Cognitive abilities and prospective memory: a research on short time intervals affecting people's decision making and planning

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Abstract

In this paper, we explored the effect of time on people's prospective memory intentions and their cognitive abilities when making memory predictions. Although retention interval was the experimental variable in between phases of our experiments, we modified the intensity of the ongoing activity and the sources of the prospective activities in experiment one and two. Thus, we conducted two experiments: in experiment one participants generated future intentions and predicted their performance; in experiment two participants performed a more compelling task while instructed and tested about the prospective tasks that had to be remembered. In both experiments respondents had to recall the future intentions on later stages. Generally we found that time has a negative impact on memory. There is a strong decay in memory after 30 minutes and not much further decay after 60 minutes. We also observed that people's predictions about their memory don't take into account the effect of time interval on memory. Our objectives were to contribute to the existing literature on human metacognition through testing prospective memory performance, predictions and fluency before and during the execution of future intentions. Furthermore, the present thesis attempted to corroborate the use of advertising and promotion in order to maintain vivid the desire and the need to buy products in consumers' minds, as they fail to predict that their memory decays over short periods of time. People forget faster than they anticipate and are thus likely to forget what they need to do if not having a memory cue.

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1. Introduction

In introducing the concept that rationality and consciousness are two limited but malleable human traits (Simon, 1990), we inexorably soared the lengthy and intricate literature of human logic and memory functions, when approaching situations of decision making and planning. The constructivist bond existing between reasoning and memory, moulded by the surveillance of human intelligence (Piaget & Inhelder, 1973), appraises people's (meta)cognitive abilities in terms of their monitoring and control functions, in particular the correctedness and the informativeness properties of their information reports. On the basis of the observations stemming from this theoretical view, we stress out the importance of people's complex cognitive system, which shapes human behaviour among different circumstances and contexts, that ultimately is responsible for the generation and execution of everyday goals and plans. When digging into the working memory model (see Baddeley, 1986) and then looking for an understanding of the practices that characterise people's planning intentions and their relative strategies, we find ourselves exploring the basics and means of prospective memory.

This work concerns people's prospective memory abilities when dealing with day-to-day situations on the face of decision making and action. Although previous research has focused for the most on retrospective memory and the relevancy of an event's information for efficient decision making processes (Yaniv & Foster, 1995), the paradigms depicted for prospective memory research have been developed. The term prospective memory involves a complex range of cognitive processes in addition to memory that, inevitably, fall into the standard hypothesis of *constructivism* that reasoning is a key factor in trimming people's memory abilities (Gero, 2008). Fortunately, later theorists have offered new and interesting ideas about how the cognitive system is affected by thought and reason, so to demonstrate that prospective actions are remembered and executed at appropriate times in the future. These ideas are comprised within the broader classes of *attentional monitoring* and *spontaneous retrieval*. The first subject embraces the view that in order to perform an intended action at a specific time in the future, the environment must be checked or monitored for signals (Smith & Bayen, 2004); the second subject presumes that prospective remembering in everyday

settings relies on less voluntary and less demanding cognitive processes (McDaniel & Einstein, 2007).
It is very challenging to obtain objective experimental evidence on these topics but, before turning to our research, we tried to respect as much as possible the scientific study paradigm and parameters that have been developed to investigate prospective memory while designing our experiments. In particular, Figure1 (see Appendix) displays the major elements that have been followed in this paper. Within this paradigm, all sorts of prospective memory tasks can be implemented (McDaniel & Einstein, 2007).

The upshot of this research is that, once a person creates or collects intentions, memory and cognitive judgment strategies do not undertake the same path for the near future, but they follow disparate routes over short time intervals. One reason why this phenomenon has found wider ground of interest and research stems from the closely related area of consumer behaviour in the marketing field. In fact, the process of making consumer decisions and implementing these decisions can greatly influence people's conduct when they have to perform an action (i.e. a purchase). Gollwitzer and Sheeran (2009) talk about *self-regulatory strategies* when people form intentions and translate those intentions into action on the edge of receiving information (stimuli) of a product, brand or promotion. Furthermore, Guynn (2003) suggests that upon forming an intention, consumers put consciously themselves in a prospective retrieval mode. However, for everyday settings we believe that for very short periods of time, mostly circumscribed within one hour time, consumers forget portions of their initial intentions and fail to predict that their memory will not remember every single action they planned to perform. Based on the findings of our analysis, a focused link with the marketing management practice will be finally asserted.

2. **Philosophy of social research**

In this introductory section we aim at highlighting briefly the philosophical orientation and methodology of the researcher in his attempt to understand people's memory and cognitive abilities. First, we will explain the philosophical position, which is adopted throughout the study and what are its main characteristics; second, we will offer a brief review about the methodologies used while conducting the research.

Throughout the entire research the experimenter adopts a *perspectivist* position, "a thesis that expresses a naturalistic understanding of the human… …conditioned by the biological, psychological, cultural and linguistic background in which we are embedded" (Simpson, 2012, p. 7). This theoretical stance is characterised by the rejection of a *systematic reality* view of the world and its knowledge of it, but agrees with the idea that the nature of things are described by the eyes of the beholder (Kinash, 2010). In our study, the researcher believes that he studies and analyses an environment where people are living and performing ordinary activities. The phenomena stemming from his study are considered to spring from the researcher's ability to stop and penetrate the cognitive and unconscious paradigms of people's mental processes of generating (or collecting) prospective intentions of future actions and their planning strategies.

The methodology used in the research involves qualitative approaches to the collection of data, but it also follows quantitative analysis methods to its description. In particular, the methods encompass *anthropological* techniques, which include the choice of collecting information from interviewing and observing people (Bernard, 1998), and *analytic* techniques, which follow the adoption of statistical analysis of the data. Throughout, the thesis features an *abductive* approach in relation to the description of the findings (truth) about the psychological aspects and characteristics of human memory and behaviour. In fact, as Fann (1970) described the defining characteristics of an abductive approach, the premises made do not guarantee a general conclusion applicable to different contexts from those of the study. Thus, the researcher believes that his findings are significant when dealing with similar situations that have distinguished his research, but he is less confident on his findings when studying and interpreting very different contexts of analysis.

Although we decided to study people's memory and learning in everyday life contexts, the researcher expects the same results for consumption and purchase tasks that show similar environments and time requirements of those of his experiments.

In his attempt to study people's memory and cognitive processes, the researcher reflects about *constructivism* and agrees with past research ideologies that reasoning and memory are strongly glued by human intelligence. The constructivist view held in the paper is such that the knowledge about people's cognitive abilities, that has been developed by many scholars over the past decades, is considered to be socially constructed: its meaning is created by shared understanding or interpretation of its nature (Ackermann, 1995). In fact, after many researchers have found analogous results in their own studies on the subject, our researcher believes in past findings' relevancy; thus, he tries to follow and continue past empirical studies on people's memory and cognitive abilities in order to progress and develop new findings on people's decision making processes and planning strategies.

3. Literature Review

3.a Human rationality and intelligence

One of the most intriguing topics that have come over economists and psychologists in the past century is human rationality and its bond to decision making. Generally, the branch of consumer behaviour that has for so long captured researchers' attention looked to modern mainstream theories that assume people make their choices, and act consequently, in a way to maximise their utility (Simon, 1990). As fascinating as this argument can be it must be scaled down to seize the meaning of how any problem of everyday life is faced and managed. More specifically, the cognitive capabilities which describe human behaviour are bounded by limits that have for common denominator the idea that memory capacity can hold restricted amount of information in the short term and long term interval. Factors such as the environment in which the information is processed, the nature of the material processed, cognitive abilities and cognitive beliefs (and more) all play an important role in defining the rational limitations of each individual involved in a decision making situation. Consistent with this, previous research in consumer behaviour has shown that memory is a key factor that drives consumers' choices (e.g., Hauser & Wernerfelt, 1990; Janiszewski, Kuo, & Tavassoli, 2012; Nedungadi, 1990; Pechmann & Stewart, 1990). This is because if a certain product is not considered at the time of purchase it is likely not to be bought (Hauser & Wernerfelt 1990; Mitra & Lynch 1995). What is essential to understand in order to expand and visualise the focus of the present research is that memory is a crucial ingredient, if not key, for reasoning and intelligence. The philosophical field that investigates this matter, known as *constructivism*, sees logic itself as reliant on the relationship between reasoning and memory; as Piaget and Inhelder (1973) appraised "the schemata used by the memory are borrowed from the intelligence" (in Fuzzy-trace Theory, Piaget & Inhelder, p. 3).

On the assumption that rationality is a function of the skills and knowledge of each individual (Simon, 1990) intelligence can be either fixed or malleable. Those who believe intelligence is a fixed entity tend to accredit their performances to innate abilities whereas those who consider it an incremental unit attribute their performances to effort as well as cognitive abilities (Miele et al., 2011). The importance of this discussion is embedded in the recent researchers' interest in *metacognition* and the evolution of human consciousness

(Dunlosky & Metcalfe, 2009). The term metacognition refers to the ability to assess one's own future memory so to supervise and address specific goals, where its achievement depends upon the actions taken afterwards (Nelson & Narens, 1990). Accordingly, the ground floor for the empirical enquiry conducted on human intelligence and memory is paved on two major functions of metacognition: the monitoring and control functions. The basic notion behind the monitoring mechanism of memory is that it assesses the correctedness of potential memory responses to specific circumstances where, complementary to this function of memory, the control mechanism determines whether or not the most accurate (best) memory response available to the subject needs to be reported (Goldsmith et al., 2002). The speculative theoretical framework on metamemory developed by Nelson and Narens (1990) attracts vast attention to the study of consumers and their behaviour when we realise that the cognitive system which bears the monitoring and control processes is also responsible for the formation of goals and plans in everyday life. The literature discusses and stresses the role of metacognitive skills in transferring the awareness of one's cognitive processes to the design of practical solutions when facing learning and planning activities (Koriat & Bjork, 2006). Thus, it is necessary to understand the means with which people's cognitive beliefs operate in order to comprehend the mental practices on planning that lead to action. It is important to remember that metamemory and the strategies that follow about monitoring and control memory functions are a unique characteristic for each individual examined, as well as for the reasoning and intelligence views presented earlier.

3.b Battle between the naturalistic and laboratory research

Most of the research on planning and mental rehearsal has been concerned with how memory performs in accordance with the environment and the situation in which is used. It is particularly true that metamemory functions and schema are influenced by the external factors that define the background and setting of where the information is encoded (Koriat et al., 2006). The share of research that has encountered debate over the what, the how and the where memory phenomena should be studied concerns proponents of the naturalistic research opposed to supporters of the laboratory study. The dispute entails the characteristics of the traditional laboratory research defined in terms of *storehouse* concept of memory as opposed to everyday memory research defined in terms of *correspondence* metaphor of memory

(Cohen & Conway, 2008). In Koriat and Goldsmith paper (1996) on memory metaphors the idea of investigating and analysing memory as a cable link between what a person reports and the facts that have actually occurred (correspondence metaphor) permits to conceive the conception of memory as a representation or description about some past event. Thus, essential to this explanation and definition of memory there is the ability of people to faithfully report events by being evaluated in terms of *accuracy*¸ content and quality (*informativeness*) of reports. All of these aspects of the correspondence metaphor find robust affinity with the everyday memory research in which what is remembered is not less important than how much. The storehouse metaphor, in contrast, conceptualises memory as a storage space strongly related to the list-learning paradigm in which input elements (information) are deposited in a warehouse where later will be retrieved (Koriat & Goldsmith, 1996). Here, the measure of memory is merely concerned with the number of units of information that can be recalled at a later stage.

