided by the BDI-IA, with both measures obtaining similar statistically significant results. However, the MDAS has a limitation that is shared by its original and Portuguese versions: The absence of validation studies for clinical samples – a current validation study for the original version is under way.

The HAMD-17 is also perceived to possess several limitations, among which the uneven weight attributed to different symptom domains and the multiple factorial structures found by different studies (Bagby et al., 2004). An additional limitation to the Portuguese version is the absence of validation studies. In spite of this, it is one of the most widely used clinician rated measures of depression, chosen for the present study as a complement to self-report measures.

A different type of limitation derives from the adoption of a Major Depressive Disorder diagnosis as provided by different clinical staff members of the Hospital where data collection of Study 2 took place. Albeit instructions to present the study only to patients that satisfied the DSM-IV-TR criteria for MDD, a component of individual variability may have been introduced in the diagnostic process as different psychiatrists and psychologists were involved. Additionally, the reliability and validity of the DSM system itself has been questioned (Parker, 2005), given the ambiguous and complex set of guidelines that the authors of the DSM have created to diagnose depression. Both DSM-IV-TR and DSM-V criteria allow for several possible different patterns or clusters of symptoms, all of which can still all meet the diagnostic criteria for MDD (American Psychiatric Association, 2000). This was addressed by Trivedi

and Greer (2014) who stated that "Because in most studies the patient populations are heterogeneous with respect to diagnosis, number of episodes, treatment status and severity of depressive symptoms, these studies report considerable variability in outcomes" (p. 21). The current thesis attempted to limit some of these constraints by administering self-report and interviewer-based clinical measures to assess the severity of the depressive symptoms exhibited by depressed participants.

13.1.2. The Three Step Diary Questionnaire

There are several limitations that derive from the multiple constructs being assessed in the Three Step Diary Questionnaire. They apply to both Studies 1 and 2, and are described below.

13.1.2.1. The use of a diary methodology

The use of a diary methodology in Studies 1 and 2 can constitute a methodological weakness (Ball, 2010) if there is a reliance on the self-selection of events by participants, introducing a participant bias to the data collected. In multiple studies similar to those of Study 1 and 2, participants were required to record distinctive and memorable evens, which meant that the events recorded might fail to generalize to all autobiographical experiences. Consequently, Studies 1 and 2 tried to circumvent these limitations by asking participants to register the first event that came to mind in both voluntary and involuntary retrieval, irrespective of the events' importance. The fact that all possible events were considered equally important to this task was repeated throughout the first session of both studies.

Another limitation derives from the fact that the spatiotemporal specificity of

events was assessed solely by the PI, as no additional raters were used to classify the events and subsequently compare assessments

Despite the aforementioned limitations, the use of a diary methodology allowed for an examination of the participants' emotional reactivity in naturalistic settings, enabling a more ecologically valid assessment of their emotional functioning (Bylsma, Taylor-Clift, & Rottenberg, 2011). Moreover, by repeatedly sampling the participants' daily life experiences, their dynamic reactions to the environment were better assessed than via single-point assessments (Bylsma et al., 2011).

Another strength of the Three Step Diary Questionnaire, as applied in Studies 1 and 2, was that unlike in other studies (see Piolino et al., 2006 for details), participants were required to register only MTT events they re-experienced or pre-experienced. This was meant to capture the autonoetic dimension relevant to a real MTT experience while limiting the risk that participants simply provided events varying in spatiotemporal specificity but ultimately deprived of autonoetic conscience (e.g., autobiographical facts).

13.1.2.2. Past vs. future MTT

When addressing future MTT, no distinction was made between "memories of the future" and truly novel future events. While both are future MTT events by default, as they are yet to occur, the frequency with which they have been pre-experienced differs. The former refer to events that have been pre-experienced more than once, likely as a result of their association with current goals (e.g., imagining oneself passing the VIVA), whereas the latter refer to events being pre-experienced for the first time. In lieu of this difference, it is possible they differentially impact the phenomenological

variables tested in this thesis, a distinction unaccounted for.

Additionally, the level of creativity and fantasy associated with future MTT events, and the level of accuracy of past MTT events, were not tested. While the latter would require access to secondary sources of information in order to assess the truthfulness of the events remembered, the former would imply administering additional measures to control for creativity levels.

Despite these limitations, this is the first study, to the author's knowledge, to have simultaneously assessed future voluntary and involuntary MTT events in dysphoric and depressed individuals, and to have performed between-group comparisons with healthier control groups, with the intent of obtaining relevant pilot findings about the subjective experience of future MTT in these different populations.

13.1.2.3. Voluntary vs. involuntary retrieval

According to Hall et al. (2014), when asked to report involuntary MTT events, it may prove difficult for participants to refrain from using voluntary retrieval strategies. Although this may constitute a possible limitation, the difference between both types of retrieval was made clear to all participants and the open-ended period of the diary task sought to prevent the introduction of time constraints that might lead participants to feel pressured to report events and opt for voluntary retrieval in the involuntary modality.

Another possible limitation may lie in the additional questions present in the notebook for involuntarily retrieved events. When categorizing events as specific, extended, or categoric, the PI sometimes found useful information in the open-ended questions exclusive to involuntary events. These allowed for greater clarity in the

classification of the events' specificity when compared to voluntary retrieval, and thus seems be a limitation of this measure.

13.1.2.4 Cue words used in the voluntary retrieval of MTT events

In the Three Step Diary Questionnaires provided to the participants in the form of a notebook, several cue words were presented to elicit voluntary past and future MTT events. A limitation of Studies 1 and 2 is that the cue words presented were not matched for length in letters, imagery, concreteness, fluency, and emotionality, which may have introduced an element of variability in the results (Spreng & Levine, 2006). Additionally, although the thematic variability of the cue words adopted in Studies 1 and 2 partially overlapped with that of Berntsen (1996), themes such as "location" and "activity" were not represented in the list of cue words presented.

Furthermore, Dalgleish et al. (2007) state that the voluntary retrieval of events in such an autobiographical task may be susceptible to variations in executive control regardless of the level of depression, and that executive control is involved in mediating the relationship between depression and specificity. Consequently, the lack of a working memory measure introduces a potential source of variability in the results concerning Hypothesis 1.

13.1.3. Statistical analyses and power

The absence of *a priori* power calculations meant that Studies 1 and 2 may have lacked statistical power to detect the effects proposed and, as such, results reported here should be interpreted with caution until replicated by larger studies in the future.

The results obtained via post-hoc ANCOVAs in Studies 1 and 2, wherein depression severity was assessed as a continuous variable instead of dichotomised across groups, suggest these analyses, when compared to mixed-design ANOVAs, had a greater power to detect statistically significant differences. The reason for such a discrepancy may have been due to the fact that, in the ANCOVAs, mood group was assessed as a continuous variable, which permitted bypassing some of the power limitations associated with the categorisation/dichotomisation of mood group across Studies 1 and 2 (Altman & Royston, 2006; Dawson & Weiss, 2012; MacCallum, Zhang, Preacher & Rucker, 2002; Royston, Altman, & Sauerbrei, 2005). This superior power to detect differences translated, across Studies 1 and 2, into the discovery of additional statistically significant effects. These often involved factors that in the original analyses exhibited small to medium-sized effects and were very close to the threshold of statistical significance.

Despite power limitations, and given the exploratory nature of the hypotheses being tested, both studies are useful in that they provide pilot findings that can help inform subsequent research. Moreover, effect sizes have been reported throughout the analyses, as they provide estimates that will enable future studies to determine sample sizes more precisely.

The discrepancies in the sample size of the participant groups of Study 1, coupled with results underlain by a non-normal distribution and heterogeneous variance, hinder the extrapolation of the present results.

Finally, Hypotheses 3c, 3d, 4a, 5a and 5b in Studies 1 and 2 follow an acceptance-support hypothesis testing framework, which implies they are particularly vulnerable to low power (Nickerson, 2000). As a consequence, and given the reduced

sample size of both studies, support for these hypotheses may be a consequence of low power and not indicative of a lack of effect. Thus, generalisation of these results warrants caution and requires replication in future studies.

13.2. Conclusions and Future Studies

Future research exploring MTT in dysphoric and depressed individuals would benefit not only from addressing the aforementioned limitations, but also from a better discrimination of both the dysphoric and depressed populations, their joint analysis, the use of complex statistical techniques that account for clusters, and from the inclusion of personality assessment measures. In the case of the former, and regarding dysphoric participants, an analysis of both low-dysphoric and high-dysphoric participants would help evaluate possible continuities/discontinuities involving the MTT variables under study, helping further understand their interaction with dysphoric mood and possible usefulness in a therapeutic setting. As for depressed participants, a greater homogeneity in the symptomatology exhibited by participants, or their clustering in accordance to the number of depressive episodes, would provide similar benefits while possibly helping to uncover further key contributors to MTT.

In what concerns the joint assessment of dysphoric and depressed individuals, and as previously mentioned, a single study design matching controls, dysphoric and depressed individuals for possible confounds would allow for a better understanding of model vs. residual variance, avoiding the inevitable loss of valuable information that occurs when the same statistical analyses are performed across different studies.

The issue of the statistical analyses employed is also of key importance to

better understand the relation between MTT and depression. By performing hierarchical linear modelling analyses that account for participants as the higher-level clusters (McLelland, Devitt, Schacter, & Addis, 2015; Wright, 1998), with BDI severity as a higher-level predictor, and Temporality and Type of Retrieval as lower-level predictors, within-participant factors can be assessed in greater detail, with reduced loss of information.

Regarding the inclusion of measures of personality assessment, the fact that personality can differentially impact several phenomenological characteristics of MTT implies future studies would benefit from using such measures as an attempt to disentangle the contributions of dysphoric and depressed mood from those of personality factors. Two personality traits have been shown to be particularly impactful in depression: neuroticism, which implies negative emotionality and sensitivity to negative stimuli, and thus leads to a range of negative moods and proneness to emotional instability and self consciousness; and extraversion, referring to positive emotionality (Clark, 2005; Cuijpers, Van Straten, & Donker, 2005; Farmer et al., 2002; Klein, Durbin, & Shankman, 2010).

