UNIVERSITA' DEGLI STUDI
"G. d'Annunzio" Chieti-Pescara

SCUOLA SUPERIORE "G. d'Annunzio"

Dottorato di Ricerca in Earthquake and Environmental Hazards

Ciclo XXXVII

Motivational factors and risk preparation: a study on curiosity

Dipartimento di Scienze

Settore Scientifico Disciplinare M-PSI/01

Dottoranda
Dott.ssa Erika MARASCIA

Coordinatore
Prof.ssa Rita DE NARDIS

Tutor
Prof. Alberto DI DOMENICO

Anni Accademici 2021/2025


BY

DEDICATION

Alla vita, che mi sorprende e arricchisce ogni giorno, a ciò che è stato e ciò che sarà.

TABLE OF CONTENTS

SELF PRESENTATION 1

ABSTRACT 3

THESIS PRESENTATION 6

CHAPTER 1 – COLLABORATIVE ENCODING WITH A NEW CATEGORIZATION TASK: A CONTRIBUTION TO COLLABORATIVE MEMORY RESEARCH 14

1.1 INTRODUCTION 14
1.2 MATERIALS AND METHODS 20
1.2.1 PARTICIPANTS 20
1.2.2 STIMULI 20
1.2.3 DESIGN 21
1.2.4 PROCEDURE 22
1.3 RESULTS 24
1.3.1 NOMINAL RECALL 25
1.3.2 ADJUSTED RATIO OF CLUSERING 28
1.4 DISCUSSION 29
1.5 CONCLUSION 33
1.6 SUPPLEMENTARY MATERIAL 33

CHAPTER 2 – CURIOSITY KILLED THE CAT BUT NOT MEMORY: ENHANCED PERFORMANCE IN HIGH-CURIOSITY STATES 36

2.1 INTRODUCTION 36
2.2 MATERIALS AND METHODS 39
2.2.1 PARTICIPANTS 39
2.2.2 MATERIALS 40
2.2.3 PROCEDURE 41
2.3 RESULTS 42
2.3.1 TRIVIA RECALL 43
2.3.2 FACE RECOGNITION 44
2.5 DISCUSSION 45
2.6 CONCLUSIONS 47

CHAPTER 3 – VALIDATION OF THE MAGICCATS DATASET IN THE ITALIAN CONTEXT: A STUDY ON EPISTEMIC EMOTIONS 50

3.1 Background & Summary 50
3.2 Materials And Methods 54
3.2.1 Participants 54
3.2.2 Magiccats Stimuli 55
3.2.3 Normative Rating Procedure For Magiccats 56
3.3 Data Records 57
3.4 Technical Validation 58
3.5 Usage Notes 59

CHAPTER 4 – THE CURIOUS MIND: HOW IT IMPACT ON MEMORY IN YOUNG AND OLDER ADULTS 62

4.1 Introduction 62
4.2 Materials and Methods 65
4.2.1 Participants 65
4.2.2 Materials 67
4.2.3 Procedure 67
4.3 Results 70
4.4 Discussion 73
4.5 Conclusion 78

CONCLUSION 80

APPENDIX 85

REFERENCES 127

ACKNOWLEDGMENTS 152

LIST OF FIGURES

Chapter 1

Figure 1.1	The visual representation of the study design	p. 22
Figure 1.2	The mean Percent Nominal Recall for each Condition in each Recall	p. 27
Figure 1.3	The mean ARC for each Condition in each Recall	p. 27

Chapter 2

Figure 2.1	Schematic illustration of the experimental procedure	p. 41
Figure 2.2	Recall of trivia answers: memory performance for levels of curiosity in young and older adults	p. 43
Figure 2.3	Accuracy for memory of faces: memory performance for levels of curiosity in young and older adults	p. 44

Chapter 4

Figure 4.1	Schematic illustration of the experimental procedure	p. 69
Figure 4.2	Accuracy for memory of words: memory performance in young and older adults	p. 72
Figure 4.3	Accuracy for memory of words: memory performance for levels of curiosity	p. 72
Figure 4.4	Accuracy for memory of words: memory performance for levels of curiosity in young and older adults	p. 72

LIST OF TABLES

Chapter 1

Table 1.1 Percentage of recalled words, ARC, intrusions, and repetitions for nominal and collaborative groups in the individual and collaborative conditions during Recall 1, 2 p. 25

Chapter 2

Table 2.1 Neuropsychological and demographic data p. 39

Chapter 3

Table 3.1 Distribution of the lists among participants p. 58

Chapter 4

Table 4.1 Neuropsychological and demographic data p. 66

Appendix

Table A1 Neuropsychological and demographic data p. 85

Table A2 Details of the MagicCATs stimuli p. 97

Table A3 The rating Means and SDs for individual magic tricks p. 112

SELF PRESENTATION

PhD student: Erika Marascia
Program: Earthquake and Environmental Hazards
Cycle: XXXVII
ID: 3224275
Email: erika.marascia@unich.it



I am PhD student Erika Marascia, and I am a psychologist. I graduated with honors in Psychology from the University of "G. d'Annunzio" of Chieti-Pescara in 2020. From January 2021 to December 2021, I completed a one-year post-graduate internship at the Laboratory of General Psychology and Aging at the same university. During this period, I focused on topics related to aging, motivation, and memory, combining research activities with neuropsychological assessment of older adults and individuals experiencing cognitive difficulties. I successfully passed the qualifying state examination in psychology in 2022.

In November 2021, I began my PhD program in *Earthquake and Environmental Hazards*. My research project is centered on the role of motivational factors in memory processes across the lifespan, with the aim of applying these findings in the future to improve the encoding and retrieval of critical information in protocols designed for environmental emergencies. Additionally, over the course of these years, I have deepened my knowledge by attending courses, seminars, conferences, and webinars at both national and international levels. I have also actively participated in several academic conferences, delivering oral presentations and presenting posters.

I am passionate about advancing psychological research and its practical applications, aiming to contribute to a deeper understanding of memory processes and their role in overcoming real-world challenges.

ABSTRACT

In a world increasingly impacted by environmental hazards, effective communication and training are essential to reducing risks and improving public safety. Examining the situation in Italy, its geographical position makes it highly susceptible to seismic activity due to intense compressive forces, which have led to numerous catastrophic earthquakes throughout history. Despite this, the population remains highly vulnerable due to fragile infrastructure and insufficient awareness and preparedness, resulting in poor decision-making during emergencies. Particularly concerning is the lack of risk education for the older adults, who constitute a significant proportion of residents in high-risk areas.

In this context, memory plays a crucial role, as the ability to retain and recall critical information during emergencies can significantly influence survival and decision-making. Given the necessity of promoting a culture of prevention through preparedness and planning, this research examined how curiosity and social interactions shape memory, providing insights applicable to risk education and emergency response training, especially for older adults.

To this aim, the first study, published in Psychological Research, investigated collaborative memory encoding using a novel categorization task, assessing how social interactions influence recall and whether collaborative encoding facilitates or disrupts memory organization. The findings contribute to understanding how teamwork and group learning influence memory performance, a critical factor in the design of effective training programs for emergency preparedness.

The second study, published in Brain Science and presented at the 15th Annual Conference of the Italian Society of Aging Psychology (SIPI) in Padua in 2022, examined how high curiosity states enhance memory retention, demonstrating that high-curiosity conditions improve recall for both targeted and incidental information. This study provides insights into how curiosity-driven cognitive engagement enhances memory performance, shedding light on mechanisms that can be leveraged to optimize learning and long-term retention.

The third study focused on the validation of the MagicCATS dataset in the Italian context, ensuring that the stimuli are culturally appropriate for use in cognitive and

psychological research. This validation process was essential to selecting high effective materials for a subsequent experiment on epistemic emotions and memory, providing a reliable foundation for future studies on curiosity and learning in the Italian context.

The fourth study explored how curiosity, elicited by a new category of materials, impacts memory, comparing younger and older adults to determine whether curiosity-driven memory benefits persist across different age groups. The results highlight age-related differences in cognitive engagement and retention, which are particularly relevant for designing age-appropriate training programs and ensuring that emergency preparedness education is both inclusive and effective for older adults.

This exploratory phase serves as a foundation for future applied research aimed at integrating curiosity-driven learning into emergency preparedness and emergency risk communication strategies. The findings may contribute to the development of innovative training programs, risk communication materials, and decision-making protocols designed to improve public safety in environmentally hazardous regions. By incorporating curiosity-based approaches, this research aims to broaden knowledge of memory processes in order to foster resilience, enhance information retention, and ultimately support more effective emergency response efforts, particularly for vulnerable populations such as older adults.

THESIS PRESENTATION

The present PhD thesis represents a significant milestone in my academic journey and a key achievement in my research on the topic *Motivational factors and risk preparation: a study on curiosity.*

Over the past years, the central focus of my research has been to examine the effects of curiosity and collaboration on memory and learning, with a particular emphasis on comparing younger and older adults. This exploration formed the foundation of my first research objective: to understand how to enhance memory performance and learning outcomes. Closely tied to this primary goal is a broader, long-term aim: to provide actionable insights into the development of interventions designed to improve public safety and well-being. For instance, fostering curiosity-driven learning could support the creation of more effective emergency communication strategies, particularly for older adults. Given the growing proportion of older populations residing in high-risk areas, enhancing their comprehension of and responsiveness to emergency instructions could significantly bolster safety and resilience in these vulnerable groups. While the primary focus of my research has been on the first objective, the second remains a long-term endeavor, one that holds promise for future development and application.

Before delving into the details of my research, it is crucial to discuss the foundational concepts of motivational factors and curiosity, particularly their roles in influencing memory performance.

Motivation, curiosity, and interest: overlapping dynamics and distinctive features

Motivation is a psychological process that activates, directs, and sustains behavior toward achieving goals. It arises from the interaction between internal factors, such as needs, desires, and expectations, and external factors, including incentives and environmental stimuli (Deci & Ryan, 1985). According to Self-Determination Theory, individuals are naturally driven to grow, find meaning, and face challenges through the fulfillment of three basic needs: autonomy, competence, and

relatedness (Deci & Ryan, 1985). This theory distinguishes two primary forms of motivation:

- Extrinsic motivation refers to behavior driven by the pursuit of external rewards or the avoidance of punishment. For example, an individual might work hard primarily to secure a salary increase, rather than out of an inherent desire for productivity. In this case, the behavior is guided by external incentives (Ryan & Deci, 2000).
- Intrinsic motivation, by contrast, reflects a natural inclination to "seek out novelty and challenges, to extend and exercise one's capacities, to explore, and to learn". Activities performed under intrinsic motivation are driven by enjoyment, challenge, or inherent satisfaction, rather than by external pressures or rewards (Ryan & Deci, 2000).