The line of thinking in which the correspondence metaphor is located makes a lot of sense when memory needs to be applied for complex events, places and conversations where people have freedom to opt for absolute correctedness or only approximately correct answers. The factors that administrate control of accuracy are well suited for specific categories of situations, such as witness memory (Cohen & Conway, 2008). For the purposes of our research we will attribute stouter importance to the storehouse concept of memory. A quantity-oriented approach to memory will be experimented and later discussed so to measure the effect of different retention intervals after an initial encoding phase.

Proceeding on the battle between naturalistic studies as opposed to laboratory studies it is critical to introduce the concept of *prospective* memory. Prospective memory refers to remembering to convey intended actions at a particular point in the future (McDaniel & Einstein, 2007). Daily tasks and exercises which require even minimal reflection such as pick up the newspaper on the way to work or the mail in the mailbox when coming home are inextricably bound with prospective memory. Briefly, prospective memory is remembering to do something at an appropriate time in the future. Though, to perform an intended activity one must recall there was an intention and also the ways to execute it (*retrospective* memory). In everyday environments both of these memory components are adopted and implemented, but there is difficulty among metamemory researchers in finding accordance on the way memory should be studied. Laboratory study supporters score high both in representativeness and generalisability whether we follow the concept of *ecological validity* described by Kvavilashvili and Ellis (2004) in their paper on the subject. Through representativeness it is meant the extent to which the information encoded (or the situation) resemble a real event in everyday living context. Generalisability it is referred to the degree the findings of a specific experiment are applicable to other similar real situations. By using these criteria the authors explicate that real-world research is more likely to fail mostly because of the lack of control over the external factors which characterise the environment of analysis. So, the incapability of generalisation due to the distinctive and inescapable context in which the research is conducted significantly limits the potential of naturalistic enquiry. Nevertheless, in spite of the undeniable advantages of laboratory research, many contemporary researchers moved outside the laboratory. The amount of research that has been done on a naturalistic setting stimulated controversy about the methods on memory exploration (Winograd, 1994). By remaining on the highlighted subject of the environment and its influence on the research methodology (and analysis) it is also necessary to agree with the view that any explanation of performance or behaviour of any memory system must account for the variables of the moment. It is in fact the memory's job to encode, organize and set up the information in a way to make it available for the immediate or later use. Recall of specific task details from memory depends on context and external cues and much of the subject's knowledge is acquired during a specific activity within a unique task environment (Alterman, 1996). The typical approach to examine prospective memory on a natural setting is, then, to observe people's success in carrying out intentions in the future without influencing or altering the space and time in which their intentions are performed. The nature of this research enables metamemory students to look at how people handle prospective memory demands; it also enables researchers to scrutinize planning and hierarchical organization of the intentions which are extremely hard to read in the laboratory (McDaniel & Einstein, 2007).

The bottom line to this quarrel is that the phenomena of memory are so miscellaneous that there is no single set of methods that is of better adoption to the exclusion of others. Laboratory research on prospective memory is really useful for testing theories and for predicting real world circumstances although there may be key features of real world prospective memory activities which are tough to capture in a typical laboratory paradigm (McDaniel & Einstein, 2007). At date, theories and findings developed in laboratory guide the search for analogues in everyday situations, and the discoveries stemming from naturalistic studies are backed up by in lab experiments. As concluded by Cohen and Conway (2008) on the matter a hybrid methodology has become commonplace among memory scholars. Others suggest that researchers use a laboratory experiment to test a hypothesis and replicate it in a field experiment that resembles the situations simulated in the lab experiment. This is because the lab experiment is internally valid. That is, potential confounds are controlled for. The field experiment is then necessary to show that the effect exists in reality.

On the present paper there will be a strong focus on prospective memory, and so in looking to participants' intentions to perform specific actions in the future, but it will keep a retrospective aspect on its endeavor too. The research, in respect to the conclusions drawn upon the practices and methodologies derived by the literature, will fall into the category of naturalistic enquiry. Our decision to perform an experiment not in laboratory but in the field does not specifically support one option to the other, it simply adjusts to the time and space constraints of our possibilities and research design. However, we believe that there is enough evidence from laboratory experiments to derive our hypotheses. And, thus, a field experiment is recommended to test them in real life.

3.c Working memory and cognitive abilities

Over the last 50 years there has been an incremental evolution regarding the question whether memory should be referred as a unitary system or whether it should be decomposed in a complex structure with different divisions and purposes. From the mid-70's it was spreading the idea that memory couldn't run with a singular model picture, as studies coming from brain-damaged patients appeared to show a disruption between the ability to build new long lasting memories and completing tests, which instead required short term recollection of information (Baddeley, 1992). In pursuing this hypothesis, several results from memory experimentation on cognitive skills such as reading, reasoning and comprehension have been obtained and the concept of a working memory system has gradually substituted the older concept of a unique memory division. Working memory appears then to be focal to many traits of human behaviour as primary as consciousness, rationality and learning. The architecture of the working memory model is organized mainly in three components: the *central executive*, the *phonological loop* and the *visuo-spacial sketchpad* (Baddeley, 1986). In brief, the central executive has the duty to regulate and coordinate the flow of material to be stored and retrieved; it performs storage and processing maneuvers by keeping a flexible but limited capacity. The phonological loop retains information encoded in verbal form (i.e. speech-based information) for a short term interval; it comprises a store and a rehearsal control process. Finally, the visuo-spacial sketchpad is specialised for screening the information that can be embodied in forms of either its spacial or visual characteristics (Morris & Gruneberg, 1994).

The reasons that brought to our discussion the description of this model are related to the nature of human rationality and consciousness. In particular, the fact that attention, type of information, priori and posteriori knowledge and environment are entailed in an intricate web of connections may lead to miss the processes which describe human memory. In fact, people's brains tend to accumulate and place memory materials in memory nodes, which then connect and associate with priori knowledge and experiences through interconnecting links (Anderson & Bower, 1973). This chain of relationships between components of cognition, reasoning skills and environmental factors require a flexible picture of memory that is able to combine both the general purpose resources (provided by the central executive) and the specialised processing and storage functions of memory (managed by the phonological loop and the sketchpad). One of the best ways to understand this picture of memory and translate it into a helpful tool for the analysis of individuals' cognitive processes and abilities is by looking into the means and methods people use when reporting information. Goldsmith et al. (2002) had conducted deep research on the subject by focusing on personal control over report options, which look at how individuals use the option "to volunteer or withhold answers in the service of enhancing one's accuracy" (Goldsmith et al., 2002, p. 73). In their specific study they have focused on the two alternatives of free report versus forced report while testing memory on an open/closed list of general knowledge questions. The discriminant between the two was pinpointed by the freedom given to participants to choose whether to answer the questions in a specific manner or in a generic one. What is interesting and relevant for our purposes is that when people choose the option of free report they adjust memory accuracy and sacrifice quantity. Thus, we find that people use in a strategic manner the theoretical working model of memory that has been discussed. The phonological loop and sketchpad, responsible for the acquisition and storage of data, participate in a monitoring function of memory where the correct (or relevant) piece of information is stocked and assessed for future remembering (or not) in the short term (Baddely, 1992). The other memory function responsible for determining the utilization of the best piece of information held, the control function, is performed by the central executive.

If we speculate on the idea that working memory mechanics and report options have a strong connection when dealing with information that has a short time span (from collection to recall) we could reach the hypothesis that people's rationality on everyday memory is about building structures of encoding and retrieval that are related to goals and their achievement (Anderson, 1996). Yet, the discussion relative to the construction of operative everyday goals and their execution yields concerns on the prospective memory topic earlier presented. According to Graf and Uttl (2001), intentions of actions that are retained in working memory can be distinguished between vigilant tasks and prospective tasks where the first ones are involved in monitoring the prospective intentions and the second ones are planned activities to be later performed.

In an everyday context where multiple variables play a role in influencing and impacting people's attention it is plausible to imagine a complex system of interconnected wires and nodes in memory's architectural structures. Maintaining short term memories and representations in the face of numerous variables and distractions from other ongoing activities relies on working memory abilities, as well as planning of intended actions (Rose et al., 2010). Hence, situations that request for an equilibrium between environment and a set of tasks in working memory comprise identical types of attentional control procedures as the ones of prospective memory tasks.

In our study we look at prospective memory tasks that need to be recalled within a short period of time, and so involving working memory functions in the process of storage and retrieval. The environment maintained its natural settings and participants performed an ongoing activity. We tried to keep a busy and naturalistic scenario so that participants had to engage in an unconscious process of organization and association of the information collected in the first phase of the experiment, to be recalled at a second stage.

3.d Cognitive beliefs and confidence

One of the best reasons to study metacognition (awareness on one's own cognitive processes) derives from its potential to play a central part in guiding how people learn, how they organize information and what causes action (Kornell & Metcalfe, 2006). In order to reach part of the central engine of such potential metacognition has often been observed by soliciting predictions of memory performance, especially through *judgments of learning* (JOLs) that are formulated right after some information has been acquired or after some delay. JOLs may be measured on the basis of *absolute accuracy* which is the correspondence between memory predictions and memory performance, or on the basis of *relative accuracy* which refers to the degree JOLs differentiate between what is and what is not remembered (Rhodes & Tauber, 2011). In an important research executed by Nelson and Dunlosky (1991) when made after a time interval, JOLs were better at discriminating among items with low or high probability of being remembered than when JOLs were said immediately. This terrific discovery had several lines of support from the fact that people can make better memory predictions after a delay because they rely on information from their long term memory. However, on the immediate judgment side it has been found that several dissociations exist between predicted performance of recall and actual performance: one overestimates his own future memory performance because of an overconfidence bias that occur, typically, when the question and the answer are both at disposal of the subject when making a prediction (*foresight bias* or *perspective bias*) (Koriat & Bjork, 2005). Koriat and Bjork (2004) have also examined the hypothesis that JOLs may be governed by processing fluency during the encoding information phase on the basis of the experiences or beliefs about one's cognitive abilities (see also Koriat & Ma'ayan, 2005). Hence, the investigation continued into the heuristics bases of metacognitive judgments when learning new items or material and, in the past decade, an alternative cue-utilization hypothesis in metacognitive judgments has gained impetus. According to this assumption JOLs are naturally inferential, depending on a series of internal and mnemonic cues which have some degree of legitimacy in predicting one's own future performance of memory recall, as well as on subjective confidence. The mnemonic cues encountered in the literature include the ease of processing the information during encoding, familiarity and ease of retrieval (fluency with which information comes to mind) (see in Koriat & Ma'ayan, 2005) which all belong to the general dimension termed *processing fluency*. Furthermore, processing fluency can originate different typologies of phenomenal experience contingent either with some attributes of the past or particular attributes of the stimulus at present (Kelley & Jacoby, 1996). Unfortunately, though, the dynamics of human memory are complex and not intuitive. Accurate beliefs about how memory works are tremendously important in a variety of contexts and situations in which people (students, consumers and more) come to decision making and almost certainly rely on memory cues to support their actions. In a lot of circumstances, in particular within a short retention, people do not predict that they will forget over time, thus resulting in “a failure to appreciate the degree to which memory can change over time”, referred as *stability bias* (Kornell & Bjork, 2009).