Both traits differ in how they impact depression (Jylhä, Melartin, Rytsalä, & Isometsä, 2009) and MTT's phenomenological characteristics (Luchetti, Rossi, Montebarocci & Sutin, 2016). Neuroticism has been connected with negative biases involving attention, interpretation of information and emotion regulation (Ormel et al., 2013), as well as reduced positivity biases in past MTT (Rasmussen & Berntsen, 2010; Rubin et al., 2008). Extraversion, by comparison, has been shown to have a negative correlation with depression in cross-sectional studies (Cox, McWilliams, Enns, & Clara, 2004; Farmer et al., 2002) and a positive correlation with a positivity bias in

past MTT (Berntsen et al., 2011; Rubin et al., 2008; Rubin & Siegler, 2004; but see Rasmussen & Bertnsen, 2010).

This thesis sought to provide valuable original findings regarding several phenomenological aspects of normal mood, dysphoric, never-depressed, and depressed individuals' past and future, voluntary and involuntary MTT. By adopting a wider conceptualisation of MTT, duly supported by existing theories and conceptualisations of MTT systems and processes, this thesis allowed for comparisons to be made between findings restricted to specific MTT events and findings encompassing specific and general MTT events. This allowed the incorporation of new and relevant information in existing theories, thus making a contribution to the current literature and raising several questions to guide future research.

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Appendix 1

Appendix 1. Sociodemographic characteristics, clinical measures' scores and mean totals of MTT events, semantic associates, and omissions of the excluded participants of Study 1

Variable	Excluded Participants, n=15
Age (years)	M = 26.53, SD = 6.75
Gender (male/female)	2/13[c]
Education years [a]	M = 15, SD = 1.60
Mental Health history [b]	6[c]
BDI-IA 1st Session	M = 10.40, SD = 6.20
BDI-IA 2nd Session	M = 8.60, SD = 5.78
STAIS 1st Session	M = 40.60, SD = 10.26
STAIS 2nd Session	M = 39.93, SD = 9.08
STAIT 1st Session	M = 41.20, SD = 10.90
STAIT 2nd Session	M = 43.33, SD = 8.86

Notes.
[a] Refers to the number of successfully completed school years.
[b] Refers to previous/current history of psychopathology, determined by the participant having attended/attending a mental health service. No participant mentioned having been/currently being under treatment for depressive disorder.
[c] Number of participants.

Appendix 2

Appendix 2. Feedback form provided to participants of Study 1

Comentários

Nº de Participante___

Pedimos-lhe o favor de dar a sua opinião relativamente ao estudo em que acabou de participar. Quais foram os aspectos que considera terem sido mais positivos e aqueles que foram mais negativos?

_____
_____
_____
_____

De que forma poderia, na sua opinião, o estudo ser melhorado?

_____
_____
_____
_____

O que é que lhe causou mais dificuldades no estudo?

_____
_____
_____
_____

Agradecemos a sua preciosa contribuição e recordamos-lhe que, se pretender discutir algum aspecto da investigação com os investigadores responsáveis, estamos completamente disponíveis para tal. Basta contactar-nos via os endereços de e-mail e contactos de telemóvel fornecidos.

Appendix 3

Appendix 3. Sociodemographic questionnaire of Studies 1 and 2

QUESTIONÁRIO SOCIO-DEMOGRÁFICO

Nº de Participante:

Idade:

Género: M / F

Nível de Escolaridade:_____
Se está presentemente a frequentar um nível de ensino, indique por favor o ano: (por exemplo, 6º ano, 9º ano, 2º ano da Universidade, etc.) _____

Tem algum historial de psicopatologia? _____
Em caso afirmativo por favor indique qual: (Por exemplo, diagnóstico de depressão, ataques de pânico, etc.) _____
_____

Encontra-se a tomar alguma medicação? _____
Se sim, por favor discrimine qual a medicação à qual está a recorrer: _____
_____
_____
_____
_____

Appendix 4

Appendix 4. Beck Depression Inventory (BDI-IA) - Measure not presented due to copyright restrictions

Appendix 5

Appendix 5. STAI Y-Form - Measure not presented due to copyright restrictions

Appendix 6

Appendix 6. Notebook presented to participants (excerpt provided here, full version provided in thesis CD)

Questionário sobre Projeções Involuntárias em Eventos Futuros

Projeção Involuntária nº 1

Instruções: Pedimos-lhe que ao experienciar uma projeção involuntária no futuro, responda de forma imediata às questões em baixo assinaladas com um asterisco (*). As restantes questões (sem asterisco) deverão ser respondidas, o mais tardar, no final do dia em que teve a experiência de se projetar involuntariamente no futuro. As 20 questões que se seguem dizem respeito a esse evento futuro imaginado, existindo uma questão adicional sobre a perspetiva em que experienciou o evento.

Data: _____/_____/_____

1. * Onde estava quando o evento futuro lhe veio à mente?

2. * O que estava a fazer?

3. * Pensou em mais alguma coisa enquanto estava a fazer isto?

4. * A sua atenção estava concentrada em determinadas tarefas ou pensamentos? (1 = "fortemente desconcentrada"; 5 = "fortemente concentrada").

1	2	3	4	5

5. Como estava o seu humor (-2 = "muito mau"; 0 = "neutro"; 2 = "muito bom").

-2	-1	0	1	2

6. Descreva, usando as suas palavras, a situação em que o evento futuro lhe veio à mente.

7. * Descreva o evento futuro.

8. Compare o conteúdo da representação do evento futuro com o que ocorreu no seu pensamento e meio envolvente imediatamente antes do evento futuro lhe vir à mente. Estava alguma coisa no meio envolvente ou na sua atividade, atenção ou na sua mente que se repetiu na representação do evento futuro? Confirme os elementos comuns mais salientes (pessoa(s)/local/experiência sensorial/objecto/sentimento/temática de vida/ tema/atividade/palavras/outros/nada em comum).

9. Os elementos em comum estavam presentes no meio envolvente exterior/físico ou apenas presentes em pensamento? (exteriores/internos/misto).

10. Esta representação futura refere-se a um episódio particular do seu futuro? (sim/não).

Sim	Não

11. * Quão vívida é a representação do evento futuro? (1 = ‘‘nublada e sem imagens”; 5 = ‘‘tão clara e vívida como se fosse experienciada de novo”).

1	2	3	4	5

12. * A representação do evento futuro afectou o seu humor? (de forma positiva/negativa/sem impacto). Em caso afirmativo, qual das seguintes emoções é que o evento lhe causou (alegria/tristeza/repulsa/raiva/medo/Outra – Qual?)

Sim	Não
De que forma afetou o humor?	
Positiva	
Negativa	
Sem Impacto	
Emoções	
Alegria	
Tristeza	
Repulsa	
Raiva	
Medo	
Outra - Qual?	

13. * Reagiu fisicamente em resposta à representação do evento futuro– por exemplo, falando consigo mesmo, sorrindo, chorando, tremendo, tendo palpitações, rindo-se, batendo em objetos etc. (sim/não/ se sim por favor escreva como).

Sim	Não
Como?	

14. Já tinha pensado anteriormente sobre esta representação do evento futuro? (1 = ‘‘nunca”; 5 = ‘‘muito frequentemente”).

1	2	3	4	5

15. A representação futura é sobre um evento que será central para a sua história de vida? (1 = ‘‘não é central para a sua história de vida”; 5 = ‘‘muito central para a sua história de vida”).

1	2	3	4	5

16. A representação futura é acerca de um evento que será central para a sua identidade?
(1 = ‘‘não é central para a sua identidade”; 5 = ‘‘muito central para a sua identidade”).

1	2	3	4	5

17. * O evento futuro imaginado é positivo ou negativo (-2 = ‘‘muito negativo”; 0 = “neutro”; 2 = ‘‘muito positivo”).

-2	-1	0	1	2

18. * O evento futuro imaginado é uma situação emocionalmente intensa (1 = "sem intensidade"; 5 = "muita intensidade").

1	2	3	4	5

19. * Durante aproximadamente quanto tempo esteve o evento futuro imaginado na sua consciência? Forneça a sua melhor estimativa em segundos: ____ ou minutos ____.

20. Que idade tem no evento futuro imaginado? (idade em anos).

Continue e responda à questão sobre perspetiva do lado direito desta folha e às questões sobre a sua Projeção Voluntária na página seguinte

Questão acerca da Perspetiva em que experienciou o Evento Futuro Involuntário

1 – Pense novamente no evento futuro que imaginou. Selecione qual das seguintes opções melhor traduz a forma como viu este evento futuro e responda à questão dessa opção:

A - Viu o seu evento futuro como outra pessoa o veria. Consegue ver o evento futuro como se fosse um espectador e por isso consegue ver-se a si mesmo(a) no evento futuro. Se for esta a perspetiva em que viu o seu evento futuro, a partir de onde se estava a ver (estava por cima de si, atrás de si)?

B - Vê o evento futuro com os seus olhos e não como se fosse um espectador. O que vê do evento futuro?

C - Nenhuma das perspectivas acima indicadas se adequam à sua experiência do evento futuro. Se este é o caso, como é que descreveria a sua visão do evento futuro?

Questionário sobre Projeções Voluntárias em Eventos Futuros

Projeção Voluntária nº 1

Instruções: Tendo terminado o preenchimento do questionário relativo à sua projeção involuntária e à perspetiva em que a experienciou, pedimos-lhe agora que retire o post-it e, a partir da palavra chave que encontrar, se projete de forma voluntária num evento futuro. Após imaginar esse evento, responda a todas as questões que se seguem e que dizem respeito a esse evento futuro e à sua perspetiva.

Palavra Chave: ALEGRIA

1. Descreva o evento futuro.

2. Esta representação futura refere-se a um episódio particular do seu futuro? (sim/não).

Sim	Não

3. Quão vívida é a representação do evento futuro? (1 = "nublada e sem imagens"; 5 = "tão clara e vívida como se fosse experienciada de novo").