Intrinsic motivation was famously illustrated in Harlow's (1950) experimental study on rhesus monkeys. In this study, the monkeys were presented with a mechanical puzzle involving interlocking pins, hinges, and latches. Without any external reward, such as food or the avoidance of punishment, the monkeys began to manipulate the puzzle spontaneously. Over time, they became adept at solving it, driven solely by the satisfaction of mastering the task (Harlow, 1950). Harlow's findings challenged the then-dominant behaviorist paradigms, which emphasized external reinforcement as the primary driver of behavior. Instead, his work underscored an innate drive, a curiosity and desire to solve challenges for the sheer sense of accomplishment. This internal drive has played a crucial role in evolution and human development, encouraging individuals to explore new environments and acquire skills essential for adapting to future challenges (Ryan & Deci, 2000). Curiosity, as a psychological construct, aligns closely with the framework of intrinsic motivation (Berlyne, 1960; Ryan & Deci, 2000). It has been recognized across cultures and eras, appearing in ancient texts such as the Bible, the writings of Greek philosophers, and modern media representations (Goodale, 2003; Livio, 2017). Psychological research has studied curiosity extensively, examining its role in driving behavior and proposing it as an evolutionarily adaptive trait (Kidd & Hayden, 2015; Lau et al., 2020). Curiosity is thought to motivate a wide range of

everyday behaviors, such as pursuing hobbies like learning an instrument, gardening, or traveling (Kashdan & Steger, 2007; Silvia, 2012). It often arises in response to novel, surprising, or moderately complex stimuli, or when individuals encounter gaps in their knowledge. Unlike random information-seeking, curiosity fosters intentional, goal-directed exploration. Importantly, individuals are not equally curious about all forms of knowledge; curiosity tends to focus on specific topics or areas that align with individual interests.

Although often used interchangeably, curiosity and interest are distinct concepts in both academic literature and everyday language. Interest has been described as an emotion (Kashdan & Silvia, 2009), a dynamic relationship between a person and an object (Krapp, 2007), or as a motivational factor in learning and development (Hidi & Renninger, 2006). In some theoretical frameworks, the terms overlap, for instance, curiosity is sometimes defined in terms of interest (Litman et al., 2005). However, the distinction between curiosity and interest often lies in the degree of familiarity with the subject matter:

- Curiosity typically arises when there is a moderate level of familiarity, accompanied by a knowledge gap that sparks a desire to resolve uncertainty (Litman, 2005; Loewenstein, 1994).
- Interest, on the other hand, can persist across varying levels of knowledge, from initial exposure to deep expertise (Alexander, 2003).

Additionally, their objectives differ: curiosity focuses on reducing uncertainty and filling gaps in knowledge, whereas interest emphasizes sustained attention and enjoyment (Hidi & Renninger, 2006). Understanding these nuanced relationships between motivation, curiosity, and interest is essential for clarifying the specific role that curiosity plays in memory performance.

Curiosity and scientific studies: from past to present

While curiosity is a familiar concept in everyday life, defining it scientifically has proven to be a challenge. One of the earliest formal definitions came from William James (1899), who described it as *"the impulse toward better cognition"* referring to the innate desire to seek out and acquire knowledge. He believed that this

fundamental drive pushes individuals toward increasing scientific and philosophical understanding. Shortly after, G. Stanley Hall and Theodate L. Smith (1903) conducted pioneering experimental studies on how curiosity is elicited. By analyzing questionnaires and biographical reports from mothers observing their infants, they found that newborns transition from passive observation to genuine curiosity within their first five months of life, underscoring curiosity's active role from the earliest stages of human development (Hall & Smith, 1903).

In the mid-20th century, Daniel Berlyne (1954, 1960) introduced a more structured approach to understanding curiosity, posing fundamental questions about why humans invest significant time and resources in acquiring knowledge and why some information is more compelling and memorable than others (Berlyne, 1954, 1960). Berlyne classified curiosity into two primary types:

- Perceptual Curiosity: A drive triggered by novel stimuli, often seen in animals and young children, which diminishes with continued exposure.
- Epistemic Curiosity: More relevant to humans, this type is elicited by a question and is reduced when the answer is obtained.

Building on Berlyne's framework, Litman (2005) distinguished between two subtypes of epistemic curiosity:

- Interest-Type Epistemic Curiosity (I-Type): Associated with the desire to add new ideas to one's knowledge base, often accompanied by positive emotions and broad exploratory behavior (Litman, 2005).
- Deprivation-Type Epistemic Curiosity (D-Type): Driven by the need to resolve uncertainty, leading to more targeted and specific exploration (Litman, 2005).

Beyond Berlyne's distinctions, curiosity is also categorized as state curiosity, which arises in response to environmental stimuli (Loewenstein, 1994), and trait curiosity, a stable personality characteristic reflecting an individual's general tendency to seek out novel information (Kashdan et al., 2004; Litman & Silvia, 2006). These theoretical distinctions laid the foundation for future experimental research exploring the various facets of curiosity.

A major advancement came in 1994 when George Loewenstein proposed the information-gap theory, describing curiosity as *"a cognitively induced deprivation*

arising from the perception of a gap in one's knowledge or understanding". Supporting this theory, Kang et al. (2009) conducted an experimental study using trivia questions to elicit curiosity in young participants. They found that curiosity was lowest when participants either had no knowledge of the answer or were entirely confident, whereas it peaked when they had some prior knowledge but remained uncertain (Kang et al., 2009). This validated Loewenstein's notion that a small amount of information can act as a trigger, significantly increasing curiosity. More recent research has further expanded our understanding of curiosity. Kashdan et al. (2018) defined it as *"the recognition, pursuit, and desire to explore novel, uncertain, complex, and ambiguous events"* while Grossnickle (2016) described it as *"the desire for new knowledge, information, experiences, or stimulation to resolve gaps or experience the unknown"*. These definitions highlight curiosity's broad scope, from acquiring new knowledge to navigating uncertainty and risk. Curiosity has been increasingly acknowledged in educational psychology as a key driver of learning. Given the impact of academic performance on career and life choices, research has sought to identify predictors of success. Stumm et al. (2011) argued that intellectual curiosity should be considered alongside intelligence and conscientiousness as a predictor of academic achievement, reinforcing the idea that a *"hungry mind"* plays a critical role in lifelong learning.

Beyond educational settings, curiosity has been linked to workplace performance and lifelong learning (Reio & Wiswell, 2000). Individuals with higher trait curiosity report more meaningful experiences (Kashdan & Steger, 2007) and a greater pursuit of long-term goals (Sheldon et al., 2015). Consequently, curiosity serves as a powerful motivator for both learning and personal development across different life stages.

Although curiosity manifests in various forms, cognitive psychology primarily focuses on its role in learning and memory. Specifically, in this thesis, curiosity is examined as a mechanism for knowledge acquisition, commonly referred to as epistemic curiosity, the intrinsic desire to acquire new knowledge either to close a knowledge gap or to stimulate intellectual interest (Litman, 2008; Loewenstein, 1994).

Building on this theoretical foundation, the present doctoral research aims to explore how curiosity and social interactions influence memory processes, with particular attention to their potential implications for cognitive performance and learning. Despite the well-documented role of curiosity in enhancing learning and retention, little research has examined its effects in relation to different age groups. Additionally, while collaborative inhibition has been extensively explored, the effects of collaborative encoding on memory organization and retrieval in cognitive tasks remain underexplored.

This thesis seeks to address these gaps by investigating the cognitive mechanisms underlying curiosity-driven memory and the effects of social encoding on information retention. Specifically, the research encompasses four empirical studies designed to elucidate different facets of curiosity, collaboration, and memory performance:

1. The first study examined how group interactions influence memory encoding and recall, testing whether collaborative encoding enhances or disrupts memory retrieval. This study provides insights into the cognitive benefits and limitations of collaborative learning, particularly in relation to structuring information in a way that facilitates future recall.
2. The second study explored the impact of curiosity on memory retention, demonstrating how high-curiosity states improve recall for both directly targeted and incidental information. This research contributes to a deeper understanding of how curiosity influences learning outcomes in controlled experimental settings.
3. The third study focused on validating a novel set of stimuli in the Italian context, ensuring their suitability for cognitive and psychological research. This validation step was essential to developing reliable materials for subsequent experiments on epistemic emotions and memory, strengthening the methodological rigor of the research.
4. The fourth study investigated the persistence of curiosity-driven memory benefits in both younger and older adults. By comparing age-related differences in cognitive engagement and retention, this study sheds light on how curiosity-related cognitive processes vary across the lifespan.

Taken together, these studies contribute to a growing body of research demonstrating the importance of motivational factors, particularly curiosity, in shaping cognitive processes. While this research remains exploratory, its findings lay the groundwork for potential future applications in areas such as educational strategies and cognitive training. By deepening our understanding of how curiosity and social interactions influence memory, this thesis provides a foundation for future research that could inform the development of more engaging and effective learning methodologies.

In the following chapters, the research methodology, experimental designs, and key findings of each study will be discussed in detail, providing a comprehensive analysis of how curiosity and social interactions shape memory performance. The methodology section will outline the experimental paradigms, data collection techniques, and statistical approaches employed to ensure rigorous and valid results. Each experimental design will be described with a focus on participant demographics, materials used, and procedures followed, ensuring a clear understanding of how the studies were structured.

Furthermore, the findings from each study will be systematically presented, highlighting key trends, significant results, and theoretical implications. The discussion will integrate these findings within the broader context of cognitive psychology, emphasizing their relevance to existing literature and potential future directions. By critically evaluating the strengths and limitations of each study, this thesis aims to provide a nuanced perspective on the role of curiosity and social interactions in memory performance, paving the way for further research in this domain.

CHAPTER 1 – COLLABORATIVE ENCODING WITH A NEW CATEGORIZATION TASK: A CONTRIBUTION TO COLLABORATIVE MEMORY RESEARCH

1.1 Introduction

Human memory has typically been studied in laboratory settings in which individuals encode and remember alone (e.g., Miller, 1956; Baddeley et al., 1975; Cowan, 2010). However, memory processes are influenced by social contexts, as people frequently operate within sociocultural environments that shape their interactions and behaviors (Wyer & Srull, 2014). Consequently, experimental research that replicates social interactions is essential for advancing our understanding of memory and the ways in which collaboration influences both the encoding and retrieval of information.

In collaborative memory studies, individuals typically encode information alone and then recall it either individually or in groups. Research consistently shows that groups recalling collaboratively (e.g., in dyads or triads) remembered less non-redundant information than the same number of individuals working separately. This phenomenon is termed collaborative inhibition[1] (Weldon & Bellinger, 1997). Various explanations have been proposed for this effect. One of the most obvious suggestions is social loafing, where individuals put forth less effort when they are in a group. In addition, it seems that the diffusion of responsibility is not related to collaborative inhibition (Weldon et al., 2000). Instead, the findings seem to indicate that collaborative inhibition is a cognitive phenomenon more similar to the part-set cueing deficit, a recall impairment that occurs when participants are provided with some studied items as retrieval cues (Basden et al., 1997; Nickerson, 1984). This effect may resemble the socially shared retrieval-induced forgetting phenomenon. When listeners focus on a speaker's selective recall of previously learned information, they tend to forget related information that was not mentioned (Coman

[1] We have adopted the conventional term recognized in the literature to describe the collaborative inhibition effect (see review by Rajaram & Pereira-Pasarin, 2010). Although this term may imply the presence of an inhibitory mechanism, we employ it here in a descriptive sense to indicate a negative impact on recall.