The finding that forgetting happens puts in highlight the difference between holding a metacognitive belief and applying that belief in practice. Kornell and Bjork (2009) findings on the matter suggest that people are usually overconfident in their memories and that they make memory predictions based on their situational-current state of their memories. These results are a clever sign of a stability bias in human memory as yet every area of psychology accredits the assumption that every human behaviour depends partly on the context stimulus (Erev et al., 1994). In our investigation there will be a strong interest in participants’ predictions of their future memory performance when judgments are made immediately after the storage of information. Our attention on JOLs falls into the measurement of both absolute and relative accuracy, and so on their measures of the difference between what is and what is not remembered. In the attempt to create an environment that is as casual as possible we decided not to alter any variable (besides our control variable of retention interval between the two phases in our experiments) by asking our participants to rely exclusively on their cognitive abilities, and so limiting eventual processing fluency features that would have otherwise biased our research.

4. Cognitive abilities and prospective memory

Our point of departure in attempting to understand the processes that govern and regulate people's cognitive abilities when performing an ongoing task is to put great attention on prospective memory and its decline in delayed-execute situations. To the extent that prospective memory is in general strongly affected by the environment where the respondent is examined (university campus for experiment one and the gym for experiment two) we expect that memory decays mostly due to larger time intervals as long as other variables present in nature are retained equal among each case. Nevertheless, it is important to be aware of other different cues which may alter positively (or negatively) memory performance. As described by Koriat and Bjork (2006), there exists a *theory based* cognitive ability, which corresponds to the information that is retrieved from memory, and a *mnemonic based* cognitive ability, which instead corresponds to the experienced based skills that are used automatically and unconsciously and that highlight a link between metacognitive skills and transfer (performance) in memory tests.

What remains vague from the studies that have so far documented metacognitive abilities on memory performance is the impact of very short retention intervals on retrieval of prospective memory intentions before their actual execution (in experiment one) and, eventually, during their execution (in experiment two). The work reported here examines respondents' intentions for future actions, their JOLs and their recall fluency with a focus on drawing the underlying differences between a between-subject study and within-subject one. In particular, we are interested in considering factors such as the demand of the ongoing activity performed by the respondents on the relationship between working memory and prospective memory performance. In fact, for the most part, existing studies were designed simply to determine whether working memory resources correlate with prospective memory (McDaniel & Einstein, 2007) neglecting the conditions under which the monitoring function is and is not assumed to be necessary for successful prospective memory retrieval. In order to address the issue we centered our mission on these research questions:

- Do people forget prospective memory intentions after very short time intervals?
- What pattern does the forgetting rate follow over different short time intervals?
- Are people overconfident about future memory performance?

- How does the ongoing activity influence memory performance on respondents' cognitive abilities among different studies?

The importance of these questions' answers stands in their dual contribution to two related disciplines that often are taken for largely diverse: psychology and marketing (Babutsidze, 2007). On the first instance, this research will complement the existing literature on prospective memory by analyzing the impact of short time intervals on JOLs, retrieval skills and its relationship with the working memory performance (as described above). On the second case, this paper will be an important tool for consumer behaviour researchers and marketers that aim at understanding the processes that underlay quick decision making and action of consumers when they start their purchasing journey with a conscious goal. In particular, knowing how people reason and what factors drive their instincts towards a decision at the exclusion of another is extremely important for advertisers. Braun-La Tour et al. (2004) describe a "paradigm shifting" in the field of consumer behaviour research where reconstructive memory processes, exerted by past experiences with a product, company or advert, can significantly influence preferences and prospective memory actions in the direction of a favorable brand or trademark. Furthermore, marketers will be enabled to predict consumers' action and, thus, to control with higher efficacy all the phases of designing, planning and executing an advertising campaigns. The ultimate objective for marketing managers would be pinpointing those consumers who do not perform an intention, such as forgetting to make a purchase, and reminding them of the missing action by helping them remember what they have overlooked.

There are several marketing activities where the understanding of the consumer's memory is the key for a successful managerial initiative and advertising strategy. They all hold and relate to the consumer's consciousness and rationality in his decision of making a purchase, which ultimately relies on past experiences, knowledge and intentions derived from memory. In the concluding sections of this paper more practical implications on these topics will be illustrated. Now, we will give room for presenting the methodologies and designs that have characterised this research.

5. Experiment one

In our first experiment we examined how well prospective memory intentions are remembered by respondents after five different retention intervals. As previously noted, we assume that time has a negative impact on memory performance but a positive one in defining the absolute and relative accuracy of memory predictions made immediately after formulating the intentions. The pattern would be such that the greater the time interval between the formation of intention (phase one) and retrieval of that intention from memory (phase two) the greater would be the forgetting mode and more precise would be the judgments about one's own memory abilities.

Several previous studies on planning and encoding intentions identified a bond between the complexity of the prospective memory task and the planning behaviour of people (Kvavilashvili and Ellis, 1996). Some prospective memory activities may require a set of steps to follow, such as buying a present for a friend. To accomplish this, it may be necessary to build a plan that comprises all the actions involved in the process of buying the gift, like going to the gift shop, picking an item, buying packing material and so forth. Some other intentions, second, may raise a complicated decision to undertake such as deciding to assist a colleague when you already have a tight schedule to go after. Making this decision will engage with the planning of how to complete the other tasks (Marsh, Hicks & Landau, 1998). Third but not least, prospective memory tasks "clearly differ in their importance" (McDaniel & Einstein, 2007, p. 110) and planning is stimulated in different ways. We took regard of these documented results from past research in our study by allowing our respondents to engage with all these dimensions of forming and storing future intentions in a conscious and rational way.

Method

In experiment one, we designed a between-subject study in which participants were organised in five groups of circa thirty people each. The time interval between the starting phase of encoding and the second of retrieval was the only manipulated variable. The study was conducted in two university campuses, precisely in Catòlica Lisbon University, Portugal, and Lancaster University, UK, where participants were asked to form prospective intentions that they would have performed, or thought of performing, in the following week. Following

Miller's (1994) results on his research on people's capacity limitations of information processing, where a maximum of seven pieces of *uni-dimensional* inputs can be successfully remembered over short time intervals, participants had to list a single set of ten intentions of future actions in the first phase of our experiment. At this stage, participants were also asked to make item-by-item JOLs by saying whether they would remember each individual intention mentioned and aggregate JOLs by giving the total number of elements they would later recall within the entire batch of intentions stated. Such requisite of the study enabled us to verify the relative and absolute accuracy of their predictions. After a predetermined retention period of time had passed the respondents had to revoke the intentions earlier created without any use of memory aid throughout (see Appendix, p. 41). In order to comply with the empirical requirement of data collection and analysis brought up by Simmons et al. (2011) in which authors must assemble at least twenty observations per group of scrutiny for a powerful sample to detect relevant effects, we gathered information of thirty people per cell with the exclusion of the last cell which had only twenty-one participants, due to time restrictions. The participants of our study had the freedom to choose what to say and had no time constrains during all phases of our experiment, so to induce the planning strategies that are linked to the free report option (Goldsmith et al., 2002) and the working model of memory.

Participants

One-hundred and forty-one English speaking university students of which sixty from Catòlica Lisbon University and eighty-one from Lancaster University. The students were randomly selected and randomly assigned to one of the five condition groups. They took part to the experiment without any incentive or reward for their participation.

Material

Stimuli of creating intentions consisted in making the students the question of thinking ahead of a week time in order to make them state some of the activities they planned to perform. It was vividly clarified to them that the intentions had to be different, unrelated and necessary for their upcoming days. It was also asked them to make individual and aggregate JOLs for their planned intentions during the first phase of the study. Data was produced verbally and no tool was allowed for usage to the respondents to try remember what they were saying. Only the researcher had a specific device (laptop) to allow him record manually the information (initially elaborated through Microsoft Excel).

Procedure

<u>*Phase one.*</u> Participants who were performing an ongoing activity, such as studying or working on campus, were approached by the researcher on a face-to-face interview. After having asked them about their willingness to participate and after having told them about the purpose of the study, the three steps of the experiment, the retention interval and the ban for using any memory aid the examiner started with the experiment.

<u>*Phase two.*</u> The examiner posed them a single question of listing ten future intentions they intended to perform over the following seven days. At this phase, the examiner also required them to make, immediately after each intention was mentioned, an item-by-item prediction (JOL) to stress whether they would recall or not the intention in the following phase of the study. After they listed all ten future tasks and made item-by-item predictions for each, participants had to say also how many of the total group of intentions they believed they would afterward recall by making an aggregate prediction (a number comprised between zero and ten). At the end of this second phase respondents were reminded about the memory aid ban which needed to be firmly respected for a meaningful research.

The retention intervals for the five condition groups differed so that Group1 had to go through phase two right after phase one ($t_1 = 0$), Group2 had ten minutes ($t_2 = 10$), Group3 had thirty minutes ($t_3 = 30$), Group4 had one hour ($t_4 = 60$) and Group5 had one day ($t_5 = 1$ day). The experimenter kept a chronometer throughout the experiment and managed to respect exactly the stipulated retention intervals of the study. This alteration of the independent variable ‘time’ in between groups allowed us to carry out and execute a General Linear Model analysis on the statistical software SPSS so to conduct and test an Analysis of Variances for the five experimental conditions.

During the time intervals, the examiner kept being around without losing sight of the participants. But the examiner tried not to be seen so that he did not disturb participants during their ongoing tasks. Whenever time and space allowed, the researcher interviewed more participants during the retention intervals, specifically, during the thirty, sixty and one day experimental conditions. Though, he never lost vision of the already interviewed respondents by not leaving the place where he started his research.

Phase three. In sequence, after phase two and the time lapse, participants were again approached by the researcher, who made the same question as for phase two, that is listing again the ten tasks which were mentioned earlier. He collected the prospective intentions that could be retrieved from memory by the students. Only in the immediate time interval condition participants were immediately asked to restate their tasks after phase two ended. Everyone else followed to three phases procedure.

For the ‘one day’ condition of Group5 only, the researcher fixed, in agreement with the participants, a meeting location inside the University campus and an exact twenty four hours time-lapse between the two phases of the study, in order to comply with the experiment’s requirements[1].

Results

To kick off with the analysis of the collected data three Univariate General Linear Model (GLM) studies were indispensable to verify the hypothesis that a significant effect of the independent variable time existed on memory performance, total aggregate predictions of memory performance and the aggregated item-by-item predictions of our participants. The Univariate GLM combines the analyses of ANOVAs and regression-based models and can thus handle categorical variables with many levels. These three analyses therefore will test whether there is any difference between the groups with diverse time intervals (immediate vs. 10min. vs. 30min. vs. 60min. vs. 1 day), on memory performance and on memory predictions. Memory predictions referred to the total number of items participants predicted they would remember. When participants answered they would remember an item, the response was coded as 1. In order to execute a first comparison between the respondents’ memory predictions and their actual performance we computed the total memory predictions as the sum of the ten item-by-item memory predictions. Memory performance was the total number of items participants actually remembered after the time interval.