1	2	3	4	5

4. A representação do evento futuro afectou o seu humor? (de forma positiva/negativa/sem impacto). Em caso afirmativo, qual das seguintes emoções é que o evento lhe causou (alegria/tristeza/repulsa/raiva/medo/Outra – Qual?)

Sim	Não
De que forma afetou o humor?	
Positiva	
Negativa	
Sem Impacto	
Emoções	
Alegria	
Tristeza	
Repulsa	
Raiva	
Medo	
Outra - Qual?	

5. Reagiu fisicamente em resposta à representação do evento futuro– por exemplo, falando consigo mesmo, sorrindo, chorando, tremendo, tendo palpitações, rindo-se, batendo em objetos etc. (sim/não/ se sim por favor escreva como).

Sim	Não
Como?	

6. Já tinha pensado anteriormente sobre esta representação do evento futuro? (1 = "nunca"; 5 = "muito frequentemente").

1	2	3	4	5

7. A representação futura é sobre um evento que será central para a sua história de vida? (1 = "não é central para a sua história de vida"; 5 = "muito central para a sua história de vida").

1	2	3	4	5

8. A representação futura é acerca de um evento que será central para a sua identidade? (1 = "não é central para a sua identidade"; 5 = "muito central para a sua identidade").

1	2	3	4	5

9. O evento futuro imaginado é positivo ou negativo (-2 = "muito negativo"; 0 = "neutro"; 2 = "muito positivo").

-2	-1	0	1	2

10. O evento futuro imaginado é uma situação emocionalmente intensa (1 = "sem intensidade"; 5 = "muita intensidade").

1	2	3	4	5

11. Durante aproximadamente quanto tempo esteve o evento futuro imaginado na sua consciência? Forneça a sua melhor estimativa em segundos: ____ ou minutos ____.

12. Que idade tem no evento futuro imaginado? (idade em anos). _____

Continue e responda à questão sobre perspetiva do lado direito desta folha

Questão acerca da Perspetiva em que experienciou o Evento Futuro Voluntário

1 – Pense novamente no evento futuro que imaginou. Selecione qual das seguintes opções melhor traduz a forma como viu este evento futuro e responda à questão dessa opção:

A - Viu o seu evento futuro como outra pessoa o veria. Consegue ver o evento futuro como se fosse um espectador e por isso consegue ver-se a si mesmo(a) no evento futuro. Se for esta a perspetiva em que viu o seu evento futuro, a partir de onde se estava a ver (estava por cima de si, atrás de si)?

B - Vê o evento futuro com os seus olhos e não como se fosse um espectador. O que vê do evento futuro?

C - Nenhuma das perspectivas acima indicadas se adequam à sua experiência do evento futuro. Se este é o caso, como é que descreveria a sua visão do evento futuro?

Appendix 7

Appendix 7. Documents regarding the Ethical Approval of Study 1

Appendix 7a. Ethical approval from ISPA Lab (Translation)

Dear Researcher

Following your request to use the Participants Pool of ISPA-UI we hereby inform you that after all requests were analysed you were attributed 35 participants (1 session of 30 minutes each + notebook application) for the data collection.
It is now essential to know what is the time window during which you intend to proceed with the data collection.
The experimental sessions will occur in the period comprehended between the 26th of October and the 15th of December, with pre-scheduled hours 13h30 e 18h00. If your data collection needs to proceed outside these schedules please contact the laboratory technician.
Please answer this email with indications of the days and schedules where you intend to proceed with the data collection, considering that each session has an average of 15 participants.
The allocation of schedules will be done according to the requests' order of arrival which means that the quicker you reply the better odds of obtaining the days and schedules you intend.

In case of doubts regarding the entire process, please do not hesitate to send us an email.

With the best of regards,

Hugo Alves (Laboratory Technician)

Appendix 7b. Ethical approval from ISPA (Translation)

Lisbon, 28th of November 2013

I, Victor Cláudio, Auxiliar Professor at ISPA-IU, hereby declare that I accompanied, throughout its different stages, the implementation process of the research with University students carried out by Joao Pedro Garcez Aurelio dos Santos at ISPA-IU, related to his PhD thesis entitled "Voluntary and Involuntary Mental Time Travel in Depression - Characteristics and Mechanisms". I confirm that in September 2011, before the student data collection began, I provided the necessary and legitimate ethical approval in order for the data collection to occur, given that at the time there had still not been created an Ethical Commission at ISPA-IU (this Commission was formalised in 2012 with me as its Coordinator).

Lastly, it is important to mention that the participation in the pretest of a 5th year student of mine, namely in the data collection process, followed all the necessary ethical procedures. All the participants in the pretest were informed, in a clear and unequivocal manner, that this student would have access to the data as she would use part of these data for her thesis, to be developed under my direct supervision. Once again I stress that all ethical and necessary procedures were followed in order to implement this research and to follow it through, according to ISPA's-IU criteria as well as the criteria of the Health and Psychology Investigation Unit pertaining to the Foundation for Science and Technology of Portugal.

With no further issue,

Victor Claudio
Auxiliar Professor at ISPA-IU
Coordenator of ISPA-IU Ethical Committee

Appendix 7c. Ethics Review Form for Level 2 and 3 Assessment of the Research Ethics Committee of the School of Health in Social Science (includes Studies 1 and 2).

School of Health in Social Science Research Ethics: Level 2/3 checklist

University of Edinburgh
School of Health is Social Science
RESEARCH ETHICS COMMITTEE
Ethics review form for level 2 and level 3 assessment

This form should be used for all research projects carried out by staff or students in the School of Health in Social Science that have been identified by self-audit as requiring detailed assessment - i.e. level 2 and level 3 within the three-tier system of ethics approval set out by the School Research Ethics Committee. The levels within the system are explained in the School Research Ethics Policy and Procedures document. Please indicate which level applies to your research.

If you are applying for IRAS review or other external review submitted in English, you do not need to complete this form but must deposit a copy of your application to IRAS or another body as directed by your subject area Research Ethics Co-ordinator.

This form provides general School-wide guidance. Proposers should supplement these with detailed provisions that may be stipulated by research collaborators (e.g. NHS) or professional bodies (e.g. BPS, SRA). The signed and completed form should be submitted, along with a copy of the research proposal, research instruments and information and consent sheets to the relevant person (Subject Area Research Ethics Co-ordinator for staff, postdoctoral fellows and postgraduate students, Dissertation supervisor for undergraduate students). Level 3 requests should also be lodged electronically with the School Research Ethics Administrator for forwarding to the Chair of the School Research Ethics Committee.

Research Ethics Committee will monitor level 2 proposals annually to satisfy themselves that the School Ethics Policy and Procedures are being complied with. They will revert to proposers in cases where there may be particular concerns or queries. For level 2 and 3 assessments, research work must not proceed until issues raised have been considered by the appropriate people. It is particularly important that level 3 applications are submitted well in advance of any required date of approval.

The form developed by the College of Humanities and Social Science is used for level 2 and 3 reviews. If the answer to any of the questions below is 'yes', please give details of how this issue is being/will be addressed to ensure that ethical standards are maintained.

1 THE RESEARCHERS	
Your name and position	João Pedro Garcez Aurélio dos Santos
Proposed title of research	Voluntary and Involuntary Mental Time Travel in Depression - Characteristics and Mechanisms.
Funding body	FCT – Fundação para a Ciência e Tecnologia, Portugal
Time scale for research	18 months
List those who will be involved in conducting the research, including names and positions (e.g. 'PhD student')	João Pedro Garcez Aurélio dos Santos

School of Health in Social Science Research Ethics: Level 2/3 checklist

2 RISKS TO, AND SAFETY OF, RESEARCHERS	
Do any of those named above need appropriate training to enable them to conduct the proposed research safely and in accordance with the ethical principles set out by the College?	**No**
Are any of the researchers likely to be sent or go to any areas where their safety may be compromised, or they may need support to deal with difficult issues?	**No**
Could researchers have any conflicts of interest?	**No**

3 RISKS TO, AND SAFETY OF, PARTICIPANTS	
Could the research induce any psychological stress or discomfort?	**Yes.** The research implies that depressed and control individuals will produce an autobiographical memories/future episodic thoughts' diary that can influence their mood positively/negatively.
Does the research involve any physically invasive or potentially physically harmful procedures?	**No**
Could this research adversely affect participants in any other way?	**No**

School of Health in Social Science Research Ethics: Level 2/3 checklist

4 DATA PROTECTION	
Will any part of the research involve audio, film or video recording of individuals?	**No**
Will the research require collection of personal information from any persons without their direct consent?	**No**
How will the confidentiality of data, including the identity of participants (whether specifically recruited for the research or not) be ensured?	The confidentiality of the data will be assured given that personal identification of the participants will not be possible. Participants will be attributed numbers and their only identifying data will be age/ gender/socio-educational status. All other identifying information will be deleted.
Who will be entitled to have access to the raw data?	The researcher and his Supervisors
How and where will the data be stored, in what format, and for how long?	Electronic data will be stored in password-protected electronic folders. An electronic database will be kept for the full duration of the PhD plus two additional years (for further scientific publications involving the data collected), while physical data (questionnaires, diaries) will be kept only for the duration of the PhD. Documents (questionnaires, diaries) will be stored at the Health and Psychology Investigation Unit, located at ISPA University. This government funded R&D Unit is the researcher's Host Institution in Portugal and, in its facilities, there are several sets of cabinets that are locked and to which only the researcher will have access.
What steps have been taken to ensure that only entitled persons will have access to the data?	Only certain entitled individuals (researcher and supervisors) will have access to the data for only they will possess the password that allows the decryption of the files.
How will the data be disposed of?	Electronic Data will be electronically eliminated as a form of disposal. Physical (paper) data will be burned.
How will the results of the research be used?	The results of the investigation will be used for scientific publication (papers/posters/ articles).
What feedback of findings will be given to participants?	Feedback of the findings will be given to participants in the form of a summary.
Is any information likely to be passed on to external companies or organisations in the course of the research?	**No**
Will the project involve the transfer of personal data to countries outside the European Economic Area?	**No**