& Hirst, 2015; Cuc et al., 2007). Although these effects could be linked to an inhibitory mechanism, retrieval competition was later proposed as a potential cause (Rundus, 1973). However, research has shown that reinforcing certain elements does not necessarily result in the forgetting of other related elements (Bäuml & Aslan, 2004). Substantial evidence supports the retrieval disruption hypothesis (Basden et al., 1997). According to this hypothesis, individuals create unique organizational structures for the information they encode. Later, during recall, this organization is disrupted when another participant retrieves the information in a different order, resulting in reduced recall performance.

Collaborative encoding

Most research on collaborative memory has primarily focused on collaborative recall. However, daily life involves numerous situations where individuals engage in collaborative encoding. For instance, Brown (2003) found that students who worked together to create conceptual maps performed better than those who worked alone. It has been suggested that collaborative encoding may help mitigate the effects of collaborative inhibition, as individuals who encode information together tend to develop more compatible retrieval strategies, thereby reducing potential interference during recall. However, only a limited number of studies have examined collaborative encoding, and these studies have produced heterogeneous results. Andersson and Rönnberg (1995) investigated the impact of various factors on collaboration and found no benefits of collaborative encoding. In Experiment 2, participants watched a 34-minute video without communicating and, after a 2-minute delay, discussed it. Following the discussion, participants performed both an individual and a second individual or collaborative recall task. The results showed greater collaborative inhibition among participants who discussed the video compared to those who did not. Since those who collaborated showed recall impairments, the researchers interpreted these results as evidence of a collaborative encoding deficit. However, as the encoding task was not active, it may not have fostered the development of shared cognitive organizational structures.

On the contrary, other studies suggest that collaborative encoding can eliminate the effects of collaborative inhibition (Barber et al., 2012; Finlay et al., 2000; Harris et

al., 2013). For example, Finlay et al. (2000) manipulated collaboration during both encoding and recall. In this study, the encoding task was structured to align the sequential organization of stimuli, which led participants to adopt similar organizational patterns. The results showed that collaborative inhibition was either reduced or eliminated when participants shared a similar retrieval strategy, supporting the retrieval strategy disruption hypothesis. Similarly, Harris et al. (2013) provided evidence that collaborative encoding can eliminate the collaborative inhibition effect when active collaboration is involved.

It is important to note that if the collaborative inhibition effect arises from disruptions to recall strategies, collaborating with the same partner during both encoding and retrieval should reduce disruption and mitigate this negative effect. Conversely, collaborating with a different partner during recall should not counteract the collaborative inhibition effect. Barber et al. (2010) examined this possibility but found no definitive conclusions. They observed similar recall performance among participants who collaborated during encoding, regardless of whether subsequent recall was individual, with the same partner, or with a different partner. Since the collaborative inhibition effect was absent, the question of whether reducing the effect depends on the partner remains unresolved.

Collaborative encoding may not only influence the collaborative inhibition effect but could also negatively impact overall recall performance. Collaboration during encoding may distract participants from focusing on the task itself (Barber et al., 2012). Numerous studies have demonstrated the close relationship between attention and memory, showing how divided attention (DA) can impair memory performance (Anderson et al., 1998; Baddeley et al., 1984; Craik et al., 1996). Specifically, DA during encoding negatively affects both memory and secondary task performance compared to full attention (FA) conditions (Fernandes & Moscovitch, 2000; Naveh-Benjamin et al., 1998, 2000). Naveh-Benjamin et al. (2000) argued that DA during encoding shifts the quality of encoding from a more elaborative, semantic type to a more superficial one. Other studies have shown that DA during encoding disrupts recollection-based processing (Yonelinas, 2002) and affects the retrieval of contextual information associated with the target (Sacher et al., 2009).

Although few studies have focused on collaborative encoding, none have conclusively shown that collaborative encoding is beneficial for recall. Some studies suggest that, under certain conditions, collaboration during encoding can counteract the negative effects of collaborative inhibition during recall. This might depend on whether recall is performed individually or in collaboration with the same partner or a different one. However, no conclusive evidence currently supports this hypothesis. Therefore, it is crucial to further investigate how collaboration during both encoding and recall influences recall performance.

The collaborative memory paradigm has been applied to various types of emotionally valenced stimuli, such as positive, neutral, and negative content, including pictures (Barber et al., 2017), movies (Andersson & Rönnberg, 1995), real-life events (Yaron-Antar & Nachson, 2006), and short video (Wessel et al., 2015). Studies employing emotional stimuli have typically replicated key findings in collaborative memory research, such as collaborative inhibition (Vredeveldt et al., 2016; Wessel et al., 2015) and individual post-collaborative benefits (Bärthel et al., 2017; Yaron-Antar & Nachson, 2006).

While understanding the mechanisms underlying collaborative recall and the impact of emotional stimuli on recall performance is essential, it is important to consider that, when remembering, we not only recall information collaboratively but may also encode it collaboratively. In most studies on collaborative memory, including those using emotionally valenced stimuli, the encoding phase was conducted individually. Collaborative encoding with emotional material, however, remains an area requiring further investigation.

The present study

Collaboration during the encoding phase can have both detrimental and beneficial effects on recall performance, leading to collaborative encoding deficits and collaborative inhibition effects. This study aims to comprehensively examine both effects and explore how the composition of collaborative groups (i.e., involving the same or different partners during the encoding and recall phases) influences recall performance and the organizational patterns of recalled information. According to the retrieval disruption hypothesis (Basden et al., 1997; Rajaram & Pereira-Pasarin,

2010), the reduction of collaborative inhibition may depend on the composition of the collaborative groups during recall: whether they are composed of the same or different partners from the encoding phase. Groups that collaborate with the same partners in both phases may develop similar retrieval strategies, which may help mitigate the collaborative inhibition effect. To investigate this, we designed a task that encourages active collaboration among participants, enabling us to assess the extent to which partners in different collaborative groups use similar organizational strategies.

Previous studies may not have effectively produced collaborative effects due to the conditions and tasks employed. For example, tasks like the one used by Andersson and Rönnberg (1995) might not foster active collaboration among participants. To address this limitation, we developed a modified version of the collaborative memory paradigm that includes an encoding task designed to stimulate discussion and active collaboration—key components for effective collaborative encoding. The task involved the organization of the material to be studied (Basden et al., 1997, 2000). Specifically, we used a categorization task in which participants, either individually or in pairs, classified emotionally charged word stimuli into predefined categories. While the categories for some words were straightforward (e.g., HEALTH-nurse), others were intentionally ambiguous, requiring participants to reach a consensus through discussion.

Furthermore, while previous collaborative encoding studies have relied on recall performance to infer the effects of organizational similarity, we introduced an objective measure of organization to directly assess whether the structure of recalled information matched the organization established during encoding. To this end, we used the Adjusted Ratio of Clustering (ARC—Roenker et al., 1971) to evaluate the organization of recall and to gauge the degree of disruption in retrieval strategies (Basden et al., 1997).

Additionally, we extended the investigation by including not only the four conditions derived from the factorial combination of encoding and recall types (individual or collaborative)—which are crucial for assessing the intended effects—but also an additional condition inspired by Barber's (2010) study. This condition involves collaborative recall with a different partner than the one involved in the

encoding phase. This allows us to examine whether the reduction or elimination of the collaborative inhibition effect requires the same partner during both encoding and recall. The following conditions were included: in the Ind–Ind condition, participants encoded and recalled individually; in the Ind–Col condition, they encoded individually and recalled collaboratively; in the Col–Ind condition, they encoded collaboratively and recalled individually; in the Col– Col_{sam} condition, they encoded and recalled collaboratively with the same partner; and in the Col– Col_{diff} condition, they encoded collaboratively and recalled collaboratively with a different partner. Lastly, an additional individual recall phase was included to assess whether any effects (e.g., collaborative inhibition or encoding deficits) observed during the first recall trial persisted over time. *Figure 1* depicts the study design and the task phases.

Based on the reviewed literature, we hypothesized that collaborative encoding hinders recall, since encoding takes place under divided attention. In contrast, when encoding is performed individually, participants can give their full attention to the task, leading to better memory performance. Our first hypothesis predicts that collaborative encoding will result in deficits both in the number of items recalled and in ARC scores. Consistent with this, we expect better recall performance following individual encoding compared to collaborative encoding, regardless of the recall condition (individual or collaborative). Moreover, if the collaborative encoding deficit is attributed to poor learning of the material, this effect should be long-lasting and evident during the second individual recall trial.

The second hypothesis predicts a collaborative inhibition effect, where collaborative recall will negatively impact nominal recall, particularly when participants collaborate with a different partner than the one who was involved in the original encoding (i.e., Col–Col_{diff}). This effect is expected to be reflected in both ARC scores and nominal recall, in line with the retrieval disruption hypothesis (Basden et al., 1997). Our third hypothesis suggests that the collaborative inhibition effect will be reduced (or even eliminated) when the same partners collaborate during both encoding and recall. This reduction should be due to the similar organization of the material and cross-cuing between partners, which helps prevent disruptions in the retrieval process. We expect this reduction to be observed in both

nominal recall and ARC scores, as it depends on the organization of the material. Finally, the fourth hypothesis posits that among the groups that encoded collaboratively, those who do not experience retrieval disruption (i.e., Col–Ind or Col–Col$_{sam}$) should perform better than those who experience disruption when recalling collaboratively with a different partner (Col–Col$_{diff}$). Furthermore, if the collaborative inhibition effect is caused by disruptions due to differing organizational strategies between partners, this effect should not be observed during the second individual recall, where no such disruption occurs.

1.1 Materials and methods

1.2.1 Participants

The sample size was determined based on previous studies investigating collaborative inhibition and collaborative encoding deficits (Barber et al., 2010; Harris et al., 2013), which included 48–69 participants per condition. In total, 320 participants completed the tasks: 160 Italian undergraduate students (age: M: 20.46, SD: 3.19; education: M: 14.80, SD: 1.23) from the University of Chieti (Italy) and 160 Spanish undergraduate students (age: M: 19.81, SD: 3.09; education: M: 14.01, SD: 1.05) from the University of Jaén (Spain). Using samples from two different countries allowed for an assessment of the results' generalizability across both populations. Participants were randomly assigned to one of five experimental conditions before the study began. Informed consent was obtained from all participants in accordance with the Helsinki protocol (World Medical Association, 2013). The study was approved by the Ethical Committee of the University of Jaén (protocol number NOV.21/2.PRY).