[1] The researcher almost exactly respected the ‘one day’ condition with every participant as the latest delay he experienced with one of the twenty-one respondents of Group5 reached approximately ten minutes after the twenty-four hours gap.

In the first test, the GLM disclosed that retention intervals have a significant impact on memory performance (*F*(4, 136) = 4.61, *p* < .01, see appendices Table3). In figure 1, we can observe a decrease in the number of tasks remembered from the immediate time interval until the one hour interval, and a small increase after one day. In the second test, referred to the total aggregate predictions of memory performance, the same analysis produced a marginally significant effect of time on the dependent variable (*F*(4, 136) = 2.19, *p* = .07, Table5). In the third test, relative to the aggregated item-by-item predictions, the model yielded a significant result (*F*(4, 136) = 3.78, *p* < .01, Table7). We can observe in Figure2 below that time generated more confidence to our participants about their own memory knowledge.

Next, the data was analyzed using a repeated-measures ANOVA in which memory (predictions vs. performance) was entered as a within-subjects factor and time-interval (immediate, 10 minutes, 30 minutes, 60 minutes and 1 day) was entered as a between-subjects factor. The dependent variables were memory predictions and performance. We first compared memory performance with the item-by-item memory predictions. We observed an interaction between memory and time-interval (*F*(4, 136) = 9.79, *p* < .01, see Figure2 below) meaning that the effects of condition on memory predictions and performance were not the same.

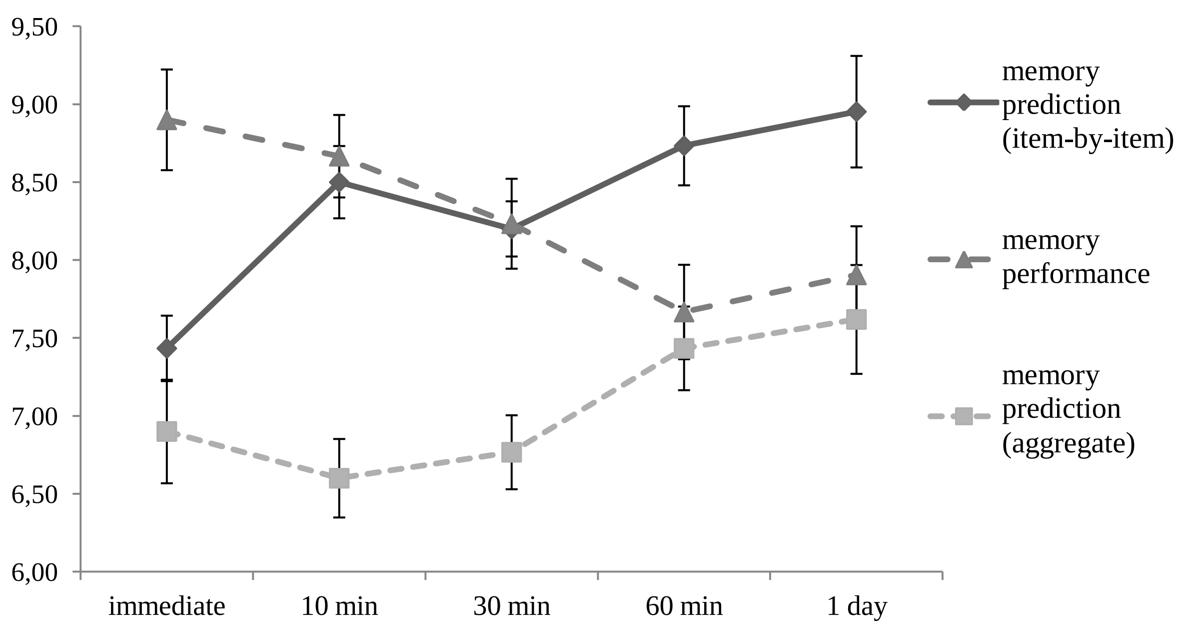
Subsequently, in order to continue probing into our primary data, we examined the specific differences between the five time conditions to verify whether those same differences may result significant and relevant to our purposes.

We observed for memory performance that those in the immediate time interval condition remembered a similar amount of items (*M* = 8.90, *SD* = 1.15) than those in the 10 minutes of interval condition (*M* = 8.66, *SD* = 1.27, *F*(1, 136) = 0.50, *p* = .48). However, those in the immediate interval condition remembered more items than those in the 30 minutes condition (*M* = 8.23, *SD* = 0.97, *F*(1, 136) = 4.06, *p* = .046). There was still a marginally significant decay of memory from 30 minutes to 60 minutes of time interval (*M* = 7.66, SD = 1.40, *F*(1, 136) = 2.93, *p* = .09), but not from 60 minutes to 1 day of interval (*M* = 7.90, SD = 1.64, *F*(1, 136) = 0.43, *p* = .51).

For item-by-item predictions, separate contrasts reveal that participants predicted they would remember fewer items in the immediate time interval condition (*M* = 7.43, *SD* = 1.77) than in the 10 minutes condition (*M* = 8.50, *SD* = 1.45, *F* (1, 136) = 6.70, *p* = .01). However, those in the 10 minutes condition, predicted they would remember a similar amount of items than those in the 30 minutes condition (*M* = 8.20, *SD* = 1.58), in the 60 minutes condition (*M* = 8.73, *SD* = 1.66) and in the 1 day condition (*M* = 8.95, SD = 1.43).

We observed no effect of age (ps = .46) nor interaction with one of our factors (ps = .54). We also observed no effect of gender (ps = .28) nor interaction with one of our factors (ps > .50).

Next, we performed the same analyses using the aggregate measure of memory predictions. That is, the number of items participants predicted they would remember. We again observed an interaction between memory and time-interval (*F*(4, 136) = 9.29, *p* < .01) meaning that the effects of condition on memory predictions and performance were not the same. However, for the aggregate memory predictions, we find no significant effect of condition (*F*(4, 136) = 2.19, *p* = .07), meaning that memory predictions for each time interval condition were more or less the same.



Note: The error bars around the points represent the standard error by the formula Standard error = Standard deviation / Square root of the number of participants in the condition. The standard error is a measure of the dispersion of the data around the points.

(Figure 2: Study 1 results)

Discussion of research findings

Experiment one produced results that were generally consistent with our forecasts. However, the absolute values of the total aggregate predictions did not yield a noteworthy significance across the five examined levels of time gap, showing that participants did not notably modify their memory strategies when thinking ahead of time. We see, thus, the occurrence of the foresight bias as predictions about one's success in retrieving the right answers (intention) are made when those answers are readily available (Koriat & Bjork, 2005). Instead, the finding that short time intervals exerts a meaningful effect on memory performance and on aggregate item-by-item predictions is in accordance with the idea that even a few tens of minutes, as measured by the scientific experiments that have been developed to explore prospective memory (McDaniel & Einstein, 2007), are perceived as sufficient to initiate a decay on recall and an overconfidence in people's cognitive abilities.

Even though our pattern of prospective memory performance brings to light similar conclusions to those that have so far portrayed what the literature on short prospective memory has documented, we cannot disregard the interesting increase of memory performance from the sixty-minute condition to the one day condition. Reasons that may explicate such phenomenon could lie on the fact that prospective memory does not display the classic negatively forgetting curve that is prominent in the literature of retrospective memory (McDaniel & Einstein, 2007). During an event-based prospective memory study conducted by Hicks, Marsh, and Russel (2000) memory performance revealed a considerable increase from a short retention condition (2.5 minutes) to a longer retention condition (15 minutes), although they predicted a constant memory decline across the time intervals. Yet, an older experiment from Wilkins (1979) found no disparities in prospective remembering from a two to thirty-six days retention conditions. One possibility to interpret these findings is that during the course of the time lapse more spontaneous and unconscious retrievals of the intention, in the moments prior their execution, may happen as the time intervals increase. Later in experiment two we tried to overcome this event by introducing a more challenging distracter activity which aimed at reducing the occurrence of these unwitting self-remindings (Kvavilashvili, 1987).

In discussing the results of the aggregate predictions we believed that performance would have been better foreseen with a longer delay between establishing the prospective tasks and the commencing of the cover intentions. As predicted, the total aggregate JOLs made by our participants improved with the increase of the retention intervals (as we see that they move near the performance line in Figure2 above), suggesting that people are more aware of *how many* of the intended actions are likely to forget in the near future when the retention gap raises. As Koriat and Bjork (2006) discovered in their studies on the metacognitive abilities of people's judgments "improved metacognition is one key to optimising transfer" (p. 1133), that is the adjustment of one's own memory functions to real world situations thank to the awareness of the retention period. Instead, although the metacognitive abilities of our respondents seemed showing an adaptation to time lapses, the aggregate item-by-item predictions pointed towards patterns of overconfidence when intentions are taken separately from one another. In our specific case, respondents were not able to successfully predict whether they would have remembered prospective intentions if processed individually, implying that they were less aware of *which* intended actions were more likely to forget. One of the causes that may explain this observed fact is based on the time being considered as a 'distance metaphor' where judgments about the upcoming future are intrinsically a function of a person's intertemporal preferences. In particular, when a temporal judgment is associated with a judgment of future time, "spacial distance will influence how long or short individuals judge a future time to be" (Kim, Zauberman & Bettman, 2012, p. 868). This phenomenon, denominated *forward telescoping*, could have contributed in misleading our participants' item-by-item predictions by making them believe that the intentions they mentioned could be remembered easier whether they planned to perform those intentions very soon in time (Prohaska, Brown & Belli, 1998). However, this increasing pattern concerning individual prospective memory predictions does not necessarily translate into people's misconduct when facing daily tasks; it merely shows the psychological reality of people's overconfidence about their own cognitive skills.

6. Experiment two

Participants' memory abilities in experiment one were very strong throughout the five condition groups, following a slow decrease over the retention times tested. We did not expect significant memory decays in each experimental condition, but we became concerned that perhaps respondents had discounted the effect of time on their memory performances because of not having yet initiated the process of executing any of the intentions said. More specifically, although our students were deeply engrossed in their ongoing activities, these last ones were not very demanding in terms of resources needed for strategic monitoring of the prospective memory intentions (McDaniel & Einstein, 2007). Kvavilashvili (1987) offered evidence that ongoing activities that are more engaging lead to lessen people's thoughts concerning the prospective tasks, so to partially blur the phonological loop and sketchpad of the working memory model that are responsible for the monitoring function of memory. In experiment one we did find an effect of time on prospective memory performance, but since participants could not perform the tasks they listed right away we wanted to test whether the effect of time would hold when respondents are focused in the examined tasks.

By testing a second sample of participants involved in a much more interesting ongoing activity we sought to decrease the chances of *spontaneous* retrieval normally triggered by the presence, and not immediacy, of the prospective memory target (McDaniel & Einstein, 2007). Marsh et al. (1998) demonstrated that by increasing the cognitive burden of the ongoing task, by adding a primary task (that is, executing an exercise), sometimes hampers the prospective memory performance. The interpretation of their results, thus, explains a takeover of the working memory resources on the prospective memory activity in favor of the ongoing task, yielding an increase in the central executive demands and a lowered prospective memory performance.