School of Health in Social Science Research Ethics: Level 2/3 checklist

5 RESEARCH DESIGN	
The research involves living human subjects specifically recruited for this research project *If 'no', go to section 6*	**Yes**
How many participants will be involved in the study?	There will be 40 participants involved in a pre-study and 100 participants involved in the actual investigation.
What criteria will be used in deciding on inclusion/exclusion of participants?	a) For pre-test study to be conducted with University students with the purpose of honing methodology related details: 1 - Proper informed consent; 2 - Two groups will be created, one with high scores of dysphoria in BDI (above 15) and the other with normative scores (below 15). There will be a group matching. b) For the investigation itself: 1 - Proper informed consent; 2 - Participants included in the depressed participant's sample will have to register "clinical depression scores" in the BDI and Hamilton Depression Scale, as well as possess a psychiatric/psychological diagnostic of depression according to DSM-IV criteria given by the accompanying physician/therapist/psychologist. Control subjects will have to register "below-depression scores" on BDI and Hamilton Depression Scale, have no previous history of psychological disorders, and be paired with the depressed participants concerning age (+/- 3 year margin), gender and Socio-Educational level (same educational status, namely, elementary school attendance, high-school attendance, university attendance).
How will the sample be recruited?	The pre-test sample will be recruited at ISPA, a Portuguese University of Psychology. The depressed participant's sample for the investigation will be collected in Portuguese Hospitals (post University of Edinburgh and Hospital Ethics' Committees approval), Portuguese Health Centres (post University of Edinburgh and Regional health committee's approval), and at Associations for Depressed Individuals (post University of Edinburgh and Association's approval).
Will the study involve groups or individuals who are in custody or care, such as students at school, self help groups, residents of nursing home?	**No**

School of Health in Social Science Research Ethics: Level 2/3 checklist

Will there be a control group?	**No**
What information will be provided to participants prior to their consent? (e.g. information leaflet, briefing session)	For an individual to be considered a participant in the study, the Ethical Board responsible for evaluating the proposal will have to consider the research proposal acceptable. Afterwards, the researcher will meet with the physicians designated by the Ethical Board to assist with the sample collection (indicating possible participants) and explain the general objectives and possible consequences of the research. These physicians, before the researcher ever has contact with the possible participants, will speak with those who meet the criteria and enquire as to their availability for a preliminary meeting with the researcher. If the participants tell their physicians that they do not wish to take part in the research or if the physician considers that, given his knowledge of the individuals, they should not be included as participants, they will never meet the researcher. There is no reference to the seeking of informed consent during this meeting. If the participant agrees to a preliminary meeting, this is when the researcher will explain the project and present the informed consent document. The researcher will ask the possible participant to think on whether he/she wishes to participate, giving him/her a 24-hour period for an answer. Before this preliminary meeting ends, researcher and possible participant will have to decide how the latter will give his final answer (several options will be provided, from transmitting it to the physician so that the researcher learns it from him, to the researcher contacting the possible participant via telephone or the possible participant having the possibility to contact the researcher via telephone or e-mail in case his answer is positive). If the answer is positive, the first project meeting will be scheduled.
Participants have a right to withdraw from the study at any time. Please tick to confirm that participants will be advised of their rights, including the right to continue receiving services if they withdraw from the study.	It is confirmed, they will be informed of all their rights.
Will it be necessary for participants to take part in the study without their knowledge and consent? (e.g. covert observation of people in non-public places)	**No**

Where consent is obtained, what steps will be taken to ensure that a written record is maintained?	A written record of the informed consent will be kept for participants of pre test and of the investigation.
In the case of participants whose first language is not English, what arrangements are being made to ensure informed consent?	The majority of participants will be Portuguese and these and others (who may be living in Portugal but not be Portuguese) will need to have a good understanding and domain of the Portuguese language.
Will participants receive any financial or other benefit from their participation?	**Yes.** By the end of their participation, participants of the main investigation (not those participating in the pre-test) will be paid a fee via gift cards.
Are any of the participants likely to be particularly vulnerable, such as elderly or disabled people, adults with incapacity, your own students, members of ethnic minorities, or in a professional or client relationship with the researcher?	**Yes**. The depressed participants are considered to be particularly vulnerable. Being so, special care will be taken. The researcher will be available at all times if any problem arises and a close contact will be kept between the researcher and the participant's accompanying physicians.
Will any of the participants be under 16 years of age?	**No**
Do the researchers named above need to be cleared through the Disclosure Scotland procedures?	**No**
Will any of the participants be interviewed in situations which will compromise their ability to give informed consent, such as in prison, residential care, or the care of the local authority?	**No**

School of Health in Social Science Research Ethics: Level 2/3 checklist

6 EXTERNAL PROFESSIONAL BODIES	
Is the research proposal subject to scrutiny by any external body concerned with ethical approval?	**No**
If so, which body?	The research proposal is subject to scrutiny by external bodies concerned with ethical approval, namely by all the institution's Ethical Boards where the depressed participant's sample will be collected and by ISPA's approval for the pre-test.
Date approval sought	Concerning the main investigation itself, the date of approval sought is not established, given that it's pending on University of Edinburgh approval and meeting periods of the corresponding ethical boards. The ideal would be, in case of approval by the University of Edinburgh, to begin establishing contacts with the Hospitals, Health Centres and Association's Ethical Boards in September. Concerning the pre-test, the ideal would be to begin collecting data in October, when new students enter the University and are more available to participate in studies.
Outcome, if known *or*	ISPA will approve the pre-test investigation. As for the Hospitals, Health Centres and Associations, due diligence will need to be followed.
Date outcome expected	

7 ISSUES ARISING FROM THE PROPOSAL
In my view, ethical issues have been satisfactorily addressed Signature - Lisbon, 17th of June 2011

School of Health in Social Science Research Ethics: Level 2/3 checklist

FEEDBACK FROM ETHICS TUTOR

School of Health in Social Science Research Ethics: Level 2/3 checklist

This is a very interesting proposal but I do feel there are a number of ethical issues that require to be addressed before approval can be given.

- The proposal to store identifiable, sensitive, confidential information "securely put away" in the researcher's home appears inadequate. Would it be possible to suggest an alternative?
- The research states that he will have contact with the participant's doctor, it would be helpful to specify that permission for this will be sought on the consent form.
- The process of recruitment and consent in unclear.
  - The proposal states patient's will be identified by hospitals and health centres and then that they will meet with the research and be handed a diary during that meeting.
    - ☒ Will participants be able to make an appropriately informed choice to meet with the researcher?
    - ☒ There is no reference to the seeking of informed consent during this meeting.
    - ☒ There appears to be no opportunity for the participant to take time to consider if they wish to be involved (normally 24 hours).
- Local ethical approval will need to be gained for this study from the appropriate Portuguese authority. The university will require a copy of this approval.

I look forward to hearing your thoughts regarding how these might be addressed.

Signature - Dr S O'Rourke

Position- Ethics Tutor

Reply

Dear Professor O'Rourke,

I wish to thank you for the input and all the recommendations. In the next page I propose a list of modifications that hopefully will be in accordance with the suggestions made. These modifications have also been introduced in the respective form and the pages where they are located are also listed below. The attached informed consent and research proposal have also been modified in accordance to the suggestions made.

Best regards,

João Garcez Aurélio

School of Health in Social Science Research Ethics: Level 2/3 checklist

- The proposal to store identifiable, sensitive, confidential information "securely put away" in the researcher's home appears inadequate. Would it be possible to suggest an alternative? ***The confidential information will be stored at the Health and Psychology Investigation Unit, located at ISPA University. This government funded R&D Unit constitutes a Host Institution, in Portugal, to the researcher, and has a set of cabinets that are locked and to which only the researcher will have access.*** Page 2

- The research states that he will have contact with the participant's doctor, it would be helpful to specify that permission for this will be sought on the consent form. ***It has been introduced in the section Benefits and Risks of the Informed Consent.***

- The proposal states patient's will be identified by hospitals and health centres and then that they will meet with the research and be handed a diary during that meeting.

  ☒ Will participants be able to make an appropriately informed choice to meet with the researcher? ***For an individual to be considered a participant in the study, the Ethical Board responsible for evaluating the proposal made to the institution will have to accept it. Afterwards, the responsible physicians will be notified and the researcher will meet with them and explain the objective of the research. The physicians, before the researcher has contact with the possible participants, will speak with those that meet the criteria and discuss their availability for an initial meeting with the researcher so that he can explain the project. This implies that, if the participants are not inclined to participate, they will not even meet the researcher.***

  - There is no reference to the seeking of informed consent during this meeting. ***If the participant agrees to a preliminary meeting, this is when the researcher will explain the project and present the informed consent document. The researcher will ask the possible participant to think on whether he/she wishes to participate, giving him/her a 24-hour period for an answer. Before this preliminary meeting ends, researcher and possible participant will have to decide how the latter will give his final answer (several options will be provided, from transmitting it to the physician so that the researcher learns it from him, to the researcher contacting the possible participant via telephone or the possible participant having the possibility to contact the researcher via telephone or e-mail in case his answer is positive). If the answer is positive, the first project meeting will be scheduled***. (Page 5)

  ☒ There appears to be no opportunity for the participant to take time to consider if they wish to be involved (normally 24 hours). ***See the answer above***. (Page 5).

  ☒ Local ethical approval will need to be gained for this study from the appropriate Portuguese authority. The university will require a copy of this approval. ***A copy of the approval from the University (ISPA) where the pre-test will be held and from the different institutions that allow us to interview possible participants will be given to the University of Edinburgh.***

School of Health in Social Science Research Ethics: Level 2/3 checklist

FEEDBACK FROM ETHICS TUTOR
Dear **Mr Aurélio** Thank you for your revised proposal with the clarifications requested. I am now happy to approve your application and do not consider it to require further ethical review within the University of Edinburgh. However, as previously stated, you will need to apply for ethical permission at the hospitals / health boards from which you will be recruiting and to log their approval with the University of Edinburgh. Signature - Dr S O'Rourke Position- Ethics Tutor Date- 05/09/11

Appendix 8

Appendix 8. Informed consent form of Study 1

DOCUMENTO DE CONSENTIMENTO INFORMADO

TÍTULO DA INVESTIGAÇÃO - Viagens no Tempo Voluntárias/Involuntárias e a Influência do Humor - Características e Mecanismos.