1.2.2 Stimuli

A total of 90 affective words (30 neutral, 30 negative, and 30 positive) were selected from the Italian (Montefinese et al., 2014) and Spanish (Redondo et al., 2007) versions of the ANEW database (Bradley & Lang, 1999) for the Italian and Spanish administrations, respectively. Six general categories were chosen: Health, Environment, News, Behavior, Education, and Relationships. This selection ensured that some words were easily categorizable (e.g., the word "nurse," which

intuitively fits into the HEALTH category), while others were more difficult to categorize (e.g., "hate," which could belong to either the RELATIONSHIPS or BEHAVIOR category).

Overall, the words differed in valence ($p < 0.001$), with neutral words showing significant differences from both negative and positive words ($p < 0.001$) in arousal. However, negative and positive words did not differ in arousal ($p > 0.26$). All words were comparable in terms of length, frequency of use, and familiarity ($p > 0.25$). Familiarity values for Spanish affective words were also comparable ($p > 0.12$).

To ensure consistency between the languages, the absolute value of the difference in valence and arousal between Spanish and Italian words was calculated, and only those with a difference of less than 0.70 were selected. A mixed ANOVA revealed no significant differences between languages (Italian and Spanish) in terms of valence, arousal, and number of letters ($p > 0.52$). Comparisons of frequency were not possible due to differences in how the frequency was calculated in the Italian and Spanish databases. Likewise, familiarity could not be compared, as not all words in the Spanish database had familiarity values.

1.2.3 Design

Participants were assigned to one of five experimental conditions based on the encoding phase (collaborative or individual) and Recall 1 phase (collaborative with the same partner, collaborative with a different partner, or individual):

- The first group (Ind–Ind) encoded and recalled individually.
- The second group (Ind–Col) encoded individually and recalled collaboratively.
- The third group (Col–Ind) encoded collaboratively and recalled individually.
- The fourth group (Col–Col_{sam}) encoded and recalled collaboratively with the same partner.
- The fifth group (Col–Col_{diff}) encoded collaboratively and recalled collaboratively with a different partner.

Refer to *Figure 1.1* for the visual representation of the study design.

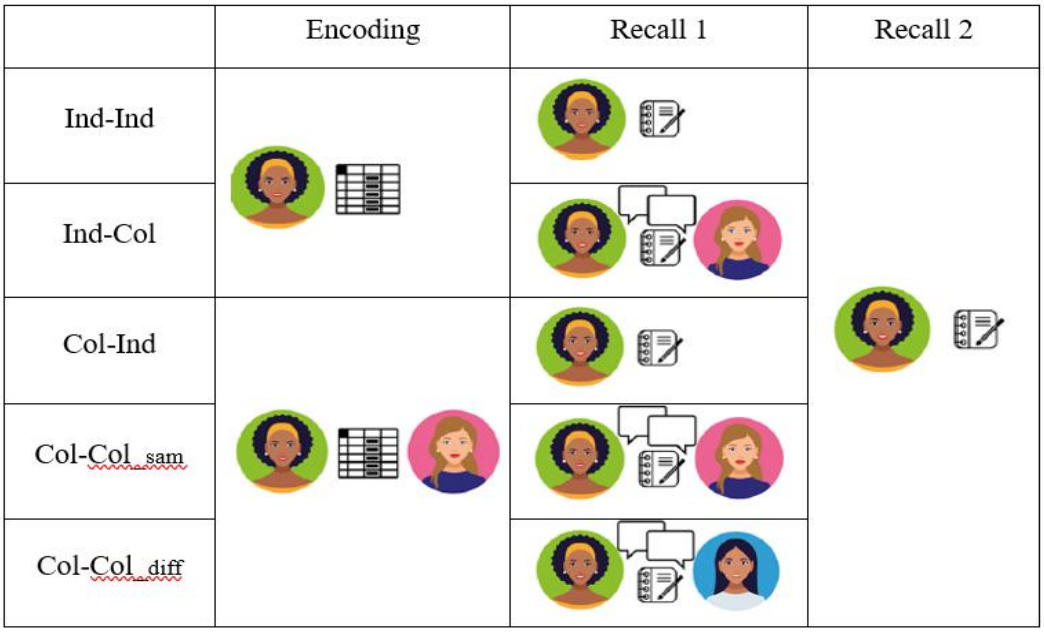

Figure 1.1 - The visual representation of the study design, indicating the five conditions and the three principal phases. Note. Ind–Ind: individual encoding and individual recall, Ind–Col: individual encoding and collaborative recall, Col–Ind: collaborative encoding and individual recall, Col–Coldiff, collaborative encoding and collaborative recall with a different partner, and Col–Colsam: collaborative encoding and collaborative recall with the same partner.
Images adapted from: https:// it. vecte ezy. com.

1.2.4 Procedure

A modified version of the collaborative memory paradigm (Congleton & Rajaram, 2011, 2014; Pepe et al., 2021) was adopted, incorporating three main phases: Encoding (individual vs. collaborative), Recall 1 (individual vs. collaborative), and Recall 2 (individual). The entire session lasted approximately 60–75 minutes.

Encoding Task: Individual Encoding Condition

Participants worked individually at a desk. The experimenter explained that the study aimed to examine memory and described the task: 90 words printed on index cards were scattered on the desk alongside six cards labeled with general categories (Health, Environment, Education, News, Relationships, and Behavior).

Participants were instructed to classify each word into one of the six categories, with 15 words assigned to each. Once all cards were categorized, participants could use any remaining time (from a total of 30 minutes) to review and adjust their classifications. A timer was placed on the desk to indicate the remaining time.

Encoding Task: Collaborative Encoding Condition

The procedure was identical to the individual condition, except that pairs of participants worked together at the same desk, where both could see the words. Participants were instructed to discuss and agree on the placement of each word into a category. Dyads were formed by matching participants who did not know each other, verified before the task began.

Distractor Task 1

After the encoding task, all participants completed a 7-minute individual distractor task, playing a computer game like Snake. Participants in the collaborative encoding condition were moved to separate rooms for this task.

Recall 1 Following the distractor task, participants performed a free recall task for 7 minutes, which varied based on their assigned condition:

- Individual Recall: Participants listed as many words as they could remember individually.
- Collaborative Recall: Dyads worked together, either with the same partner or a different partner from the encoding phase. One participant was designated to write down the words, but only items agreed upon by both participants were recorded. Collaborative recall instructions emphasized consensus (see Harris et al., 2012, 2013).

The experimenter instructed all participants to continue attempting to recall words until the time expired.

Distractor Task 2

Participants completed a second distractor task individually, practicing the Snake-style game for 5 minutes.

Recall 2 In the final recall phase, all participants performed an individual free recall task for 7 minutes, following the same procedure as Recall 1. This phase aims to assess residual memory effects, including collaborative inhibition or encoding deficits.

Post-Experimental Debriefing

Participants completed a debriefing session tailored to their condition. Those in collaborative groups were asked about strategies used during encoding and recall

and their experiences with collaboration. All participants had the opportunity to ask questions, were fully debriefed about the study objectives, and were thanked for their participation**.**

1.2 Results

We conducted a 2 × 3 × 5 × 2 mixed ANOVA to examine recall measures (nominal and normal), incorporating Recall (1 and 2) and valence (negative, neutral, positive) as within-subject factors, and condition (Ind–Ind, Ind–Col, Col–Ind, Col–Col$_{sam}$, and Col–Col$_{diff}$) and sample (Italian, Spanish) as between-subject factors. Additional ANOVAs excluding the valence variable were conducted for the ARC and intrusion measures.

To evaluate the study's hypotheses, a set of four orthogonal contrasts was employed. The first contrast, addressing the initial hypothesis, assessed the collaborative encoding deficit by comparing the mean recall of groups with individual encoding against those with collaborative encoding. The second contrast, aligned with the second hypothesis, examined the classical collaborative inhibition effect by comparing the Ind–Ind group to the Ind–Col group. The third contrast tested the hypothesis predicting a reduction or elimination of the collaborative inhibition effect when recalling with the same partner, by comparing the Col–Ind group to the Col–Col$_{sam}$ group. Finally, the fourth contrast, designed to evaluate the corresponding hypothesis, focused on groups that underwent collaborative encoding. It compared the group that both encoded and recalled collaboratively with a different partner to the average performance of groups that recalled either with the same encoding partner or individually (Col–Ind and Col–Col$_{sam}$ vs Col–Col$_{diff}$). This analysis aimed to determine whether recalling with a different partner was more detrimental than recalling with the same partner or individually.

All *p*-values reported were corrected for multiple comparisons using the false discovery rate (FDR) adjustment at the 5% significance level, as described by Benjamini and Yekutieli (2001).

Table 1.1 presents descriptive statistics for each condition across all measures. Analyses of nominal recall and ARC are detailed below, while those for normal

recall and intrusions are included in the supplementary materials. Although repetitions were recorded, their frequency was too low to warrant separate analysis.

Table 1.1 - Percentage of recalled words, ARC, intrusions, and repetitions for nominal and collaborative groups in the individual and collaborative conditions during Recall 1, 2.
Values for each variable are means, with standard deviations in parentheses.
ARC Adjusted Ratio of Clustering.

Recall	Encoding task	Recall group	Condition	Nominal recall	% of recalled words	ARC	% of intrusions	% of repetitions
Recall 1	Ind	Ind	Ind–Ind	56.0 (10.50)	36.04 (12)	0.35 (0.27)	2.25 (2.36)	0.36 (0.63)
		Col	Ind–Col	47.26 (9.0)	47.26 (8.91)	0.25 (0.27)	1.94 (1.73)	0.25 (0.62)
	Col	Ind	Col–Ind	49.06 (11)	32.17 (11.13)	0.30 (0.20)	1.42 (1.57)	0.22 (0.57)
		Col with the same partner	Col–Colsam	41.66 (11.40)	41.66 (11.40)	0.28 (0.26)	2.25 (1.61)	0.34 (0.70)
		Col with different partner	Col–Coldif	39.30 (8.26)	39.30 (8.26)	0.17 (0.12)	1.47 (1.67)	0.31 (0.70)
Recall 2	Ind	Ind	Ind–Ind	56.11 (10.40)	36.32 (12.70)	0.41 (0.25)	2.58 (2.23)	0.27 (0.70)
		Col	Ind–Col	57.74 (13.63)	40.47 (13.70)	0.41 (0.23)	2.2 (2.16)	0.50 (1.0)
	Col	Ind	Col–Ind	50 (11)	32.64 (11.84)	0.32 (0.23)	2.08 (1.85)	0.22 (0.45)
		Col with the same partner	Col–Colsam	48.09 (13.65)	35.74 (13.20)	0.31 (0.22)	2.47 (2.21)	0.26 (0.60)
		Col with different partner	Col–Coldif	47.22 (10.46)	32.15 (9.10)	0.25 (0.19)	1.95 (1.65)	0.22 (0.63)