Another key difference between experiment two and experiment one looked at testing every participant of the second study to every variation that our experimental variable followed, so that we had a within-subject study instead of another between-subject design, that already characterised our study one, where respondents are assigned to groups of different retention intervals.

Method

In experiment two we tried to measure, as for experiment one, the impact of time on prospective memory performance. Though, differently from before, participants were instructed by the researcher about the prospective tasks that to had to be borne in mind (and possibly execute) during a compelling ongoing activity, which required both body movements and strong cognitive attention (that is, a basketball training session). The design followed a within-subject study where participants were organised in three groups of five and where the experimental condition 'time' was manipulated equally for everyone. All participants within the same group were given, in the first phase of the experiment, the same and all pieces of information, which were clustered in categories on the basis of their nature and difficulty. The groups only differed in the order of the tasks given, for example Group1 received as first relatively easy information which explained the execution of a set of tasks, then a medium difficulty information set for the execution of another set of tasks, and finally a high difficulty information set for a third set of tasks. Group2 received first the medium set, followed by the high and easy sets; Group3 received first the high set, followed by the easy and medium sets (see Figure3 below for the information sets and Figure4 for their order in each group). During the first phase of the study participants were only asked to listen to the instructions and then to make three aggregate predictions (JOLs) for each set of instructions and one aggregate prediction for the total set of information. Subsequently, all groups were asked on three separate steps of the experiment to interrupt their ongoing activity to verbally recall the tasks they were initially presented; precisely, immediately after phase one ($t_1 = 0$), after ten minutes ($t_2 = 10$) and after thirty minutes ($t_3 = 30$). The order of the information asked at each stage followed rigorously the order of the allocation of the instructions given at the beginning. This experiment, given its design and complexity, was conducted in three different training sessions, therefore each experimental group was examined separately from one another.

Participants

Fifteen students of Lancaster University men's and women's basketball teams that played at the Sports Centre facility in the campus during three post-season sessions; specifically, ten boys and five girls. The players were randomly approached and selected in one of the sessions from a total group of circa twenty each time and were also randomly assigned to one of the three orders of information sets. As for experiment one, participants took part to the experiment without any incentive or reward for their participation. The basketball players in each session, taken as a whole, were known by the experimenter as he had been their coach throughout the season.

Material

Information provision by the researcher was only on verbal form. The instructions accounted for a total of twelve pieces of data distributed in three clusters of four on the basis of their nature and difficulty (Figure3). In particular, instructions were designed to be fundamentals of the game of basketball that referred to the use of 'hands' on the ball (the easy set), the use of 'feet' on the floor (the medium set) and the use of 'body' on the court (the high difficulty set)[2]. Respondents were asked not to, for the entire duration of the experiment, take note, rehearse or talk about the information received. At the point of the recalling tests participants were distributed a piece of paper and a pen for the data collection. Microsoft Excel was again the initial tool at disposal of the researcher to fill in the data that was collected through the use of pieces of papers during the experiment.
The twelve pieces of information for the field experiment follow:

How to use the **HANDS** on the ball (EASY)	How to move the **FEET** on the floor (MEDIUM)	How to position the **BODY** on the court (DIFFICULT)
• The thumbs should form a T shape when holding the ball • The middle finger of the shooting hand should be positioned on one of the cavities of the ball • The hand palms never touch the ball • The fingers of the shooting hand point up to the sky before shooting	• The body weight should be entirely on the toes (heels up) with the knees are bent • The toe of the changing-direction foot must point towards the new way • To perform a cross over move the second step must be very small • The attacking foot from a 'stop and go' situation always goes forward	• When playing man-to-man defense the chest must be in front of the opponent's • The weak side defense is positioned along the imaginary line of the two baskets and one meter below the passing line • When catching the outlet the body should be next to the sideline on the projection of the free-throw line • A 'cut to the basket' must end under the hoop, below the low-post position

(Figure3).

[2] The information sets' difficulty levels have been defined by the experimenter. At the time of the experiment, he held 17 years of (inter)national experience on the game of basketball, both as a player and as a coach. He benchmarked the level of difficulty of the information sets with a close colleague of his, who also had circa 20 years of basketball experience.

Order of the information sets that each group received and performed, (the allocation of the orders was random to the experimental groups):

Group one: order of information sets' learned and retrieved	**Group two**: order of information sets' learned and retrieved	**Group three**: order of information sets' learned and retrieved
1. Hands – (performed at t = 0) 2. Feet – (t = 10 min) 3. Body – (t = 30 min)	1. Feet – (t = 0) 2. Body – (t = 10 min) 3. Hands – (t = 30 min)	1. Body – (t = 0) 2. Hands – (t = 10 min) 3. Feet – (t = 30 min)

(Figure4).

Procedure

Phase one. Five players of twenty who showed up for a post-season basketball session were randomly approached by the researcher to volunteer for the experiment before the session started, which took place at the gym. Given their acceptance, participants were instructed to form one team, about the study's procedure and its steps (see Appendix for the structure of the interactions, p. 47).

Meanwhile the researcher had picked and talked to the experimental group, the remaining players, those who did not participate to the study, were told to form other teams by themselves and start playing games against each other.

Phase two. As second step, participants to the study were verbally taught by the examiner about all three information sets, thus receiving the entire group of instructions at one of the orders previously described in a random way. They also were told about the instructions' informative nature, but not about the different levels of difficulty.

Phase three. All individuals within the group were asked orally (see the text below for the actual conversation and questions), immediately after phase two, to make a total of four memory predictions: three aggregate predictions for each set of information and one aggregate prediction for the total package of tasks received. They were handed a piece of blank paper and a pen each by the examiner to make predictions. Each player had to write his name on the paper. During this phase each group of players, right after predictions were made, had to list also the first set of instructions they had been given (that is, either the four pieces of information about ‘hands’, ‘feet’ or ‘body’). Memory performance was tested on a different paper from the predictions’ one. The immediate test condition was already being executed. Participants had to report the information in an open ended space on the paper provided to them for data collection. This is how the situation was handled by the experimenter:

> <Please, take now one piece of paper and pen. Write down your names and four numbers that should represent how many tasks that I gave you, you think you will recall. The first three refer to each set of information you received. Please, write your predictions in order with the order of the information sets you received. They should be three numbers comprised between zero to four. The fourth and last number should represent your total memory prediction. A number between zero and twelve. Once you have finished please give me back pens and papers. Take now another piece of paper and please list the tasks of the first set you received. Please, always put your name on it. Once you have finished please give me back pens and papers and go playing. I will stop you when ten minutes will be passed. Thank you>.

The players were asked to play one (or more) game of basketball as ongoing activity against the other teams, which were external to our research. Participants had freedom to perform the instructed tasks (or not) during the game.

Phase four. After ten minutes the experimental groups had to stop the ongoing activity, under indication of the experimenter, and report on another paper, always handed by the experimenter, what they could remember about the second set of prospective instructions given by the researcher. Pens were also distributed by the experimenter. This is how the experimenter approached again each group:

> <Ok guys, please stop playing. Pick up a piece of paper and a pen, write your name and please list the tasks of the second set you received. Once you have finished please give me back pens and papers and go playing. I will stop you when other twenty minutes will be passed. Thank you>.

Phase five. After thirty minutes the experimental groups had to stop again the ongoing activity and report on a third piece of paper the third set of prospective tasks given at the outset. The end of this phase concluded our study:

<Ok guys, please stop playing. Pick up a piece of paper and a pen, write your name and please list the tasks of the third set you received. Once you have finished please give me back pens and papers and go playing. The experiment is finished. Please do not yet talk about anything about the experiment. Thank you>.

Results

We analyzed the data using a repeated-measures ANOVA in which memory (predictions vs. performance) was entered as a within-subjects factor, the time-interval (immediate, 10 minutes, 30 minutes) was also entered as a within-subjects factor and the counterbalancing of order of instructions (hands, foot, body) as a between-subjects factor.

We observed an interaction between memory and time-interval ($F(1, 12) = 7.27$, $p = .02$, Table8) meaning that the effects of time intervals on memory predictions and performance were not the same. In order to understand this interaction, we examined the effect of time intervals on memory predictions and performance separately[3].

We found a significant effect of time interval on memory performance ($F(1, 12) = 12.12$, $p < .01$, Table10), but not on memory predictions ($F(1, 12) = 0.42$, $p = .53$, Table9). The effect of time interval on memory performance was marginally qualified by an interaction with the counterbalancing condition of what instruction came first ($F(1, 12) = 3.56$, $p = .06$, Table10) suggesting that the memory decay was stronger for some types of instructions. As one can see in table 1, there is a decay in memory performance from the immediate time interval condition to the 30 minutes time interval condition. This effect is not observed in memory predictions. Only for the information set relative to ‘hands’ there is no decay in memory performance from the immediate time interval to the 30 minutes of interval.

Level of information	**Level of time interval**	**N**	**Memory predictions**		**Memory performance**	
			Mean	**Std Dev**	**Mean**	**Std Dev**
hands	**immediate**	**4**	2.49	0.33	1.75	0.96
hands	**10 min**	**5**	2.53	1.12	2.20	1.30

[3] When reporting on the distributed pieces of paper the memory predictions that were initially asked, a total of five participants failed in writing their aggregate predictions for the individual information sets, possibly due to the presence of distractions in the gym or negligence. In order to cope with this issue and continue with the analysis of the data, their prediction values have been substituted with the average prediction of their group for the relative information set.

Level of information	Level of time interval	N	Memory predictions		Memory performance	
			Mean	Std Dev	Mean	Std Dev
hands	**30 min**	**6**	2.44	0.50	2.17	1.33
feet	**immediate**	**6**	2.83	0.75	2.50	0.84
feet	**10 min**	**4**	2.74	0.18	1.50	1.29
feet	**30 min**	**5**	2.53	1.12	1.60	0.89
body	**immediate**	**5**	2.73	1.30	3.40	0.89
body	**10 min**	**6**	2.78	0.75	2.33	1.21
body	**30 min**	**4**	2.74	0.18	1.25	0.50

(Table12 – SPSS).

Next, we added the years of experience (M = 5.46, SD = 2.48) as a continuous predictor in the analyses. We observed that years of experience qualified the interaction between memory and time interval ($F(1, 12) = 6.84$, $p = .02$, Table11). A median split in the years of experience was performed (median = 5.5) and respondents were classified as having high or low years of experience. As we can observe in the table below the decay of memory after 30 minutes is lower among experienced players.

	Years of experience	Mean	Std. Deviation	N
Predictions no interval	**Low**	2,4214	,91509	7
	High	2,9500	,82714	7
	Total	2,6857	,88174	14
Predictions 10 min	**Low**	2,4214	,70996	7
	High	2,9000	,83417	7
	Total	2,6607	,78451	14
Predictions 30 min	**Low**	2,4214	,70996	7
	High	2,7571	,68704	7
	Total	2,5893	,69342	14
Memory no interval	**Low**	2,429	,9759	7
	High	2,714	1,2536	7
	Total	2,571	1,0894	14
Memory 10 min	**Low**	2,000	1,1547	7
	High	2,000	1,4142	7
	Total	2,000	1,2403	14

Memory 30 min	**Low**	1,143	,3780	7
	High	2,000	1,0000	7
	Total	1,571	,8516	14

(Table13 – SPSS).