RESUMO DA INVESTIGAÇÃO - O objectivo geral desta investigação é o de compreender melhor a relação entre os processos da memória autobiográfica, da projeção episódica futura e do estado de humor. Nesta investigação irá ocorrer uma sessão inicial que terá como objectivo explicar todos os elementos da investigação e responder a todas as questões que tenha acerca do estudo. De seguida, e nesta mesma reunião, ser-lhe-á pedido que preencha um conjunto de questionários que permitem obter informações acerca dos seus dados sócio-demográficos (p.e., idade, género) e o seu estado de humor. Após o preenchimento destes questionários, ser-lhe-á entregue um caderno de registos, no qual lhe será pedido que escreva, durante uma primeira semana, as suas memórias autobiográficas voluntárias e involuntárias (o ideal será que estas sejam registadas todos os dias, com um máximo de duas memórias voluntárias e involuntárias por dia). Durante a segunda semana do estudo deverá registar no caderno o máximo de duas projeções episódicas futuras, voluntárias e involuntárias, por dia, de preferência todos os dias. Quando as duas semanas tiverem terminado, irá ocorrer uma segunda sessão com a investigadora, já previamente agendada, para que possa indicar quais foram, na sua opinião, os aspectos mais positivos e negativos deste estudo e preencher novamente os questionários sobre o seu estado de humor.

Ao assinar em baixo, está a confirmar que: (1) leu e compreendeu o documento de informação para os participantes que lhe foi fornecido, (2) as questões acerca da sua participação neste estudo foram respondidas de forma satisfatória, (3) está ciente dos riscos potenciais (nos casos em que estes existem), e (4) está a participar nesta investigação de sua livre vontade (e sem qualquer coação).

_____
Nome do Participante (Impresso)*

_____ _____
Assinatura do Participante* Data

_____ _____
Nome da pessoa que obtém o consentimento Assinatura da pessoa que obtém o consentimento

**Os participantes que desejarem manter algum nível de anonimato podem usar as suas iniciais*

Appendix 9

Appendix 9. Information sheet form of Study 1

DOCUMENTO DE INFORMAÇÃO PARA OS PARTICIPANTES

TITULO DA INVESTIGAÇÃO
Viagens no Tempo Voluntárias/Involuntárias e a Influência do Humor - Características e Mecanismos.

CONVITE
O(A) Senhor(a) está a ser convidado(a) para fazer parte de uma investigação sobre memória e humor desenvolvida por João Pedro Garcez Aurélio dos Santos, que é o investigador responsável pela investigação e aplicada pela investigadora Lara Paraíso Vicente. Esta investigação para a qual está a ser convidado está a ser supervisionada pelo Professor Doutor Victor Cláudio, do ISPA.
O objectivo geral desta investigação é o de compreender melhor a relação entre os processos da memória autobiográfica, da projeção episódica futura e do estado de humor. Este projecto é financiado pela Fundação para a Ciência e Tecnologia de Portugal e foi aprovado pelo Comité de Ética na Investigação em Psicologia da Universidade de Edimburgo e pela Comissão de Ética do ISPA.

O QUE IRÁ ACONTECER
Se aceitar participar neste estudo, irá ter uma primeira sessão com a investigadora na qual esta responderá a todas as questões e dúvidas que queira colocar. De seguida, e nesta mesma sessão, ser-lhe-á pedido que preencha um conjunto de questionários que permitem obter informações acerca dos seus dados sócio-demográficos (p.e., idade, género) e o seu estado de humor. Após o preenchimento destes questionários, ser-lhe-á entregue um caderno de registos, no qual lhe será pedido que escreva, durante uma primeira semana, as suas memórias autobiográficas voluntárias e involuntárias (o ideal será que estas sejam registadas todos os dias, com um máximo de duas memórias voluntárias e involuntárias por dia). Durante a segunda semana do estudo deverá registar no caderno o máximo de duas projeções episódicas futuras, voluntárias e involuntárias, por dia, de preferência todos os dias. Quando as duas semanas tiverem terminado, irá ocorrer uma segunda sessão com a investigadora, já previamente agendada, para que possa indicar quais foram, na sua opinião, os aspectos mais positivos e negativos deste estudo e preencher novamente os questionários sobre o seu estado de humor.

DURAÇÃO DO ESTUDO
O estudo, em condições normais, demora cerca de 180 minutos (três horas) distribuídos por duas semanas: A distribuição de tempo pelas diferentes tarefas é a seguinte:

1ª Sessão: 30 minutos;
2ª Sessão: 10 minutos;
Registos diários no Caderno de Registos: 10 minutos x 14 dias = 140 minutos;

DIREITOS DO PARTICIPANTE
O(A) Sr.(a). pode, em qualquer altura do estudo, decidir interromper em definitivo a sua participação, não estando obrigado a fornecer qualquer tipo de explicação. Tem o direito de exigir que quaisquer dados que tenha fornecido sejam destruídos.
Tem o direito de omitir ou recusar-se a responder a qualquer questão que lhe seja colocada.
Tem o direito de obter respostas para as questões e dúvidas que possua acerca dos procedimentos do estudo (a não ser que a resposta a estas questões interfira com os resultados do estudo). Se tiver alguma dúvida em consequência deste documento de Consentimento Informado, deve colocá-la à investigadora antes do início do estudo.

BENEFÍCIOS E RISCOS
Não são conhecidos benefícios ou riscos para a sua pessoa a partir da participação neste estudo. As memórias e a projeção no futuro têm uma influência no humor mas essa influência dependerá sempre de vários factores, como a própria pessoa e o tipo de memórias/projeções episódicas futuras que esta tenha. Se houver algo de negativo que decorra do estudo, pode contactar o investigador em qualquer altura.

CONFIDENCIALIDADE/ANONIMATO
Os dados recolhidos não irão conter qualquer informação que permita a sua identificação. Os nomes pessoais e de cidades/locais que sejam fornecidos nas memórias/projeções episódicas futuras serão alterados de modo a que os originais não possam ser identificados. Os dados que fornecer no Questionário Sócio-Demográfico serão associados a um número de participante e será esse número que o passará a identificar nesta investigação. Os dados recolhidos serão usados exclusivamente com propósitos científicos, nomeadamente tendo em vista apresentações orais e em poster, bem como publicações em revistas científicas. A confidencialidade e o anonimato dos seus dados será sempre garantida.

PARA MAIS INFORMAÇÕES
A Investigadora Lara Vicente Paraíso e o Investigador Responsável (João Garcez Aurélio) terão todo o gosto em responder, em qualquer altura, às suas questões acerca deste estudo. Pode contactá-los da seguinte forma:

Instruções para Preenchimento do Caderno

O que é uma memória autobiográfica: Uma memória autobiográfica é uma memória sua, de um episódio da sua vida. Quando tem uma memória autobiográfica, recorda-se do episódio que viveu, recorda-se de estar nesse episódio, do que estava a viver nesse momento e do local/pessoas com quem estava.

Qual a diferença entre memória autobiográfica voluntária e involuntária: Uma memória involuntária é uma memória que parece surgir do nada, sem que tenha que se esforçar por recordar de algo. De repente, lembra-se de um episódio que viveu, no qual estava presente. Numa memória voluntária, pedimos-lhe que se esforce por se recordar de uma memória da sua vida com base numa palavra que lhe fornecemos.

O que é uma projeção autobiográfica: Uma projeção autobiográfica ocorre quando se projeta a si no futuro e se vê a si mesmo a viver uma situação que ainda não ocorreu. Vê-se a si mesmo num determinado local a fazer algo, mas ainda não aconteceu. É igual a uma memória autobiográfica só que enquanto que a memória autobiográfica já lhe aconteceu na sua vida, a projeção ainda não.

Qual a diferença entre projeção autobiográfica voluntária e involuntária: Uma projeção involuntária é uma projeção que parece surgir do nada, sem que tenha que se esforçar por se ver a si mesmo(a) no futuro. De repente, imagina-se a viver um episódio no futuro (pode ser o dia seguinte, semana seguinte, ano seguinte). Numa projeção voluntária, pedimos-lhe que se esforce por se imaginar a viver um episódio no futuro com base numa palavra que lhe fornecemos.

O que lhe pedimos que faça neste estudo: Pedimos-lhe que, durante 7 dias escreva pelo menos 1 memória involuntária e 1 memória voluntária por dia. Pode escrever até um máximo de 2 memórias involuntárias e 2 voluntárias por dia. Sempre que preenche uma memória involuntária, respondendo a todas as questões, tem que preencher imediatamente a memória voluntária que se segue.
Ao fim dos 7 dias a preencher entre 1 e 2 memórias involuntárias e 1 e 2 memórias voluntárias por dia, vai ter pelo menos 7 memórias involuntárias mais 7 memórias voluntárias no caderno. No máximo, vai ter 14 memórias involuntárias mais 14 memórias voluntárias. Tenha em atenção que vai ter sempre o mesmo número de memórias involuntárias e voluntárias, porque assim que termina de responder às questões da memória involuntária, tem que passar imediatamente para a voluntária e responder a todas as questões da memória voluntária.
Ao fim de 7 dias a escrever as memórias involuntária e voluntárias, vamos pedir-lhe que faça o mesmo para as projeções involuntárias e voluntárias. Ou seja, que, durante 7 dias escreva pelo menos 1 projeção involuntária e 1 projeção voluntária por dia. Pode escrever até um máximo de 2 projeções involuntárias e 2 voluntárias por dia. Sempre que preenche uma projeção involuntária, respondendo a todas as questões, tem que preencher imediatamente a projeção voluntária que se segue.
Ao fim dos 7 dias a preencher entre 1 e 2 projeções involuntárias e 1 e 2 projeções voluntárias por dia, vai ter pelo menos 7 projeções involuntárias mais 7 projeções voluntárias no caderno. No máximo, vai ter 14 projeções involuntárias mais 14 projeções voluntárias. Tenha em atenção que vai ter sempre o mesmo número de projeções involuntárias e voluntárias, porque assim que termina de responder às questões da projeção involuntária, tem que passar imediatamente para a voluntária e responder a todas as questões da projeção voluntária.