1.3.1 Nominal recall

For the Col–Ind and Ind–Ind conditions, dyads were formed by pairing participants who recalled individually and were scheduled in consecutive time slots within the participation schedule. Nominal scores were calculated by summing the unique items recalled by both members of each dyad. Each correctly recalled item, regardless of whether it was remembered by one or both members of the dyad, was counted as a single correct recall response. *Figure 1.2* illustrates the proportion of nominal recall for Recall 1 and Recall 2 across all conditions (refer also to *Table 1*). A 2 × 3 × 5 × 2 mixed ANOVA was conducted on the percentage of nominal recall, with Recall (1 and 2) and valence (negative, neutral, positive) as within-subject

factors, and condition (Ind–Ind, Ind–Col, Col-Ind, Col–Col$_{sam}$, and Col–Col$_{diff}$) and sample (Italian, Spanish) as between-subject factors. The analysis yielded the main effects of Recall, $F(1, 150) = 139.7$, $p < 0.001$, $\eta_p^2 = 0.482$, and Condition, $F(4, 150) = 7.72$, $p < 0.001$, $\eta_p^2 = 0.17$, and the interactions Recall x Condition, $F(4, 150) = 20.93$, $p < 0.001$, $\eta_p^2 = 0.358$, Valence x Sample, $F(2, 300) = 5.09$, $p = 0.019$, $\eta_p^2 = 0.033$, and Recall × Valence, $F(2, 300) = 4.48$, $p = 0.013$, $\eta_p^2 = 0.029$. The data were collapsed across samples in subsequent analyses because neither sample ($F < 1$) nor the interaction Sample × Condition, $F(2, 150) = 0.90$, $p = 0.654$, $\eta_p^2 = 0.023$, proved to be significant.

During Recall 1, the contrasts confirmed both the collaborative encoding deficit and collaborative inhibition effects. Specifically, in support of the first hypothesis, a collaborative encoding deficit was found, with groups that encoded individually showed a higher recall performance than the groups that encoded collaboratively, $t(155) = 5.06$, $p = 0.001$, $d = 0.81$. Consistent with the second hypothesis, the classic collaborative inhibition effect was observed: among the groups that encoded individually, the group that recalled collaboratively had lower recall performance than the group that recalled individually, $t(155) = 3.42$, $p = 0.003$, $d = 0.54$; Similarly, collaborative inhibition was found among groups encoding collaboratively, $t(155) = 2.95$, $p = 0.011$, $d = 0.47$, aligning with the third hypothesis. Lastly, for groups encoding collaboratively, those recalling collaboratively with a different partner had lower recall performance compared to those recalling individually or with the same partner (fourth hypothesis), $t(155) = 2.79$, $p = 0.016$, $d = 0.45$. Follow-up comparisons revealed that recall collaboratively with other partners resulted in lower recall performance than recall individually, $t(155) = 3.89$, $p = 0.001$, $d = 0.624$, but in similar performance than recall with the same partner, $t(155) < 1$.

For Recall 2, only the collaborative encoding deficit was found, consistent with the first hypothesis. Groups encoding individually showed a higher recall performance than the groups that encoded collaboratively, $t(155) = 4.44$, $p < 0.001$, $d = 0.71$. All the other contrasts did not reach significance ($p > 0.1$), indicating the absence of a collaborative inhibition effect.

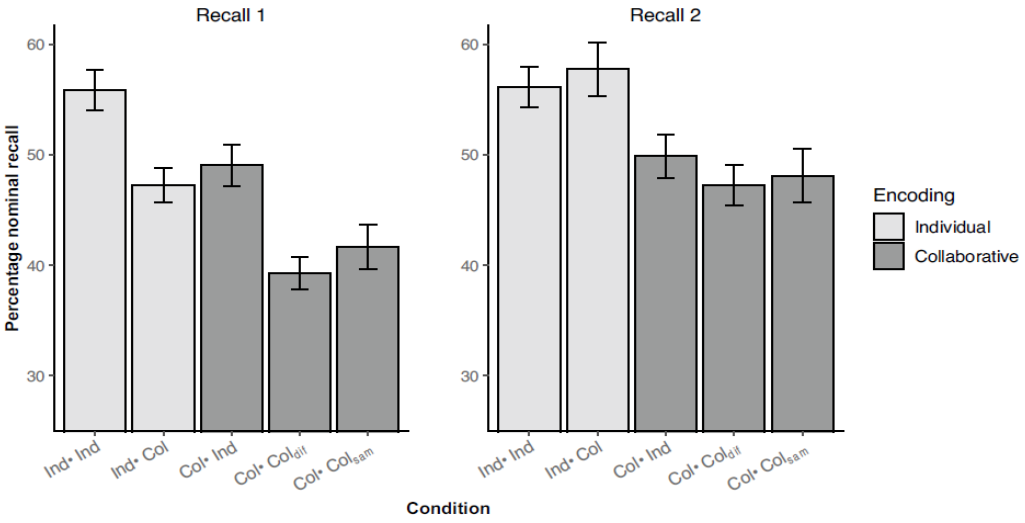

Figure 1.2 – The mean Percent Nominal Recall for each Condition in each Recall.
Note. Ind–Ind: individual encoding and individual recall, Ind–Col: individual encoding and collaborative recall, Col–Ind: collaborative encoding and individual recall, Col–Coldiff, collaborative encoding and collaborative recall with a different partner, and Col–Colsam: collaborative encoding and collaborative recall with the same partner.

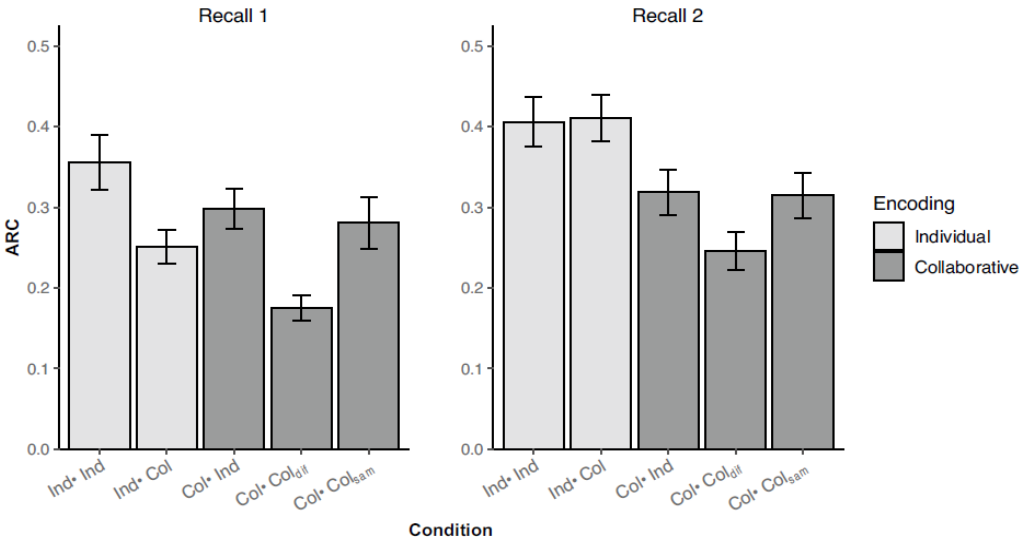

Figure 1.3 – The mean ARC for each Condition in each Recall.
Note. Ind–Ind: individual encoding and individual recall, Ind–Col: individual encoding and collaborative recall, Col–Ind: collaborative encoding and individual recall, Col–Coldiff, collaborative encoding and collaborative recall with a different partner, and Col–Colsam: collaborative encoding and collaborative recall with the same partner.

1.3.2 Adjusted Ratio of Clustering (ARC)

Figure 1.3 illustrates the mean Adjusted Ratio of Clustering (ARC) scores for both Recall 1 and Recall 2 across all conditions. An ARC value near 1 indicates recall that perfectly adheres to the category-based organization of the material, whereas a value of 0 reflects a random recall pattern (Saraiva et al., 2023). To analyze ARC scores, a 2 × 5 × 2 mixed ANOVA was conducted with Recall (1 and 2) as the within-subject factor, and condition (Ind–Ind, Ind–Col, Col–Ind, Col–Col$_{sam}$, Col–Col$_{diff}$) and sample (Italian, Spanish) as between-subject factors. The ARC value quantifies the ratio of actual category repetitions in recall to the maximum possible repetitions. The analysis revealed the main effects of Recall, $F(1, 310) = 35.07$, $p < 0.001$, $\eta_p^2 = 0.102$, Condition, $F(4, 310) = 6.57$, $p < 0.001$, $\eta^2 = 0.080$, and the interaction Recall × Condition, $F(4, 310) = 4.74$, $p = 0.004$, $\eta_p^2 = 0.058$. Given that neither sample, $F(1, 310) = 1.66$, $p = 0.346$, $\eta_p^2 = 0.005$, nor the interaction Sample × Condition ($F < 1$) proved to be significant, the data were collapsed across samples in subsequent analyses. For Recall 1, the results did not support the first hypothesis, as no significant collaborative encoding deficit was observed; groups that encoded individually and those that encoded collaboratively showed similar ARC scores, $t(315) = 2.13$, $p = 0.08$, $d = 0.24$. However, consistent with the second hypothesis, a collaborative inhibition effect was detected among groups encoding individually: those recalling collaboratively had lower ARC scores compared to those recalling individually, $t(315) = 2.79$, $p = 0.016$, $d = 0.31$. Aligned with the third hypothesis, the collaborative inhibition effect was eliminated among groups encoding collaboratively when recalling with the same partner, as ARC scores were comparable to those of the group recalling individually, $t(315) < 1$. Finally, in line with the fourth hypothesis, groups that encoded collaboratively and recalled with a different partner showed significantly lower ARC scores than the other two groups, $t(315) = 3.51$, p = 0.002, d = 0.40. Follow-up analyses revealed that recalling with a different partner resulted in lower ARC scores compared to recalling with the same partner, $t(315) = 2.81$, $p = 0.016$, $d = 0.32$, and to recalling individually, $t(315) = 3.28$, $p = 0.004$, $d = 0.37$. This suggests that recalling with a different partner hindered the level of organization in recall.

In Recall 2, a collaborative encoding deficit was observed, supporting the first hypothesis. Groups encoding individually had higher ARC scores than those encoding collaboratively, $t(315) = 4.49$, $p < 0.001$, $d = 0.51$. This result contrasts with Recall 1, where the collaborative encoding deficit was not significant after applying the FDR correction. Lastly, among the groups encoding collaboratively, no significant differences were found between those recalling with a different partner and those recalling with the same partner or individually, $t(315) = 2.06$, $p = 0.092$, $d = 0.23$. This indicates that the collaborative inhibition effect does not persist over time.