Discussion of research findings

The overall logic of experiment two was the same as for experiment one, where our objective was again to measure the impact of retention intervals on memory performance and memory predictions. The results originated from the analysis of the data almost exactly mirrored what the research had already found, that there is a significant impact of short time intervals on prospective memory performance of our participants, but no significant change appeared in their judgments of learning. In fact, across the three different retention gaps that have been examined, memory predictions showed very small (or no) adjustments over time. As for experiment one, this phenomenon should be explained by the foresight bias since our respondents were asked to make the aggregate predictions for the three information sets and the entire group of instructions right after having received all information from the examiner at the beginning of the experiment. Thus, the answers to their memory tests, which were later performed, were readily available at the immediate condition.

To summarise, the results on memory performance illustrated a decay independently of the difficulty of the ongoing activity that participants had to carry out. According to McDaniel and Einstein (2000) though, in their studies about the existence of a *multiprocess theory* of prospective memory on humans where the effectiveness of spontaneous retrieval processes rely on the diverse situations in which people stand and, therefore, yield an adjustment of people's memory strategies in different contexts, the nature and demands of the ongoing task affect the degree of processing the prospective memory intentions. In our case, the challenging ongoing task of playing basketball very likely brought the players into engaging with different strategies that would have allowed them to improve their memory performance (i.e. employing visual coding strategies to process the information received on the game of basketball, so to give it a meaning when playing), although memory retrieval ended in following a strong negative rate for those information sets designed to be of medium (use of feet) and of high (use of body) difficulty levels. Instead, if we look to the prospective task results relative to the low level of difficulty (use of hands), memory performance did not decrease over time, meaning that the nature of the information does have a consequence on encoding and retrieval fluency of people. We do observe a marginally significant interaction with the type of the instruction (p = .06) suggesting that people forget over time medium (feet) and difficult material (body), but not easy material (hands). In conceptualising this effect, we may find ourselves agreeing with Winkielman and Cacioppo (2001) who discovered that evaluations of sets of information (for example, an object) are "adversely affected by the difficulty with which judgment-relevant information about the object can be processed" (p. 248; see also Winkielman, Schwarz, Fazandeiro & Reber, 2003). Therefore, the easier the data to handle, the more probable is that that data is integrated and remembered.

The ability to recall places, things and people encountered in the course of daily life is fundamental to learn from experience. Without memory, anybody would be lost and would operate aimlessly. Thus, persistence of acquired information is vital to a numerous of situations (Smith & Kosslyn, 2009). When we considered our respondents' years of basketball experience to make a comparison between players' memory performance with many years of practice (> 5.5 years) and players' memory performance with less experience (< 5.5 years), we discovered that those players who were more familiar with the game of basketball had a slower decreasing rate of forgetting about the instructions given by the experimenter. This situation may be explained by the unsurprising contribution to memory performance of long term memory, which causes remembrance of past events to guide the present through thought and action (Smith & Kosslyn, 2009). As a result, we should conclude that people with a relatively strong background on a specific area or subject remember new information about that area in an easier manner than people without strong experience. Another theory that may help us understand this phenomenon lies in the definition of *episodic memory*, which supports memory for definite life events (Tulving, 1993); in our case, we refer it to anything related to basketball retrieved from past and long term memory, like previous trainings and games, that our participants might have experienced before the conduction of the study.

7. Experiments' limitations

Although our experiments contributed in answering our research questions we must be aware of the shortcomings of our trials. Considering the idea that prospective memory predictions and performance strongly depend on the environment and situation in which people is found, we are obliged to recognise that, for the purposes of analyzing only the effect of one independent variable (time), selecting participants who were closely related in terms of naturalistic settings (university study halls in experiment one; basketball gym in experiment two) might have influenced our research. Likely, by doing so, we simply have meaningful results when we find ourselves describing similar scenarios. Furthermore, in our first experiment, the selected context of investigation, chosen mainly because of time and money restrictions, yielded a population sample of respondents composed of entirely students, with an average young age comprised between eighteen and thirty-five (see Table0a and 0b). This bounder might have influenced the highly positive prospective memory performance in our analysis as university students are more educated in finding roadways to carry new information within their brain regions of memory storage (Willis, 2006).

The desire to create a real-world prospective memory phenomena is often at odds with the willingness to grasp the full richness of a natural event (Banaji & Crowder, 1989). In the first study, we tried to extract people's ideas for their future actions by making them a question that forced them to think about activities that they would have undertaken. Doing so, inevitably, we transformed an unconscious cognitive action of planning into a conscious and rational one. In addition, when making plans and schedules thinking of the near future, people enhance their abilities of retrieval fluency due to subtle and automatic associative memories between the internally generated events and their past experiences (Moscovitch, 1994).

Making retention intervals salient makes people more sensitive to time horizon (Zauberman et al., 2009), and the execution of the prospective intention during those intervals yields a high activation state for those intentions that have been executed. On the subject, Goschke and Kuhl (1993) say that retrieval latencies from memory are consistently faster for actions that had been performed (*intention superiority effect*). In our case, during the second phase of experiment two, respondents were instructed about all the three information sets and about the retention intervals in which they had to be examined. In between phases participants had to play one or several games of basketball in which they had freedom to perform the taught prospective tasks. Our research results might have been influenced by this phenomenon because, whether players performed the instructed activities during one of the retention gaps, they could have more easily remembered to report the tasks that were objects of our research. This circumstance might have resulted into a higher memory performance that would have not happened if players did not execute the prospective activities. Even though we believe this phenomena might have taken place, memory performance in experiment two did not follow flat forgetting rates, but still it decreased over time.

Another relevant observation, that intentions of future tasks happen uncontrolled and very quickly in people's minds, seemed to have limited our research when we required our respondents to interrupt, in two (or more) separate occasions, their ongoing activities to encode and recall the prospective intentions. Yet, the examiner's presence and intervention might have triggered monitoring and strategic memory functions which would not be as obvious and noticeable as in a natural and research-free environment (Guynn et al., 2005; Jacoby & Hollingshead, 1990). All of these factors, as the previous ones, could have induced to higher response rates and better memory performance of our participants.

7.a Directions for future research

In studying several prospective memory phenomena, many researchers have tended to centre their focus on those issues connected with the amount and quality of information that could be retrieved after an encoding or a creative phase. Our work explicitly focused on the effects of time on memory performance and memory predictions. In our domain, it was relevant to understand how retention intervals influence people's metacognitive abilities. A further step on the subject, that the literature on prospective memory is still missing, would look upon experimental designs and applications that permit psychologists and memory scholars to pinpoint the thin threshold lying in between the initial decay of prospective memory performance and the latter improvement in memory retrieval fluency (as we have encountered in between the sixty-minute condition and the one-day condition of experiment one). The accumulation of such knowledge to the existing literature would complement the research that looks towards explaining the mental processes and memory nodes which organise the storage of information and the reporting functions in human brain. Understanding how people make plans and identifying the factors that activate their mental memory strategies would then facilitate the experts' explanation of people's behaviour when they are found in different situations.

Another topic that could be further explored in future researches refers to the relationship between prospective memory and the intention superiority effect brought up by Goschke and Kulh (1993). In particular, it would be interesting to know whether the heightened activation from memory of a specific action, thus for those future intentions that have been performed at least once already in the past, has a functional impact on prospective memory retrieval when the moment of their execution comes. The answer to this question would add on the rationale that guides psychologists when describing remembering patterns of people; it would also allow consumer behaviour investigators to formulate more precise definitions of their companies' consumer segments and targets when looking at how people act (or react) in specific situations. An example of the latter would be such that if a software development company finds itself selling a program to a new client it may expect that he knows how to use the purchased system. Whether this is not true by seeing, for instance, what type of questions the client makes about the program or what concerns he has, the software manufacturer may provide more specific customer service schemes that include some extra services for him. In sum, in the real world, knowing about prospective memory and customer behaviours could be very important to increase consumer loyalty, brand image and brand equity of the firm through a sophisticated analysis and development of one's own segments and targets.

8. Conclusion

8.a General discussion

According to our analysis conducted through the execution of two experiments, with the first one being a between-subject experiment and the second a within-subject experiment, prospective memory performance and predictions of the interviewed students appeared to be dissociated from each other. Taken as a whole, the results of our research yielded that people's memories about future intentions come across a significant reduction of performance when the retention intervals between an initial phase of generating tasks (or storage) and a second one of retrieval are less than 1 hour long. As we have observed, this phenomenon is true when the experimental condition time is embedded between the zero retention minute and the one hour condition (experiment one and two). On the other hand, when the time gap in between phases widened up from the sixty minutes condition, the rate of forgetting decreased. Thus, our results fit with the pattern of prospective memory that was previously identified and studied by Hicks et al. (2000) in their research about the attributes of retention intervals on retaining prospective memories. In addition, in line with Wyer et al. (2008), on people's ability to process information and to develop future intentions in memory, the nature and difficulty of the information present in the environment have diverse and heterogeneous effects on people's prospective memory performance. Indeed, the different information sets which were presented to our respondents in experiment two, resulted following the negative arc pattern of memory performance whether the information sets were of medium or of high difficulty to encode. Memory performance did not decrease over short periods of time when the prospective tasks were reasonably easy to remember.

When we shift the centre of the discussion away from people's memory performance, but towards their abilities to make item-by-item predictions about their memories and cognitive abilities we cannot land on the same concluding ground that paved the previous one. In fact, despite people's extensive experience throughout their lives with prospective memory tasks and its types of triggers and forecasts, they tend to overestimate their memory skills when discounting the effect of time on their singular intentions. The similar findings stemming from both experiment one and experiment two on our participants' abilities to predict their future memory, indicate the existence of a forecasting error which "results from people's tendency to anchor on their current state" (Meyvis, Levav & Ratner, 2010, p. 579) when planning to recall their future actions. In accordance with such view, the dynamics of humans' learning and memory investigated by Koriat et al. (2004) suggested the presence of a *stability bias*, that is people's propensity to assume that memory will continue to linger stable over time rather than taking advantage from past experiences. The attractive finding that people wrongly predict what intentions they will remember blossomed mainly from experiment one. The general picture from previous research is that, by and large, people can accurately monitor their memories for short periods of time (Miele, Finn, & Molden, 2011; and Rhodes & Tauber, 2011) and that generating ideas and intentions are less demanding in terms of energies and resources when thinking ahead in future remembering (Begg et al., 1991). But, while our participants seemed following an adjusting pattern over time on their overall aggregate predictions of intentions, and so getting closer in being correct with their performance, they did not actually predict better the individual items they thought of recalling. This result suggests us that internally generated intentions (as in experiment one), instead of being externally induced (as in experiment two), did not necessarily transmute in an adaptation of memory strategies to different situations. Whereas people are more precise about their total memory capacity, they are overconfident about which intentions they will remember in the future.