Tenha o caderno consigo sempre que possível: Pedimos que tenha o caderno consigo sempre que possível para poder escrever as memórias e projeções involuntárias logo no momento em que surgem. Se quando elas lhe vierem à cabeça estiver a fazer algo importante, pedimos que responda de imediato às questões que têm um asterisco à frente nesse momento (Questões 1, 2, 3, 4, 7, 11, 12, 13, 17, 18, 19 e questão da perspectiva) e depois, quando tiver mais tempo ao fim desse dia, responder às restantes. Quando acabar de responder a todas as questões de uma memória ou projeção involuntária, passe para a memória ou projeção voluntária que vem logo a seguir, e responda a todas as questões.

Appendix 10

Appendix 10a. Table with the temporal distribution (in percentages) of past MTT events according to type of retrieval.

	Dysphoric group n = 17		Normal mood group n = 39		Main effects and effect sizes *F-value*	
Age at the time the event occurred	Involuntary Retrieval	Voluntary Retrieval	Involuntary Retrieval	Voluntary Retrieval	Participant Group	Type of Retrieval
0-5	0.018 (0.042)	0.031 (0.046)	0.024 (0.052)	0.033 (0.060)	$F = 0.13$ n.s $\eta_p^2 = 0.002$ $\eta_g^2 = 0.000$	$F = 1.073$ n.s $\eta_p^2 = 0.019$ $\eta_g^2 = 0.0098$
6-10	0.11 (0.11)	0.13 (0.10)	0.13 (0.11)	0.12 (0.13)	$F = 0.022$ n.s $\eta_p^2 = 0.000$ $\eta_g^2 = 0.000$	$F = 0.025$ n.s $\eta_p^2 = 0.000$ $\eta_g^2 = 0.000$
11-15	0.092 (0.12)	0.13 (0.15)	0.14 (0.10)	0.12 (0.11)	$F = 0.22$ n.s $\eta_p^2 = 0.004$ $\eta_g^2 = 0.0028$	$F = 0.35$ n.s $\eta_p^2 = 0.007$ $\eta_g^2 = 0.0021$
16-20	0.38 (0.29)	0.35 (0.26)	0.21 (0.16)	0.26 (0.18)	$F = 5.13$ * $\eta_p^2 = 0.087$ $\eta_g^2 = 0.073$	$F = 0.091$ n.s $\eta_p^2 = 0.002$ $\eta_g^2 = 0.0002$
21-25	0.22 (0.20)	0.19 (0.19)	0.32 (0.27)	0.30 (0.26)	$F = 2.43$ n.s $\eta_p^2 = 0.043$ $\eta_g^2 = 0.039$	$F = 0.98$ n.s $\eta_p^2 = 0.018$ $\eta_g^2 = 0.0019$
26-30	0.13 (0.18)	0.13 (0.22)	0.093 (0.18)	0.11 (0.21)	$F = 0.33$ n.s $\eta_p^2 = 0.006$ $\eta_g^2 = 0.005$	$F = 0.19$ n.s $\eta_p^2 = 0.003$ $\eta_g^2 = 0.0002$
31-35	0.004 (0.017)	0.011 (0.044)	0.048 (0.12)	0.038 (0.09)	$F = 2.087$ n.s $\eta_p^2 = 0.037$ $\eta_g^2 = 0.032$	$F = 0.030$ n.s $\eta_p^2 = 0.001$ $\eta_g^2 = 0.000$
36-40	0.034 (0.14)	0.005 (0.022)	0.030 (0.094)	0.023 (0.081)	$F = 0.088$ n.s $\eta_p^2 = 0.002$ $\eta_g^2 = 0.0011$	$F = 3.043$ n.s $\eta_p^2 = 0.053$ $\eta_g^2 = 0.0088$
41-45	0.008 (0.035)	0.021 (0.088)	0.0037 |(0.016)	0	$F = 1.74$ n.s $\eta_p^2 = 0.031$ $\eta_g^2 = 0.025$	$F = 1$ n.s $\eta_p^2 = 0.018$ $\eta_g^2 = 0.0062$
46-50	0	0	0.0026 (0.016)	0	$F = 0.43$ n.s $\eta_p^2 = 0.008$ $\eta_g^2 = 0.000$	$F = 0.43$ n.s $\eta_p^2 = 0.008$ $\eta_g^2 = 0.000$

Notes.
All MTT events are included in the analyses (specific, categoric, and extended).
n.s = not statistically significant. * $p < .05$.

Appendix 10b. Table with the temporal distribution (in percentages) of future MTT events according to type of retrieval.

	Dysphoric group n = 17		Normal mood group n = 38[a]		Main effects and effect sizes *F-value*	
Age at the time the event occurs	Involuntary Retrieval	Voluntary Retrieval	Involuntary Retrieval	Voluntary Retrieval	Participant Group	Type of Retrieval
16-20	0.22 (0.36)	0.19 (0.32)	0.050 (0.19)	0.042 (0.17)	$F = 5.38$* $\eta_p^2 = 0.092$ $\eta_g^2 = 0.089$	$F = 3.032$ n.s $\eta_p^2 = 0.054$ $\eta_g^2 = 0.0013$
21-25	0.15 (0.27)	0.17 (0.27)	0.35 (0.38)	0.28 (0.35)	$F = 2.62$ n.s ♣ $\eta_p^2 = 0.047$ $\eta_g^2 = 0.045$	$F = 2.19$ n.s ♣ $\eta_p^2 = 0.040$ $\eta_g^2 = 0.0013$
26-30	0.52 (0.42)	0.43 (0.32)	0.27 (0.34)	0.29 (0.32)	$F = 4.25$ * ♣ $\eta_p^2 = 0.074$ $\eta_g^2 = 0.069$	$F = 1.58$ n.s ♣ $\eta_p^2 = 0.033$ $\eta_g^2 = 0.0021$
31-35	0.013 (0.038)	0.084 (0.097)	0.14 (0.31)	0.15 (0.26)	$F = 2.13$ n.s $\eta_p^2 = 0.039$ $\eta_g^2 = 0.035$	$F = 4,16$ * $\eta_p^2 = 0.073$ $\eta_g^2 = 0.0063$
36-40	0.0091 (0.026)	0.018 (0.042)	0.045 (0.17)	0.054 (0.17)	$F = 0.81$ n.s $\eta_p^2 = 0.015$ $\eta_g^2 = 0.015$	$F = 1.33$ n.s $\eta_p^2 = 0.024$ $\eta_g^2 = 0.0094$
41-45	0.068 (0.24)	0.038 (0.16)	0.057 (0.19)	0.054 (0.17)	$F = 0.002$ n.s $\eta_p^2 = 0.000$ $\eta_g^2 = 0.000$	$F = 2.50$ n.s $\eta_p^2 = 0.045$ $\eta_g^2 = 0.0016$
46-50	0	0.018 (0.055)	0.043 (0.16)	0.046 (0.13)	$F = 1.05$ n.s $\eta_p^2 = 0.019$ $\eta_g^2 = 0.018$	$F = 1.29$ n.s $\eta_p^2 = 0.024$ $\eta_g^2 = 0.0018$
51-55	0	0.029 (0.16)	0	0.026 (0.14)	$F = 0.56$ n.s $\eta_p^2 = 0.01$ $\eta_g^2 = 0.000$	$F = 0.14$ n.s $\eta_p^2 = 0.003$ $\eta_g^2 = 0.000$
56-60	0.0098 (0.04)	0.020 (0.045)	0.0075 (0.034)	0.015 (0.049)	$F = 0.11$ n.s $\eta_p^2 = 0.002$ $\eta_g^2 = 0.000$	$F = 1.93$ n.s $\eta_p^2 = 0.035$ $\eta_g^2 = 0.010$
61-85	0.0087 (0.025)	0.037 (0.055)	0.012 (0.039)	0.044 (0.065)	$F = 0.23$ n.s $\eta_p^2 = 0.004$ $\eta_g^2 = 0.0037$	$F = 8.24$ ** $\eta_p^2 = 0.14$ $\eta_g^2 = 0.072$

Notes.
All MTT events are included in the analyses (specific, categoric, and extended).
[a] One of the normal mood participants failed to provide the age of the future MTT events' occurrence.
n.s = not statistically significant. * $p < .05$; ** $p < .01$; ♣ $p < .05$ interaction between the factors signalled.

Appendix 11

Appendix 11. DSM-IV-TR criteria for Major Depressive Disorder

A. Five (or more) of the following symptoms have been present during the same 2-week period and represent a change from previous functioning; at least one of the symptoms is either (l) depressed mood or (2) loss of interest or pleasure.

(1) Depressed mood most of the day, nearly every day, as indicated by either subjective report (e.g., feels sad or empty) or observation made by others (e.g., appears tearful).
(2) Markedly diminished interest or pleasure in all, or almost all, activities most of the day, nearly every day (as indicated by either subjective account or observation made by others).
(3) Significant weight loss when not dieting or weight gain (e.g., a change of more than 5% of body weight in a month), or decrease or increase in appetite nearly every day.
(4) Insomnia or hypersomnia nearly every day.
(5) Psychomotor agitation or retardation nearly every day (observable by others, not merely subjective feelings of restlessness or being slowed down).
(6) Fatigue or loss of energy nearly every day.
(7) Feelings of worthlessness or excessive or inappropriate guilt (which may be delusional) nearly every day (not merely self-reproach or guilt about being sick).
(8) Diminished ability to think or concentrate, or indecisiveness, nearly every day (either by subjective account or as observed by others).
(9) Recurrent thoughts of death (not just fear of dying), recurrent suicidal ideation without a specific plan, or a suicide attempt or a specific plan for committing suicide.