1.4 Discussion

Research on collaborative memory has predominantly explored the effects of collaboration during recall, while studies examining collaborative encoding remain rare. In the present study, we investigated both collaborative encoding and recall effects using a categorization task designed to foster discussion and active collaboration among participants (Basden et al., 1997, 2000) in two cultural samples: Italian and Spanish. The findings revealed evidence of both collaborative encoding deficits and collaborative inhibition, with higher ARC scores observed in conditions where participants recalled alone or with the same encoding partner.

Collaboration During Encoding

The study identified a collaborative encoding deficit, where participants who encoded information collaboratively performed worse compared to those who encoded individually. This deficit appeared to be enduring, persisting across both Recall 1 and Recall 2, and was independent of the recall condition, as suggested by the lack of significant interaction effects. These results indicate that the mechanisms underlying encoding deficits differ from those responsible for collaborative inhibition. Furthermore, ARC scores were lower for collaborative encoding conditions in Recall 2, suggesting that collaborative encoding produces less integrated and more superficial organization of the material.

One plausible explanation for the collaborative encoding deficit is the potential for social interactions during collaboration to divert attention from the encoding task (Barber et al., 2012) and lead to divided attention (Anderson et al., 1998; Baddeley

et al., 1984; Craik et al., 1996). Under individual encoding conditions, participants could focus exclusively on the task and stimuli, facilitating deeper processing and subsequent recall.

Conversely, in collaborative encoding conditions, participants had to divide their attention between encoding the material and listening to their partner. This dual task can be demanding depending on the complexity of the material and the dynamics of the interaction. Participants also needed to attend to non-task-related social cues, such as their partner's attitudes or facial expressions, which may have further divided their cognitive resources. Additional distractions, such as engaging in discussions about categorization choices, likely competed with the memory task for attention. These factors could act as secondary tasks that diminish the cognitive resources available for encoding, thereby resulting in a deficit.

These findings align with prior research, such as Pereira-Pasarin and Rajaram (2011), who demonstrated that divided attention during encoding diminishes retrieval organization during recall. Studies using diverse paradigms have shown that DA during the study phase alters encoding quality, shifting it from a deeper, semantically driven process to a more superficial one (Naveh-Benjamin et al., 2000). Moreover, DA conditions have been shown to negatively affect both memory performance and secondary task performance when compared to full attention (FA) conditions (Fernandes & Moscovitch, 2000; Naveh-Benjamin et al., 1998).

Although much of the existing literature on collaborative memory has focused mainly on cognitive processes, it is worth exploring whether social processes, such as social conformity or fear of judgment, might mediate performance within collaborative groups (see Weldon et al., 2000 for a discussion on motivational factors). These social influences could provide additional insights into the mechanisms underlying collaborative memory processes.

Collaboration during retrieval

This study replicates the classic effect of collaborative inhibition, where dyads recalling individually demonstrate better nominal recall than collaborative groups (Andersson et al., 2006; Marion & Thorley, 2016; Rajaram, 2011; Saraiva et al., 2023). Consistent with prior findings, collaborative groups retrieved more

information than individual participants but less than nominal groups (Weldon & Bellinger, 1997). Collaborative inhibition was evident even when encoding occurred collaboratively, as evidenced by the better performance of the Col–Ind group compared to the Col–Col$_{diff}$ group. This aligns with the retrieval disruption hypothesis (Basden et al., 1997), which suggests that a participant's recall strategy is interrupted by a partner's output. Lower ARC scores in the Col–Col$_{diff}$ group further support this explanation, suggesting that recall organization was particularly hindered when study and recall partners were different.

Interestingly, the retrieval disruption hypothesis predicts that collaborative inhibition should diminish or disappear when participants encode with the same partner and then recall collaboratively (Col–Col$_{sam}$). However, the results showed no such attenuation. While it could be hypothesized that participants did not rely on their shared organization, ARC scores suggest otherwise, as no significant differences emerged between Col–Col$_{sam}$ and Col–Ind groups. These findings contrast with Harris et al. (2013), who found that collaborative inhibition was eliminated when study and recall partners were the same. A key difference is that Harris et al. (2013), included an initial individual recall phase, potentially allowing participants to consolidate information before engaging in collaborative recall.

The persistence of collaborative inhibition, even with consistent partners, suggests additional mechanisms may contribute. Retrieval blocking or inhibition may play a role, whereby remembering certain information suppresses access to other information (Anderson et al., 1994; Bäuml, 2008; Bäuml & Aslan, 2004). In collaborative contexts, retrieval blocking may result from reinforced retrieval of cue words, hindering access to non-cue words (Rundus, 1973). Social shared retrieval-induced forgetting (Coman & Hirst, 2015) may also occur, where participants forget related, unmentioned information when focusing on their partner's recall.

Alternatively, social contagion of memory errors could explain some of the observed effects (Basden et al., 2002; Davis & Meade, 2013; Huff et al., 2013; McNabb & Meade, 2014; Meade & Roediger, 2002; Roediger et al., 2001; Roediger & McDermott, 1995). For example, participants in the Col–Col$_{sam}$ group demonstrated more intrusions in Recall 1 compared to the Col–Ind group,

suggesting that partners' errors were incorporated during encoding and were not corrected during recall. This dynamic could have compounded memory errors in the collaborative groups.

As with collaborative encoding, divided attention (DA) provides another explanatory framework. Collaborative recall conditions inherently involve social and cognitive distractions, unlike individual recall, which facilitates Focused Attention (FA). DA is known to be deleterious to memory and secondary task performance, compared to FA conditions (Fernandes & Moscovitch, 2000; Naveh-Benjamin et al., 1998).

Unexpectedly, emotional valence did not influence collaborative inhibition or the encoding deficit. Neutral words were remembered better than emotional (positive or negative) words, diverging from findings that emotional material is generally better remembered (Fairfield et al., 2013; Ferré et al., 2015; Siddiqui & Unsworth, 2011; Talmi et al., 2013; Zimmerman & Kelley, 2010). A post hoc explanation is that neutral words may have been more concrete than emotional ones, enhancing memory performance (Yui et al., 2017).

Lastly, the present study allowed us to confirm the generalizability of the results obtained with the new encoding task across two separate samples from different countries. By testing both Italian and Spanish samples using the same paradigm and culturally adapted stimuli (Lang et al., 1999; Montefinese et al., 2014; Redondo et al., 2007), this study demonstrated that memory performance was unaffected by socio-cultural differences. The findings confirm the generalizability of key collaborative memory effects: collaborative encoding deficits, collaborative inhibition, and post-collaborative individual benefits.

The encoding task developed for this study successfully facilitated collaborative organization. However, its benefits may have been offset by the attentional demands of collaboration. Future research should refine such tasks to promote shared organization while minimizing distractions.

Regarding emotional stimuli, researchers should consider concreteness of the words used as stimuli, to evaluate the impact of valence on memory.

1.5 Conclusion

The present study offers a novel contribution to the field of collaborative memory, particularly by investigating the effects of collaborative encoding—an area that has been relatively underexplored in the literature. Using five experimental conditions, we examined the differential impacts of individual versus collaborative encoding and retrieval on recall performance. An additional innovative feature of this study was the exploration of whether the organization of recall output aligned with the structure established during encoding.

Our findings confirm the generalizability of results achieved with the new encoding task across diverse conditions. Notably, we observed the classic collaborative inhibition effect, even in groups where the organization of recall output matched that of individual recall groups. This suggests that the detrimental effects of collaboration during retrieval may not be fully explained by retrieval disruption. Instead, our results indicate that divided attention during collaborative tasks could also play a significant role in impairing memory performance.

1.6 Supplementary Material

Normal Recall

Normal recall is calculated by combining the recall responses of both partners without excluding redundant items (i.e., the same word recalled by two partners is computed as two correct responses). A preliminary 2 x 3 x 5 x 2 mixed ANOVA with recall (1 and 2) and valence (negative, neutral, positive) as within-subject factor, and condition (Ind-Ind, Ind-Col, Col-Ind, Col-Col_{sam}, Col-Col_{diff}) and sample (Italian, Spanish) as between factors was conducted on recall percentage. The analysis revealed the main effects of Recall, $F(1, 310) = 97.0$, $p < .001$, $\eta_p^2 = .024$, and Condition, $F(4, 310) = 9.99$, $p < .001$, $\eta_p^2 = .114$, and the interactions Recall x Condition, $F(4, 310) = 19.75$, $p < .001$, $\eta_p^2 = .203$, Valence x Sample, $F(2, 620) = 6.80$, $p = .005$, $\eta_p^2 = .021$, and Condition x Valence, $F(8, 620) = 2.57$, $p = .027$, $\eta_p^2 = .026$. Given that neither sample ($F < 1$) nor the interaction Sample x Condition, $F(4, 310) = 1.25$, $p = .45$, $\eta_p^2 = .016$, proved to be significant, the data were collapsed across samples in subsequent analyses.

In Recall 1, contrasts showed a collaborative encoding deficit, and no collaborative inhibition effects. Specifically, groups that encoded individually showed a higher recall performance than the groups that encoded collaboratively, $t(315) = 3.31$, $p = .004$, $d = 0.37$. Among the groups that encoded individually, the group that recalled collaboratively had higher recall performance than the group that recalled individually, $t(315) = 6.09$, $p < .001$, $d = 0.69$. Among the groups that encoded collaboratively, the group that recalled collaboratively had higher recall performance than the group that recalled individually, $t(315) = 5.16$, $p < .001$, $d = 0.58$. Therefore, in line with previous research, normal recall of a collaborative group was greater than normal recall of any one individual (see Rajaram and Pereira-Pasarin, 2010). Regarding Recall 2, only the encoding deficit was found, such that the groups that encoded individually showed a higher recall performance than the groups that encoded collaboratively, $t(315) = 3.51$, $p = .002$, $d = 0.40$. Other contrasts did not reach significance ($p > .05$), thus, failing to show the collaborative inhibition effect.

Intrusions

Table 1.1: the main text shows the number of intrusions in Recall 1 and Recall 2 for each condition. An overall 2 x 5 x 2 mixed ANOVA with recall (1 and 2) as within-subject factor and condition (Ind-Ind, Ind-Col, Col-Ind, Col-Col_{sam}, Col-Col_{diff}) and sample (Italian, Spanish) as between factors was conducted on intrusions (i.e., recalled items that did not appear on the original study list). The analysis yielded only a main effect of Recall, $F(1, 310) = 14.95$, $p = .001$, $\eta_p^2 = .050$. Given that neither sample, $F(4, 310) = 1.85$, $p = .324$, $\eta_p^2 = .006$, nor the interaction Sample x Condition ($F < 1$) proved to be significant, the data were collapsed across samples in subsequent analyses.

In Recall 1, the encoding deficit effect was not found since groups that encoded individually did not show different number of intrusions than groups that encoded collaboratively, $t(315) = 1.83$, $p = .14$, $d = 0.21$. Between groups that encoded collaboratively, those that recalled individually showed fewer intrusions than those that recalled collaboratively with the same partner, $t(315) = 2.58$, $p = .026$, $d = 0.29$. As for Recall 2, no contrasts reached significance ($ps > 0.4$).