8.b Capitalising on managerial contributions and practical implications

As the area of prospective memory has achieved greater attention in the cognition and memory literature, academics and professionals in the correlated fields of marketing and consumer behaviour have augmented their interest and consideration to prospective memory. In the bigger picture, prospective memory research may offer leverage on the more universal issue of comprehending human decision making and planning which, if taken in concert, facilitate the analysis and interpretation of consumer's enactment. On the subject, Gollwitzer and Sheeran (2009) reached the conclusion that people's decision making and realization strategies are intensely maneuvered by *in situ* information and encounters, meaning that consumers actively react to the situational context in which their actions are initiated. But closer to our goals and research objectives about prospective memory's applications to marketing, the same authors stress how *goal-intentions*, described as people's desired end states, are formed for the purpose of achieving one's goal in which a future goal-relevant situational cue is essential for the intentions' formation and spontaneous recall. For example, a person who has the goal to start eating healthier can form the goal-intention that, if he sees a healthy product on the store shelf when normally going grocery shopping, he will spontaneously retrieve from memory his initial intention and he will buy the healthier option. Other researches instead focused on the nature of the information cues and their intrinsic characteristics of being general versus detailed or easy versus complex (Wyer et al., 2008; and Kramer & Yoon, 2007). When dealing with the triggers that influence people's decision making and planning, Wyer et al. (2008) concluded that easier and informative types of messages have a stronger effect on consumers' decisions development and progression. One of the consequences of being unaware that memory decays and forgetting happens over time brings people to not only misjudge their memory abilities, but also to avoid adequately plan ahead.

Whether we consider prospective memory and its components in one way or in the other, forming goal-oriented intentions and their related triggering cues help people coping with issues related to goal striving, like getting started, remaining on track and executing an action. From a marketer's point of view this matter should concern him in finding a way that pinpoints those consumers who show a forgetting pattern or may do so. The marketer's objective in finding those consumers is to consent himself a prompt intervention and help people in making decisions, in retrieving from memory and in triggering an action, when they behave as shoppers in an offline or online context. This is the main reason why we find managerial contributions of our research for marketing management. Specifically, we believe that the marketing areas which hold a stronger link to prospective memory of consumers are: a) *behavioural targeting*, which refers to technologies and practices aimed at enhancing the effectiveness of advertising online (James, 2006); and b) *shopper marketing*, which instead looks upon the understanding of how one's own target consumers behave as shoppers (Shankar et al., 2011).

Behavioural targeting

In the past decade traditional online marketing came back to fashion after having been underrated by several industries (Perkett, 2010). In particular, one of the reasons why online advertising has not been very effective is that pop-ups and banner ads were seen from consumers as too unspecific and generalised to their personal needs (James, 2006). Behavioural targeting and customisation of online advertising add an extra dimension to the digital marketing field, especially for those consumers who spend in between a few minutes to more than one hour on internet for shopping. Hauser et al. (2009) showed on his paper about *website morphing* that companies would achieve overall better results if firms' websites and ads would morph to fit the consumers' cognitive styles, compromising between the analytical and intuitive displays. Since it is highly probable that people do not remember everything once they start to navigate on the net, customised pop-up ads could be the solution in helping those customers who forget to complete a specific purchase or simply do not find a specific item on a determined website (Haubl and Trifts, 2000). For example, when a consumer purchases groceries online from a major retailer for the upcoming week, sometimes the process may take more than one hour. It is then the pop-up ad that displays the forgotten item to the customer the moment he checks out for payment. Today, given the technologies and techniques at disposal of large companies, powerful database marketing methodologies and algorithms are possible for implementation (James, 2006). In fact, by providing customers with online loyalty schemes it is possible to collect specific information about that unique customers when they return to the company's website. Such collection of data about the customer would allow the sellers to pinpoint the items the customer usually purchases and to remind him of those articles he eventually leaves behind.

Shopper marketing

A focus on those marketing activities that aim at influencing a shopper along and beyond the entire path to a purchase fall within the shopper marketing field (Shankar, 2011). Over the past few years, retailers increased their resources to this practice of studying and nudging their consumers when they are in shopping mode (Deloitte Research, 2007). A deep understanding of shopper behaviour and marketing stimuli, designed not only to build brand equity and attract customers but also for leading them to make a purchase, are indispensable for an effective marketing strategy and promotional campaigns. Thus, it should become apparent to marketers that consumers' actions are driven by both their own intentions and the environment in which they are found. For the purposes of this paper, we will now consider people behaving as shoppers when buying offline, that is at the store, when they spend at least ten minutes inside the shop.

Today, many retail environments have transformed in experiential and magical settings, becoming places where more than just buying groceries and casual items; because of this, shoppers actually forget that they are shopping as they are at the store to do also other things (Flint, 2011). If the retail store had to implement its customer's knowledge and database to the development of innovative systems that would prevent or identify patterns of consumers forgetting, it would be enabled to successfully intervene and help its customers by reminding them of what they planned to purchase or did not buy. One possible idea, derived by our prospective memory knowledge that people forget within short periods of time, would be of providing consumers with memory aids that could be sent to their email addresses or handed at the store. Another solution would look at reminding the customers of what items they usually bought in the past when paying at the cashier, whether they did not pick those typical items in their karts.

As marketers and managers, if we foresee that there is going to be more sophisticated use of customers' data, which it would translate to having more technology into the store (i.e. from check-out scanners and digital signage), and if we recognize that shoppers forget what they came into the store for, we would significantly improve our retail brand by increasing customer service and subsequently brand loyalty. For instance, if a beer pub knows that whenever people buys booze they also purchase snacks, the pub's manager should try to put these two products close to each other. In the end, we would be able to improve our customers' database and to design tailored solutions to support our clients. After all, as researchers or marketers or managers, we are all working towards reaching new discoveries and answers aimed at improving our societies to live better.

9. Appendices

The prospective memory scientific study parameters:

1. Participants kept busy with an ongoing task
2. They are given some distraction before the ongoing task starts
3. Performance is measured by the proportion of successful trials

(Figure1, adjusted from McDaniel and Einstein, 2007, p. 12).

Experiment one appendices:

The experimenter's approach to participants in experiment one (in text):

PHASE1 – presentation and introduction
<Hi, my name is Enrico and I am a Master student in Catòlica and Lancaster University. I am conducting an experiment that tries to test the accuracy of memory predictions in the future, and so memory without any use of external aids. Would you like to participate at my experiment?>.

<I will need to collect some of your personal data like age, gender, profession and nationality too at the end of the research. These information will be used for research purposes only. Do you agree to this condition?>

PHASE2 – first data collection and memory predictions
<Thank you very much already for accepting. Now, I will kindly ask you to list me ten day-to-day tasks you intend to perform in the coming seven days. I will take note of them but you won't be allowed to write them down now, nor later>.

<How many of the 10 tasks you listed you think you will be able to remember (right now, 10 minutes from now, 30 minutes from now, 60 minutes from now, 1 day from now)?>
(Group1 will be asked a second time to list the ten tasks at this phase)

Retention interval (Excluded group1 which has been examined right after PHASE2, t=0). <Thank you for your participation in the first phase of the study. (10 minutes from now, 30 minutes from now, 60 minutes from now, 1 day from now) I will ask you to list the 10 tasks again. In the meantime, you can do whatever you want/need to do. But please do not use a reminder to remember the tasks.

PHASE3 – second data collection and memory performance
<10 (or 30, 60, one day) minutes of time that I asked you to wait just passed. Now, I will kindly ask you to list again the 10 tasks which you mentioned me before, in any order you wish. You can't use any memory aid now either>.

<Thank you very much for your participation so far. Would you please tell me your age, gender (probably un-necessary to ask), profession, nationality?>
<Thank you again>.

Demographic data - 26 Stem-and-Leaf Plot: (Table0a – SPSS)

Group = 1.0 (Immediate)

Frequency	Stem &	Leaf
2.00	18 .	00
3.00	19 .	000
2.00	20 .	00
4.00	21 .	0000
8.00	22 .	00000000
3.00	23 .	000
4.00	24 .	0000
1.00	25 .	0
2.00	26 .	00
1.00	27 .	0

Stem width: 1.0
Each leaf: 1 case(s)

Group = 2.0 (10 minutes)

Frequency	Stem &	Leaf
2.00	19 .	00
3.00	20 .	000
6.00	21 .	000000
5.00	22 .	00000
3.00	23 .	000
4.00	24 .	0000
3.00	25 .	000
2.00	26 .	00
2.00	Extremes	(>=33.0)

Stem width: 1.0
Each leaf: 1 case(s)

Group = 3.0 (30 minutes)

Frequency	Stem &	Leaf
2.00	18 .	00
5.00	19 .	00000
10.00	20 .	0000000000
5.00	21 .	00000
6.00	22 .	000000
1.00	23 .	0
.00	24 .	
1.00	25 .	0

Stem width: 1.0
Each leaf: 1 case(s)

Group = 4.0 (60 minutes)

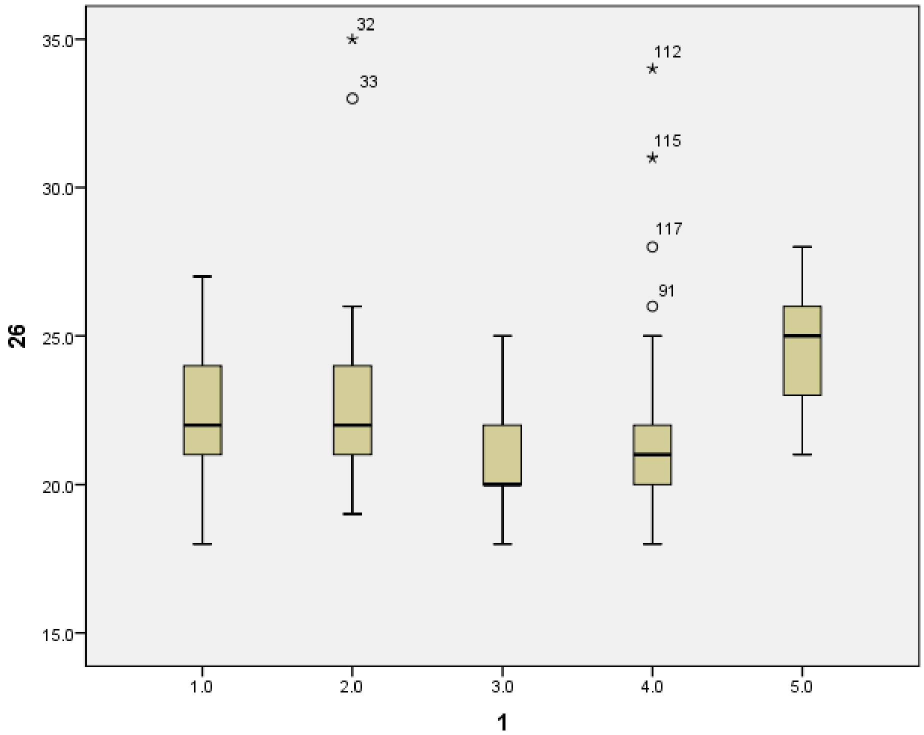
Frequency	Stem &	Leaf
1.00	18 .	0
5.00	19 .	00000
6.00	20 .	000000
6.00	21 .	000000
6.00	22 .	000000
1.00	23 .	0
.00	24 .	
1.00	25 .	0
4.00	Extremes	(>=26.0)

Stem width: 1.0
Each leaf: 1 case(s)

Group = 5.0 (one day)

Frequency	Stem &	Leaf
1.00	21 .	0
1.00	22 .	0
4.00	23 .	0000
2.00	24 .	00
4.00	25 .	0000
5.00	26 .	00000
3.00	27 .	000
1.00	28 .	0

Stem width: 1.0
Each leaf: 1 case(s)



(Table0b – SPSS).