B. The symptoms do not meet criteria for a Mixed Episode (see p. 365).
C. The symptoms cause clinically significant distress or impairment in social, occupational or other important areas of functioning.
D. The symptoms are not due to the direct physiological effects of a substance (e.g., a drug of abuse, a medication) or a general medical condition (e.g., hypothyroidism).
E. The symptoms are not better accounted for by Bereavement, i.e., after the loss of a loved one, the symptoms persist for longer than 2 months or are characterized by marked functional impairment, morbid preoccupation with worthlessness, suicidal ideation, psychotic symptoms, or psychomotor retardation.

Adapted from DSM-IV-TR (American Psychiatric Association, 2000).

Appendix 12

Appendix 12. Multidimensional Depression Assessment Scale - Measure not presented due to copyright restrictions

Appendix 13

Appendix 13. Hamilton Depression Rating Scale (HAMD-17) - Measure not presented due to copyright restrictions

Appendix 14

Appendix 14. Brief Symptom Inventory (BSI) - Measure not presented due to copyright restrictions

Appendix 15

Appendix 15. Documents regarding the Ethical Approval of Study 2 (Translated)

Appendix 15a. Ethical approval from Centro Hospitalar Barreiro Montijo E.P.E

Internal Memorandum

From: Ethics Committee

To: Engineer Izabel Pinto Monteiro
Chairman of the Board of Administration

Issue: Request for Permission to data collection

Communication from: Ref Number: 24-2012 Date: 27-09-2012

On the 27th of September 2012 the Ethical Committee for the Barreiro Montijo E.P.E. Hospital Centre convened and deliberated upon a request for a data collection process framed within a PhD investigation developed by Joao Pedro Garcez Aurelio dos Santos, a PhD student at ISPA, regarding the topic of Mental Time Travel. In face of the documents presented the Ethical Committee has no objections to the realisation of this study as long as there is acquiescence from the Director of the Service and as long as the patients clinical files do not need to be accessed.

With the best of regards,

Elvira Camacho
President of the Health Ethics Committee

Handwritten elements to the upper right side of the page state: To the Service of Psychiatry for evaluation, 25.11.2012, Joao Silveira Ribeiro (Chairman of the Board)

Handwritten elements in the lower half/right side of the page state: I consider, after talking to the author, that the PhD project is doable and useful for a better understanding of depressive processes. Thus I consider that the data collection for the PhD execution is thereby approved. *This was written by Dr. Antonio Paiva, Director of the Psychiatry Service*

Appendix 15a. Ethical approval from Centro Hospitalar Barreiro Montijo E.P.E

Secretariat of the Administration
To: joaogaurelio@gmail.com
Answer to your request in 13/9/2012

Dear Sir
Dr. João Pedro Garcez Aurélio dos Santos
Rua Miguel Pais, n.º 170 - 3º dt.º
2830-356 BARREIRO

Following through your letter of the 13th of September 2012 we now inform you that you have been authorised to collect your data at the Psychiatry Department in relation to your PhD investigation regarding the phenomenon of Mental Time Travel.

With the best of regards,

The Chairman of the Board
Joao Silveira Ribeiro

Appendix 15b. Ethical approval from Centro Hospitalar Lisboa Norte, E.P.E

Dear Sir
Dr. Joao Pedro Garcez Aurelio dos Santos
Rua Miguel Pais N 170, 3 dit
2830-356

Lisbon, 24th of October 2012

Issue: Research Project entitled "Voluntary and Involuntary mental time travel in depression - Characteristics and mechanisms"

Reporter - Prof. Dr. Maria Luisa Figueira

By the present document we inform that the above mentioned project obtained, in the meeting held on the 4th of October 2012, a favourable analysis from the Ethics Committee.
Additionally, the above mentioned study was sent to the Clinical Director, Professor Dr. Correia da Cunha with the purpose of obtaining the final clearance for its execution.

With the best of egards

The President of the Ethics Committee for Health
Prof. Dr Joao Lobo Antunes

Dear Sir
Dr. Joao Pedro Garcez Aurelio dos Santos
Rua Miguel Pais N 170, 3 dit
2830-356

Reference PCA - 19.NOV.2012 - 0818

Issue: Research Project entitled " Voluntary and involuntary mental time travel in depression - Characteristics and mechanisms".

It is my pleasure to inform you that the above mentioned research project has been approved by the Ethics Committee for Health of the CHLN (Hospital Centre Lisbon North), and authorised by the Board of Directors on the 15th of November 2012.

With the best regards

The Chairman of the Board
Prof. Dr. J. A. Correia da Cunha

Appendix 15c. Ethical approval from Hospital Garcia de Orta, E.P.E

Translation of the Garcia de Orta Hospital Approval

Dr. Ana Jorge
President of the Garcia de Orta Centre

Almada, 22nd of January 2013

Issue: Report regarding the request to conduct Research number 44/2012 entitled "**Studying the Phenomenon of Mental Time Travel in depressed individuals**".

Promotor of the Research: School of Health for Social Sciences, University of Edinburgh, with Dr. Joao Pedro Garcez Aurelio dos Santos as the Principal Researcher.

- This is a PhD thesis with the purpose of providing a better comprehension of the relation between memory processes, episodic future thinking and depression.
- **Methodology**: Two interviews comprising the application of a set of questionnaires and separated by a two week long period of everyday recording of memories and projections by the patients.
- Place where the data collection will take place: Psychiatry Service of the HGO (Garcia de Orta Hospital).
- **Informed consent** - It is complete and comprehensible. Anonymity is ensured if that is the patient's request.
- **Opinion of the Director of the Psychiatry Service**: Favourable.
- It does not imply costs nor revenues to the Garcia de Orta Hospital.
- Attached to the process are:
- The Principal Researcher's identification and curriculum vitae.

From an ethical standpoint there are no obstacles to the beginning and execution of this Research Project.

The President of the Ethics Committee

Dr. Luis Antunes

Appendix 16

Appendix 16. Informed Consent Form of Study 2

DOCUMENTO DE CONSENTIMENTO INFORMADO

TÍTULO DA INVESTIGAÇÃO - Viagens no Tempo Voluntárias e Involuntárias na Depressão - Características e Mecanismos.

RESUMO DA INVESTIGAÇÃO - O objectivo geral desta investigação é o de compreender melhor a relação entre os processos da memória, o pensamento episódico futuro e a depressão. Nesta investigação irá ocorrer uma reunião inicial que terá como objectivo explicar todos os elementos da investigação e responder a todas as questões que tenha acerca do estudo. De seguida, e nesta mesma reunião, ser-lhe-á pedido que preencha um conjunto de questionários que permitem obter informações acerca dos seus dados sócio-demográficos (p.e., idade, género) e o seu estado de humor. Após o preenchimento destes questionários, ser-lhe-á entregue um caderno de registos, no qual lhe será pedido que escreva, durante a primeira semana, os seus pensamentos episódicos futuros voluntários e involuntários (estes deverão ser registados todos os dias, com um mínimo de um pensamento episódico voluntário e um involuntário por dia). Durante a segunda semana do estudo deverá registar no caderno pelo menos uma memória autobiográfica voluntária e uma memória autobiográfica involuntária por dia, todos os dias. Quando as duas semanas tiverem terminado, irá ocorrer uma segunda reunião com o investigador, já previamente agendada, para que possa indicar quais foram, na sua opinião, os aspectos mais positivos e negativos deste estudo e receber o cartão brinde no valor de 50 euros (este será entregue sempre que todos os questionários e caderno de registo tenham sido devidamente preenchidos, tal qual solicitado). A investigação, em condições normais, durará cerca de 320 minutos ao longo de duas semanas.

Ao assinar em baixo, está a confirmar que: (1) leu e compreendeu o documento de informação para os participantes que lhe foi fornecido, (2) as questões acerca da sua participação neste estudo foram respondidas de forma satisfatória, e (3) está a participar nesta investigação de sua livre vontade (e sem qualquer coacção).

_____

Nome do Participante (Impresso)*

_____ _____

Assinatura do Participante* Data

_____ _____

Nome do Investigador Responsável Assinatura do Investigador Responsável

**Os participantes que desejarem manter algum nível de anonimato podem usar as suas iniciais*

Appendix 17

Appendix 17. Information sheet form of Study 2

DOCUMENTO DE INFORMAÇÃO PARA OS PARTICIPANTES

Titulo da investigação
Viagens no Tempo Voluntárias e Involuntárias na Depressão - Características e Mecanismos.

CONVITE
O(A) Senhor(a) está a ser convidado para fazer parte de uma investigação sobre memória e depressão desenvolvida por João Pedro Garcez Aurélio dos Santos, que é o investigador responsável por esta entrevista, licenciado em Psicologia pelo Instituto Superior de Psicologia Aplicada em 2006. Esta investigação para a qual está a ser convidado está a ser supervisionada pelo Professor Doutor Michael Power da Universidade de Edimburgo e co-supervisionada pelo Professor Doutor Victor Cláudio, do ISPA.
O objectivo geral desta investigação é o de compreender melhor a relação entre os processos da memória, o pensamento episódico futuro e a depressão. Este projecto é financiado pela Fundação para a Ciência e Tecnologia de Portugal.

O QUE IRÁ ACONTECER
Se aceitar participar neste estudo, irá ter uma primeira reunião com o investigador na qual este responderá a todas as questões e dúvidas que queira colocar. De seguida, e nesta mesma reunião, ser-lhe-á pedido que preencha um conjunto de questionários que permitem obter informações acerca dos seus dados sócio-demográficos (p.e., idade, género) e o seu estado de humor. Após o preenchimento destes questionários, ser-lhe-á entregue um caderno de registos, no qual lhe será pedido que escreva, durante a primeira semana, as suas memórias voluntárias e involuntárias (estas deverão ser registadas todos os dias, com um mínimo de uma memória voluntária e uma memória involuntária por dia). Durante a segunda semana do estudo deverá registar no caderno pelo menos um pensamento episódico futuro voluntário e um pensamento episódico futuro involuntário por dia, todos os dias. Quando as duas semanas tiverem terminado, irá ocorrer uma segunda reunião com o investigador, já previamente agendada, para que possa indicar quais foram, na sua opinião, os aspectos mais positivos e negativos deste estudo e receber o cartão brinde no valor de 50 euros.