CHAPTER 2 – CURIOSITY KILLED THE CAT BUT NOT MEMORY: ENHANCED PERFORMANCE IN HIGH-CURIOSITY STATES

2.1 Introduction

Some types of information are better remembered than others, and this disparity may be linked to curiosity. Defined as an intrinsic motivation to acquire knowledge for its inherent value rather than practical utility, curiosity plays a critical role in human behavior and cognitive processes (Berlyne, 1966; Loewenstein, 1994; Oudeyer et al., 2007). Daily activities frequently involve seeking information through various media, such as the internet, books, and conversations. According to Kashdan et al. (2018), curiosity is defined as "the recognition, pursuit and desire to explore novel, uncertain, complex, and ambiguous events," fostering and facilitating learning. Furthermore, curiosity and the pursuit of knowledge have been linked to several positive outcomes, including enhanced physical, psychological, cognitive, and social well-being. For instance, research demonstrates that curiosity can improve both the encoding and retrieval of information (Kang et al., 2009) and may also extend its benefits to implicitly encoded incidental information presented in close temporal proximity to interesting information. This mechanism is thought to involve the midbrain and hippocampus and their functional connectivity, suggesting a connection between intrinsic curiosity and extrinsic reward motivation systems (Gruber et al., 2014). These insights emphasize the importance of cultivating curiosity to enhance learning experiences, with the PACE framework proposing that dopaminergic activity facilitates hippocampal coding and memory consolidation (Gruber & Ranganath, 2019).

Despite the critical role of curiosity in intellectual behavior across the lifespan, including childhood learning and scientific discovery, it remains understudied in aging populations. Prior research indicates that normal aging leads to a decline in at least some aspects of curiosity. For example, Robinson et al. (2017) identified a decline, as individuals transition from early to late adulthood, in three dimensions of curiosity: interpersonal curiosity, epistemic curiosity, and intrapersonal curiosity (Renner, 2006).

A potential explanation for the observed decline in curiosity may lie in motivational changes associated with aging. According to the socioemotional selectivity theory (Carstensen, 2006), individuals are driven by two types of goals. On the one hand, they seek novelty, knowledge and broaden their understanding of the world. On the other hand, they aim to regulate negative emotions and maintain positive and meaningful emotional states. These dual motivations operate across the entire lifespan, with individuals typically prioritizing the pursuit of knowledge during earlier stages and shifting toward maintaining emotionally meaningful experiences as they grow older. As people age, their perception of time becomes more constrained, prompting a more selective approach to the allocation of their time and resources. When time is perceived as unlimited, individuals are more inclined to focus on acquiring new skills and knowledge to prepare for the future. Conversely, when time is perceived as limited, the likelihood of achieving long-term, expansive goals diminishes, leading individuals to prioritize present-focused objectives that grant immediate emotional gratification. Consequently, older adults often prioritize emotionally significant goals over those related to seeking new knowledge, which may result in a general perception of curiosity as less essential.

Nevertheless, curiosity has been shown to play an important role in sustaining cognitive function, well-being, and physical health among older adults. Studies employing trivia questions to measure curiosity's effect on memory found that both younger (Duan et al., 2020; Kang et al., 2009; Marvin & Shohamy, 2016; Murayama & Kuhbandner, 2011a) and older adults (Galli et al., 2018; McGillivray et al., 2015) exhibit memory advantages for high-curiosity trivia items compared to low-curiosity ones. Additionally, research that presented temporally contiguous unrelated information, during the interval between the presentation of trivia questions and the revelation of their answers indicates, in younger adults, better memory for the implicitly encoded information associated with high-curiosity trivia items compared to low (Murphy et al., 2021; Stare et al., 2018).

Galli et al. (2018), however, reported mixed findings, showing curiosity-driven memory advantages for neutral faces in older adults in one study (Experiment 1), but not in a subsequent study (Experiment 2) (Galli et al., 2018). These findings suggest that states of high curiosity can enhance learning for topics that specifically

engage an individual's interest, while, under certain conditions, they may also improve memory for information unrelated to the primary target of curiosity (Fandakova & Gruber, 2021; Galli et al., 2018; Stare et al., 2018). Nonetheless, it remains unclear whether memory is similarly enhanced for valenced incidental information during states of curiosity.

To address this gap, this study investigated how curiosity influences long-term memory and incidental memory in healthy younger and older adults. Building on the paradigm adopted by Galli et al. (2018), we include emotionally valenced (positive and negative) and neutral face stimuli to examine interactions between curiosity and affective information on memory performance. Research consistently demonstrates emotional enhancement effects on memory, with valence-specific patterns varying by age (Fairfield et al., 2022; Padulo et al., 2021). While both younger and older adults generally remember emotionally charged (positive or negative) information better than neutral information, older adults often exhibit positivity biases, recalling positive content more than negative or neutral content (Mather & Carstensen, 2005a; Reed et al., 2014). In line with studies, we hypothesize that both age groups will recall more trivia answers in high-curiosity states than in low-curiosity states. Moreover, if older adults perceive curiosity as less significant, younger adults may show greater memory advantages under high-curiosity conditions. Regarding memory for incidental face encoding, we hypothesize that younger adults will exhibit better memory for incidental faces in high-curiosity conditions compared to low-curiosity conditions, as they are likely to attribute greater significance to curiosity than to valence. Instead, we expect older adults to be more influenced by affective information, given that valence is generally regarded as more meaningful in this age group. If valence influences memory performance in older adults, we predict enhanced memory for both positive and negative faces compared to neutral ones, along with a typical positivity bias, characterized by better memory for positive faces relative to negative ones (Fairfield et al., 2022).

2.2 Materials and Methods

2.2.1 Participants

The study involved 45 younger adults (mean age = 26.38, SD = 4.44) and 45 older adults (mean age = 65.67, SD = 7.36) recruited from Chieti and Pescara, Italy. Our sample size was imposed by resource constraints (Lakens, 2022). Before beginning the experimental session, all participants completed the forward and backward digit span of the Wechsler Adult Intelligence Scale-Revised (WAIS-R; Wechsler, 1987), the Positive and Negative Affective Scale (PANAS; Watson et al., 1988) to assess current mood, and the FAS test for verbal fluency (Spreen & Strauss, 1991). Older adults were assessed for general cognitive functioning using the Mini-Mental State Examination (MMSE; Folstein et al., 1975).

	Younger = 45 (31 F)		Older = 45 (21 F)	
	M	SD	M	SD
Age group	26.34	4.49	65.67	7.36
Years of education	16.27 ***	2.67	13.08	5.09
PANAS pos	32.52	7.09	31.66	5.76
PANAS neg	22.82	6.89	17.30	5.08
Digit Span Forward	7.68	2.26	6.82	1.69
Digit Span Backward	6.95	2.31	5.24	1.84
FAS	36.41 ***	8.61	28.79	6.53
MMSE	-	-	29	1.17

Table 2.1 - Neuropsychological and demographic data.

*Note: Positive and Negative Affect Schedule (Watson et al., 1988); Digit Span-Forward and the Digit Span-Backward (Wechsler, 1987); FAS (Spreen & Strauss, 1991) and Mini Mental State Examination (Folstein et al., 1975). *** = $p < 0.001$.*

While differences were observed between younger and older adults in terms of years of education and verbal fluency, these disparities are very typical of the older Italian population. Importantly, MMSE results indicated that none of the older participants exhibited significant cognitive impairments. All participants reported good physical and mental health, no known memory issues, and normal or corrected-to-normal vision. Exclusion criteria included a history of severe head trauma, stroke, neurological disorders, major illnesses, or substance or alcohol abuse. The study received approval from the Ethics Committee of the Department of Psychological, Health, and Territorial Sciences, and all participants provided written informed consent in accordance with the Declaration of Helsinki (World Medical Association, 2013) before participating. Details regarding neuropsychological and demographic characteristics are reported in *Table 2.1*.

2.2.2 Materials

A total of 104 trivia questions and their corresponding answers were selected from Galli et al. (2018). These were translated into Italian and evaluated for curiosity levels by separate groups of younger and older adults using a 6-point Likert scale. From these 104 trivia questions, 72 were chosen to ensure equal distribution across curiosity levels.

For incidental stimuli, 108 faces were selected from the FACES database (Ebner et al., 2010a). These included colored, frontal-view photographs composed of 36 negative, 36 neutral, and 36 positive faces. Within each valence category, half of the faces were males and the other half females, with an equal split between older and younger adults. Of these, 72 faces (24 positive, 24 negative, and 24 neutral) were used during the study phase for incidental encoding, while the remaining 36 faces (12 positive, 12 negative, and 12 neutral) were reserved as novel stimuli for the test phase. Additionally, four practice faces and four trivia questions with corresponding answers were included to familiarize participants with the experimental procedure. These practice items were excluded from the main experimental session. To ensure a balanced design, the pairing of trivia questions with faces was counterbalanced across participants, and the stimuli was presented in a randomized order.

2.2.3 Procedure

Study Phase

The experimental task was conducted using E-Prime software (Taylor & Marsh, 2017). The study phase was divided into two distinct blocks, each comprising 36 trials with an equal distribution of 12 face stimuli per valence category (positive, neutral, and negative). Each trial began with a fixation cross displayed on a gray background for 500 milliseconds. Following this, participants were presented with a trivia question for 5000 milliseconds. Subsequently, a fixation cross reappeared for another 500 milliseconds before a face stimulus was shown. Participants were instructed to verbally evaluate whether the individual depicted in the image would likely know the answer to the trivia question. This task was designed to ensure that participants encoded face stimuli. A researcher recorded participants' responses using a predefined scoring protocol. After viewing the face stimulus, participants were prompted to indicate their level of curiosity about the trivia answer using a Likert scale ranging from 1 (not at all curious) to 6 (very curious). This rating was completed using the keypad. Following another 500-millisecond display of a fixation cross, the correct trivia answer appeared on the screen for 2000 milliseconds. Lastly, participants indicated whether they already knew the answer to the trivia question (YES/NO) by pressing x or z on the keyboard (see *Figure 2.1* for an example of a trial). The full study phase, including both blocks, lasted approximately 30 minutes. This was followed by a 15-minute rest period before proceeding to the test phase.