Univariate GLM – Time condition on Memory Performance:

Between-Subjects Factors:

		N
Condition	Immediate	30
	10 min	30
	30 min	30
	60 min	30
	1 day	21

(Table1 – SPSS).

Descriptive Statistics:

Dependent Variable: Memory Performance

Condition	Mean	Std. Deviation	N
Immediate	8.900	1.1552	30
10 min	8.667	1.2685	30
30 min	8.233	.9714	30
60 min	7.667	1.3979	30
1 day	7.905	1.6403	21
Total	8.298	1.3456	141

(Table2 – SPSS).

Tests of Between-Subjects Effects:

Dependent Variable: Memory Performance

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	30.280[a]	4	7.570	4.612	.002	.119
Intercept	9458.815	1	9458.815	5763.190	.000	.977
Time	30.280	4	7.570	4.612	.002	.119
Error	223.210	136	1.641			
Total	9962.000	141				
Corrected Total	253.489	140				

a. R Squared = .119 (Adjusted R Squared = .094)

(Table3 – SPSS).

Univariate GLM – Time condition on Total Aggregate Predictions:

Descriptive Statistics

Dependent Variable: Total Aggregate Predictions

Condition	Mean	Std. Deviation	N
Immediate	6.900	1.8261	30
10 min	6.600	1.3797	30
30 min	6.767	1.3047	30
60 min	7.433	1.4782	30
1 day	7.619	1.5961	21
Total	7.028	1.5489	141

(Table4 – SPSS).

Tests of Between-Subjects Effects:

Dependent Variable: Total Aggregate Predictions

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	20.301[a]	4	5.075	2.187	.074	.060
Intercept	6893.720	1	6893.720	2970.812	.000	.956
Time	20.301	4	5.075	2.187	.074	.060
Error	315.586	136	2.320			
Total	7301.000	141				
Corrected Total	335.887	140				

a. R Squared = .060 (Adjusted R Squared = .033)

(Table5 – SPSS).

Univariate GLM – Time condition on Sum item-by-item Predictions:

Descriptive Statistics:

Dependent Variable: Sum item-by-item Predictions

Condition	Mean	Std. Deviation	N
Immediate	7.433	1.7750	30
10 min	8.500	1.4563	30
30 min	8.200	1.5844	30
60 min	8.733	1.6595	30
1 day	8.952	1.4310	21
Total	8.326	1.6583	141

(Table6 – SPSS).

Tests of Between-Subjects Effects:

Dependent Variable: Sum item-by-item Predictions

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	38.507[a]	4	9.627	3.779	.006
Intercept	9664.602	1	9664.602	3793.478	.000
Time	38.507	4	9.627	3.779	.006
Error	346.486	136	2.548		
Total	10160.000	141			
Corrected Total	384.993	140			

a. R Squared = .100 (Adjusted R Squared = .074)

(Table7 – SPSS).

Experiment two appendices:

The experimenter’s approach to participants in experiment two (in text):

PHASE1 – presentation and introduction
<Hi everyone. Thank you for coming to this post-season basketball session. I am currently conducting an experiment for my dissertation that aims at testing the accuracy of memory predictions in the future, and so memory without any use of external aids. Would you like to participate at my experiment?>.

Each player was picked and asked by the researcher to participate, although the entire team had been initially approached in a gathering moment.

<I will need to collect some of your personal data like age, gender, profession and nationality too at the end of the research. These information will be used for research purposes only. Do you agree to this condition?>

PHASE2 – experiment presentation and description
<Thank you very much already for accepting. Now, I will kindly ask you guys to form one team together. I am going to teach you now about twelve pieces of information about basketball fundamentals. These twelve pieces are divided in three groups: one about the use of hands, one about the use of feet, and one about the use of body when playing the game. One mandatory requirement you must respect is: do not talk with each other or anyone else about what I am going to tell you soon. Do not rehearse or cheat. Ok?>.

Then, description of the twelve pieces of information followed, Figure#. The order of the information varied between groups as described in the main text.

PHASE3 – first data collection and memory performance
<Please, take now one piece of paper and pen. Write down your names and four numbers that should represent how many tasks I gave you, you think you will recall. The first three refer to each set of information you received. Please, write your predictions in order with the order of the information sets you received. They should be three numbers comprised between zero to four. The fourth and last number should represent your total memory prediction. A number between zero and twelve. Once you have finished please give me back pens and papers. Take now another piece of paper and please list the tasks of the first set you received. Please, always put your name on it. Once you have finished please give me back pens and papers and go playing. I will stop you when ten minutes will be passed. Thank you>.

Retention interval – 10 minutes.
PHASE4 – second data collection and memory performance
<Ok guys, please stop playing. Pick up a piece of paper and a pen, write your name and please list the tasks of the second set you received. Once you have finished please give me back pens and papers and go playing. I will stop you when other twenty minutes will be passed. Thank you>.

Retention interval – 30 minutes.
PHASE5 – second data collection and memory performance
<Ok guys, please stop playing. Pick up a piece of paper and a pen, write your name and please list the tasks of the third set you received. Once you have finished please give me back pens and papers and go playing. The experiment is finished. Please do not yet talk about anything about the experiment. Thank you>.

Repeated-measures ANOVA:

Interaction between memory (predictions vs. performance: factor1), time interval (immediate vs. 10 min vs. 30 min: factor 2), and body instructions (hands, feet, body: condi1):

Tests of Within-Subjects Contrasts:

Measure: Interaction

Source	factor1	factor2	Type III Sum of Squares	df	Mean Square	F	Sig.
factor1	Linear		7,037	1	7,037	4,552	,054
factor1 * condi1	Linear		3,456	2	1,728	1,118	,359
Error(factor1)	Linear		18,548	12	1,546		
factor2		Linear	3,588	1	3,588	9,008	,011
		Quadratic	,010	1	,010	,026	,874
factor2 * condi1		Linear	1,924	2	,962	2,415	,131
		Quadratic	,315	2	,158	,407	,675
Error(factor2)		Linear	4,780	12	,398		
		Quadratic	4,652	12	,388		
factor1 * factor2	Linear	Linear	2,129	1	2,129	7,273	,019
		Quadratic	,116	1	,116	,285	,603
factor1 * factor2 * condi1	Linear	Linear	1,877	2	,939	3,206	,077
		Quadratic	,005	2	,003	,006	,994
Error(factor1*factor2)	Linear	Linear	3,513	12	,293		
		Quadratic	4,868	12	,406		

(Table8 – SPSS).

Univariate effect of time interval (immediate vs. 10 min vs. 30 min: factor 2) on memory predictions and interaction with body instructions (hands, feet, body: condi1):

Tests of Within-Subjects Contrasts:

Measure: Memory Predictions

Source	factor1	Type III Sum of Squares	df	Mean Square	F	Sig.
factor1	Linear	,095	1	,095	,417	,531
	Quadratic	,029	1	,029	,207	,657
factor1 * condi1	Linear	,501	2	,251	1,103	,363
	Quadratic	,120	2	,060	,437	,656
Error(factor1)	Linear	2,726	12	,227		
	Quadratic	1,653	12	,138		

(Table9 – SPSS).

Effect of time interval (immediate vs. 10 min vs. 30 min: factor 2) on memory performance and interaction with body instructions (hands, feet, body: condi1):

Tests of Within-Subjects Contrast:

Measure: Memory Performance

Source	factor2	Type III Sum of Squares	df	Mean Square	F	Sig.
factor2	Linear	5,623	1	5,623	12,120	,005
	Quadratic	,097	1	,097	,148	,707
factor2 * condi1	Linear	3,300	2	1,650	3,557	,061
	Quadratic	,200	2	,100	,153	,860
Error(factor2)	Linear	5,567	12	,464		
	Quadratic	7,867	12	,656		

(Table10 – SPSS).

Interaction between memory (predictions vs. performance: factor1), time interval (immediate vs. 10 min vs. 30 min: factor 2), and years of experience (continuous measure: years of experience):

Tests of Within-Subjects Contrasts:

Measure: Interaction

Source	factor1	factor2	Type III Sum of Squares	df	Mean Square	F	Sig.
factor1	Linear		,028	1	,028	,019	,893
factor1 * years of. Exp.	Linear		1,910	1	1,910	1,283	,279
Error(factor1)	Linear		17,857	12	1,488		
factor2		Linear	1,398	1	1,398	2,676	,128
		Quadratic	,043	1	,043	,106	,750
factor2 * years of Exp.		Linear	,154	1	,154	,294	,597
		Quadratic	,075	1	,075	,183	,676
Error(factor2)		Linear	6,269	12	,522		
		Quadratic	4,891	12	,408		
factor1 * factor2	Linear	Linear	2,888	1	2,888	15,900	,002
		Quadratic	,023	1	,023	,059	,812
factor1 * factor2 * years of Exp.	Linear	Linear	1,243	1	1,243	6,842	,023
		Quadratic	,006	1	,006	,015	,906
Error(factor1*factor2)	Linear	Linear	2,180	12	,182		
		Quadratic	4,613	12	,384		

(Table11 – SPSS).

Managerial Implications slides

Consumers' Prospective Memory

What* and *why

- Def. Remembering to perform an action (i.e. a purchase) in the future*
- It influences consumers' **Decision Making**
- It influences their **Planning**

*McDaniel & Einstein, 2007

Some facts

- Consumers are **overconfident** about their memory abilities
- Very **Short-time intervals** are sufficient to make consumers **forget** their intentions
- Consumers more likely forget **specific tasks**

1

(Slide1 – PowerPoint).

On the digital Marketing side:

Behavioural targeting

- Def. Technologies and practices aimed at enhancing the effectiveness of advertising online*
- It creates opportunities for ad **customisation**
- It allows to collect **precious information** for a single customer

* James, 2006

HOW?

- By adoption of powerful **database marketing** methodologies
- By providing **online loyalty schemes**

WHY?

- Consumers spend alot of time in online shopping
- **Increase** customer **loyalty**
- **Increase sales**

2

(Slide2 – PowerPoint).

On the offline Marketing side:

Shopper marketing

- Def. The understanding of how one's own target consumers behave as shoppers *
- It creates opportunities for customer service **customisation**
- It leads to **successful promotional campaigns**

* Shankar et al., 2011

HOW?

- By using **customer's knowledge** and **customer service**
- By developing systems that prevent consumers from forgetting

WHY?

- shoppers forget what they are shopping for
- It **builds brand equity**
- **Increase** customer **loyalty**
- **Increase sales**

3

(Slide3 – PowerPoint).

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