DURAÇÃO DO ESTUDO
O estudo, em condições normais, demora cerca de 320 minutos (cinco horas e vinte minutos) distribuídos por duas semanas: A distribuição de tempo pelas diferentes tarefas é a seguinte:

1ª Reunião: 90 minutos;
2ª Reunião (15 a 20 dias depois da primeira reunião): 90 minutos;
Registos diários no Caderno de Registos: 10 minutos x 14 dias = 140 minutos;

DIREITOS DO PARTICIPANTE
O(A) Sr(a). pode, em qualquer altura do estudo, decidir interromper em definitivo a sua participação, não estando obrigado a fornecer qualquer tipo de explicação. Tem o direito de exigir que quaisquer dados que tenha fornecido sejam destruídos.
Tem o direito de omitir ou recusar-se a responder a qualquer questão que lhe seja colocada.

Tem o direito de obter respostas para as questões e dúvidas que possua acerca dos procedimentos do estudo (a não ser que a resposta a estas questões interfira com os resultados do estudo). Se tiver alguma dúvida em consequência deste documento de Consentimento Informado, deve colocá-la ao investigador antes do início do estudo.

BENEFÍCIOS E RISCOS
Não são conhecidos quaisquer riscos para a sua pessoa a partir da participação neste estudo.

CUSTOS, REEMBOLSO E COMPENSAÇÃO
Irá receber um cartão prenda no valor de 50 euros após ter completado todas as etapas do estudo. A recepção deste cartão-prenda implica um preenchimento adequado dos questionários e o registo adequado de memórias e pensamentos episódicos futuros ao longo das duas semanas tal qual estipulado nas instruções. Caso opte por interromper o estudo sem ter cumprido os parâmetros acima indicados, não haverá qualquer compensação. Ao receber o cartão brinde está a aceitar a utilização dos seus dados para a investigação.

CONFIDENCIALIDADE/ANONIMATO
Os dados recolhidos não irão conter qualquer informação que permita a sua identificação e carecem de consulta do processo clínico . Os nomes pessoais e de cidades/locais que sejam fornecidos nas memórias/pensamentos futuros episódicos serão alterados de modo a que os originais não possam ser identificados. Os dados que fornecer no Questionário Sócio-Demográfico serão associados a um número de participante e será esse número que o passará a identificar nesta investigação. Os dados recolhidos serão usados exclusivamente com propósitos científicos, nomeadamente tendo em vista apresentações orais e em poster, bem como publicações em revistas científicas. A confidencialidade e o anonimato dos seus dados será sempre garantida.

PARA MAIS INFORMAÇÕES
O Investigador Principal (João Garcez Aurélio) e os seus Supervisores (o Professor Doutor Michael Power e o Professor Doutor Victor Claudio) terão todo o gosto em responder, em qualquer altura, às suas questões acerca deste estudo. Pode contactá-los da seguinte forma:

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The PI's personal mobile phone was removed from this hardbound/electronic version for privacy reasons

Appendix 18

Appendix 18a. Table with the temporal distribution (in percentages) of past MTT events according to type of retrieval.

	Depressed group n = 32		Never-depressed group n = 32		Main effects and effect sizes *F-value*	
Age at the time of event	Involuntary Retrieval	Voluntary Retrieval	Involuntary Retrieval	Voluntary Retrieval	Participant Group	Type of Retrieval
0-5	0.041 (0.063)	0.018 (0.049)	0.037 (0.10)	0.020 (0.048)	$F = 0.009$ n.s $\eta_p^2 = 0.0002$ $\eta_g^2 = 0.000$	$F = 3.44$ n.s $\eta_p^2 = 0.053$ $\eta_g^2 = 0.022$
6-10	0.11 (0.13)	0.11 (0.11)	0.13 (0.15)	0.10 (0.12)	$F = 0.048$ n.s $\eta_p^2 = 0.00074$ $\eta_g^2 = 0.00049$	$F = 0.65$ n.s $\eta_p^2 = 0.010$ $\eta_g^2 = 0.0035$
11-15	0.097 (0.11)	0.085 (0.091)	0.12 (0.12)	0.073 (0.084)	$F = 0.021$ n.s $\eta_p^2 = 0.000$ $\eta_g^2 = 0.000$	$F = 4.74$ * $\eta_p^2 = 0.071$ $\eta_g^2 = 0.018$
16-20	0.11 (0.12)	0.10 (0.10)	0.091 (0.10)	0.10 (0.12)	$F = 0.29$ n.s $\eta_p^2 = 0.005$ $\eta_g^2 = 0.0027$	$F = 0.014$ n.s $\eta_p^2 = 0.000$ $\eta_g^2 = 0.000$
21-25	0.079 (0.11)	0.12 (0.14)	0.079 (0.12)	0.11 (0.11)	$F = 0.032$ n.s $\eta_p^2 = 0.001$ $\eta_g^2 = 0.0006$	$F = 3.31$ n.s $\eta_p^2 = 0.051$ $\eta_g^2 = 0.023$
26-30	0.090 (0.096)	0.11 (0.093)	0.12 (0.12)	0.13 (0.15)	$F = 1.11$ n.s $\eta_p^2 = 0.018$ $\eta_g^2 = 0.012$	$F = 0.61$ n.s $\eta_p^2 = 0.010$ $\eta_g^2 = 0.0029$
31-35	0.084 (0.090)	0.088 (0.15)	0.085 (0.11)	0.14 (0.17)	$F = 0.82$ n.s $\eta_p^2 = 0.013$ $\eta_g^2 = 0.0081$	$F = 1.77$ n.s $\eta_p^2 = 0.028$ $\eta_g^2 = 0.011$
36-40	0.16 (0.18)	0.14 (0.17)	0.093 (0.11)	0.077 (0.11)	$F = 5.12$* $\eta_p^2 = 0.076$ $\eta_g^2 = 0.051$	$F = 0.97$ n.s $\eta_p^2 = 0.015$ $\eta_g^2 = 0.0052$
41-45	0.10 (0.16)	0.088 (0.12)	0.10 (0.17)	0.13 (0.15)	$F = 0.29$ n.s $\eta_p^2 = 0.005$ $\eta_g^2 = 0.004$	$F = 0.17$ n.s $\eta_p^2 = 0.003$ $\eta_g^2 = 0.00071$
46-50	0.061 (0.11)	0.070 (0.10)	0.091 (0.13)	0.095 (0.16)	$F = 1.01$ n.s $\eta_p^2 = 0.016$ $\eta_g^2 = 0.013$	$F = 0.22$ n.s $\eta_p^2 = 0.004$ $\eta_g^2 = 0.001$
51-55	0.050 (0.079)	0.042 (0.10)	0.047 (0.13)	0.034 (0.078)	$F = 0.068$ n.s $\eta_p^2 = 0.001$ $\eta_g^2 = 0.0008$	$F = 0.91$ n.s $\eta_p^2 = 0.014$ $\eta_g^2 = 0.0033$
56-60	0.014 (0.067)	0.020 (0.054)	0.0089 (0.035)	0.0045 (0.025)	$F = 0.86$ n.s $\eta_p^2 = 0.014$ $\eta_g^2 = 0.013$	$F = 0.039$ n.s $\eta_p^2 = 0.001$ $\eta_g^2 = 0.000$

Notes. All MTT events are included in the analyses (specific, categoric, and extended).n.s = not statistically significant. * $p < .05$.

Appendix 18b. Table with the temporal distribution (in percentages) of future MTT events according to type of retrieval.

	Depressed group n = 31 [a]		Never-depressed group n = 32		Main effects and effect sizes *F-value*	
Age at the time of event	Involuntary Retrieval	Voluntary Retrieval	Involuntary Retrieval	Voluntary Retrieval	Participant Group	Type of Retrieval
26-30	0.028 (0.16)	0.030 (0.14)	0	0	F = 1.25 n.s η_p^2 = 0.020 η_g^2 = 0.020	F =0.040 n.s η_p^2 = 0.001 η_g^2 = 0.000
31-35	0.014 (0.077)	0.029 (0.14)	0.10 (0.30)	0.058 (0.19)	F = 1.58 n.s ♣ η_p^2 = 0.025 η_g^2 = 0.023	F = 1.30 n.s ♣ η_p^2 = 0.021 η_g^2 = 0.0015
36-40	0.27 (0.41)	0.20 (0.33)	0.11 (0.29)	0.11 (0.25)	F = 2.69 n.s η_p^2 = 0.042 η_g^2 = 0.039	F = 2.04 n.s η_p^2 = 0.032 η_g^2 = 0.0028
41-45	0.075 (0.18)	0.10 (0.22)	0.18 (0.36)	0.15 (0.26)	F = 1.30 n.s η_p^2 = 0.021 η_g^2 = 0.018	F = 0.004 n.s η_p^2 = 0.000 η_g^2 = 0.000
46-50	0.10 (0.25)	0.086 (0.21)	0.24 (0.39)	0.17 (0.28)	F = 2.50 n.s η_p^2 = 0.039 η_g^2 = 0.036	F = 3.54 n.s η_p^2 = 0.055 η_g^2 = 0.0051
51-55	0.19 (0.32)	0.19 (0.32)	0.22 (0.38)	0.25 (0.36)	F = 0.29 n.s η_p^2 = 0.005 η_g^2 = 0.004	F =0.28 n.s η_p^2 = 0.005 η_g^2 = 0.0003
56-60	0.16 (0.30)	0.16 (0.27)	0.10 (0.25)	0.11 (0.21)	F = 0.83 n.s η_p^2 = 0.013 η_g^2 = 0.007	F = 0.021 n.s η_p^2 = 0.000 η_g^2 = 0.000
61-85	0.12 (0.27)	0.21 (0.33)	0.049 (0.14)	0.15 (0.20)	F = 1.22 n.s η_p^2 = 0.020 η_g^2 = 0.016	F = 14.11 *** η_p^2 = 0.19 η_g^2 = 0.037

Notes.
[a] One participant failed to provide the age of the future events' occurrence.
All MTT events are included in the analyses (specific, categoric, and extended).
n.s = not statistically significant. * $p < .05$, *** $p < .001$.
♣ $p < .05$ interaction between the factors signalled.