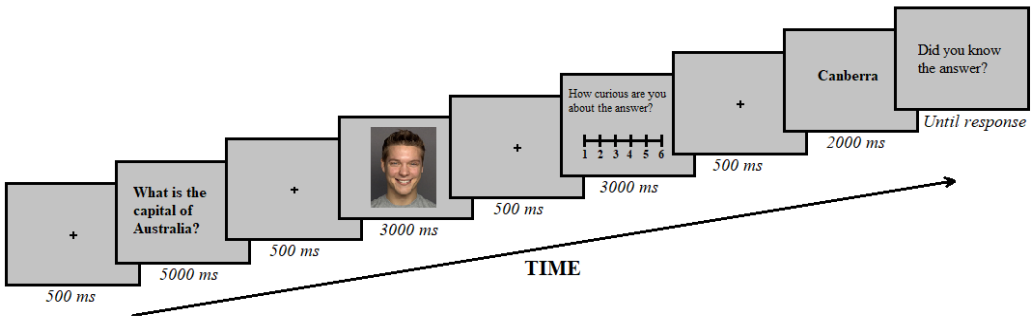

Figure 2.1 - Schematic illustration of the experimental procedure.

Test Phase

The test phase assessed memory performance for both trivia answers and face recognition. Participants were provided with a comprehensive list of the 72 trivia questions presented during the study phase and were instructed to write down as many correct answers as they could recall.

For the face recognition component, participants were shown a total of 108 face stimuli. This included 72 faces from the study phase (24 for each valence: positive, neutral, and negative) and 36 new faces (12 per valence category). Participants were instructed to indicate whether the face had been presented before (YES/NO) by pressing one of two keys on the computer keyboard (z = yes; x = no).

2.3 Results

The data analyses were conducted using Statistica 8.0 software (Weiß, 2007). In alignment with prior research, curiosity ratings were categorized into two levels: ratings of 1, 2, and 3 were classified as low curiosity, while ratings of 4, 5, and 6 were considered high curiosity (Galli et al., 2018). For the analysis, only trials where participants indicated they did not know the trivia answer were included. Memory performance for each participant was assessed by calculating the percentage of correctly recalled trivia answers and mean accuracy scores for face recognition, defined as the difference between hits and false alarms (FA) across all conditions. Subsequently, two separate General Linear Models (GLMs) were employed: one for trivia recall and one for face recognition. These models included Curiosity (two levels: high and low) and Valence (three levels: negative, neutral, and positive) as within-subject factors, while Group (two levels: younger and older) as a between-subjects factor.

2.3.1 Trivia Recall

The analyses revealed no main effect of Group (p = 1.0), indicating that the recall of trivia answers was comparable between younger and older participants. Similarly, there was no significant main effect of Valence (p = 0.425). However, a significant main effect of Curiosity was observed ($F(1,88) = 46.601$, $p < 0.001$, $\eta_p^2 = 0.346$), revealing that memory performance for trivia answers improved as curiosity levels increased in both of age groups (see *Figure 2.2*). The two-way and three-way interactions were not significant (all $p \geq 0.695$).

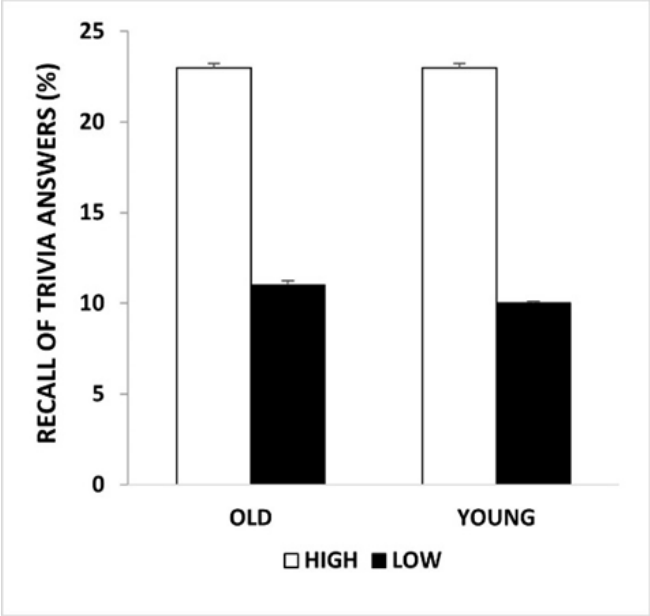

Figure 2.2 - Recall of trivia answers: memory performance for levels of curiosity in young and older adults.

2.3.2 Face Recognition

The analyses revealed a significant main effect of Group ($F(1,88) = 27.724$, $p < 0.001$, $\eta p2 = 0.240$, with a power to detect the effect of 0.999), indicating that younger participants demonstrated greater accuracy in comparison to older participants. Additionally, a significant main effect of Curiosity was observed ($F(1,88) = 4.7339$, $p = 0.03$, $\eta p2 = 0.051$, with a power to detect the effect of 0.576), showing that accuracy improved as curiosity increased (see Figure 2.3). However, no main effect of Valence was found ($p = 0.368$). Furthermore, the two-way and three-way interactions were not significant (all $p \geq 0.314$).

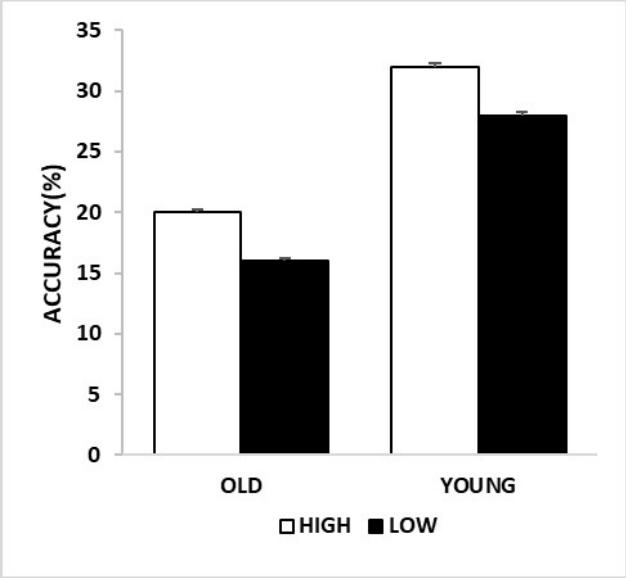

Figure 2.3 - Accuracy for memory of faces: memory performance for levels of curiosity in young and older adults.

2.5 Discussion

While prior research has indicated that normal aging is linked to a reduction in curiosity (Robinson et al., 2017), curiosity may still play a crucial role in preserving cognitive function, as well as mental and physical health, in older adults. This study investigated how curiosity affects long-term memory for trivia answers and implicit memory for faces with positive, negative, and neutral valence in both younger and older adults. In line with studies in the literature, we found that curiosity enhanced memory for trivia answers in both younger (Gruber et al., 2014; Kang et al., 2009; Marvin & Shohamy, 2016; Mullaney et al., 2014) and older adults (Galli et al., 2018), suggesting that the positive effects of curiosity on memory are maintained across the aging process. Notably, older adults experienced benefits that elevated their performance to levels comparable to younger adults. Additionally, memory for unrelated faces encountered during the study phase was also positively influenced by curiosity (Galli et al., 2018).

Interestingly, no valence- related effects on memory performance were identified, suggesting that curiosity might serve as a more potent motivational driver for memory than valence. Previous research on emotion and memory (Mather & Carstensen, 2005a) have emphasized that, although older adults show declines in cognitive control, emotion regulation abilities and memory for affective information seem to remain intact. Indeed, age does not appear to impair the processing of affective information, with evidence consistently showing that both younger and older adults remember affective content better than neutral content (Padulo et al., 2021). Furthermore, a body of research has revealed age-related patterns in memory for emotional information, such as older adults exhibiting a "positivity effect" a tendency to recall positive information more effectively than negative or neutral information (Ancoli-Israel et al., 2003; Fairfield et al., 2022; Fung & Carstensen, 2003; Kensinger & Schacter, 2008).

Several factors may explain the absence of valence effects in incidental face memory. First, the evaluation task (“Do they know the answer?”) that intervened between the incidental face stimuli and the trivia answers could have disrupted or overshadowed valence effects. The impact of curiosity on incidental memory for

faces appears to be linked to factors such as curiosity satisfaction (Marvin & Shohamy, 2016), surprise (Baranes et al., 2015), or interest following the presentation of the answer (McGillivray et al., 2015). These influences may have driven participants to prioritize knowledge-seeking behaviors over motivations tied to affective significance. Additionally, arousal effects, which could obscure valence influences, cannot be ruled out. The selected faces were sourced from the FACES database (Ebner et al., 2010), which does not provide specific arousal ratings for its stimuli.

From the perspective of the socioemotional selectivity theory (SST), positivity biases are the result of age-related shifts in goal priorities, which enhance the focus on emotionally rewarding information in attention and memory processes. Cognitive resources are essential for directing information processing toward task-relevant stimuli and filtering out less relevant inputs (Mather, 2006). In situations where tasks demand high levels of cognitive processing, older adults may allocate resources away from affective stimuli (English & Carstensen, 2015), thereby reducing or eliminating specific valence effects.

Furthermore, the prioritization of positivity in attention aligns with chronically activated goals centered on emotional meaning and satisfaction, which older adults tend to emphasize (Carstensen, 1992; Fairfield et al., 2013). This positivity effect reflects an adaptive adjustment in goal-directed cognitive processing. In this study, the encoding of faces occurred incidentally, and participants were not informed that their memory for faces would be tested. This design may have led older adults, whose cognitive resources are more constrained, to concentrate their available resources on the explicit memory task (Labouvie-Vief et al., 2010).

Nevertheless, the current study is not without limitations. Although the findings indicate that curiosity has a positive effect on memory, other factors could have contributed to the observed memory enhancement. For instance, the improvement in memory might be attributed to heightened attention or arousal elicited by the trivia questions rather than to curiosity itself. Similarly, the benefits could arise from an increase in tip-of-the-tongue experiences, which are associated with the trivia questions designed to provoke curiosity (Metcalfe et al., 2017). Additionally, other

constructs conceptually linked to curiosity, such as the need for cognition, interest, or task difficulty, may also have influenced the observed outcomes.

Future research could improve upon the current design by including measures of attention and arousal, such as eye-tracking and/or biofeedback, or by directly manipulating curiosity and similar constructs within the same experimental design.

2.6 Conclusions

Although curiosity tends to decline with normal aging, it may remain a crucial factor in supporting cognitive function, mental well-being, and physical health. This study demonstrated that curiosity positively influenced both memory for trivia answers and memory for unrelated faces. These findings highlight the importance of incorporating motivational factors, particularly curiosity, when studying memory performance across different age groups. Future research should explore the effects of curiosity on incidental memory involving a broader range of stimuli. The implications of such investigations could extend across various domains and warrant testing in real-world contexts. For example, in clinical contexts, recent interventions for older adults with cognitive impairment often include elements such as personalization, novelty, and interactivity, which can implicitly foster curiosity. For instance, biographically tailored robot-assisted games (Catricalà et al., 2023), AI-driven reminiscence systems using personal photographs (Carós al., 2020), and immersive virtual nature environments (Kalantari et al., 2022) have all demonstrated positive effects on engagement, emotional response, and cognitive stimulation. However, these approaches rarely measure curiosity directly or ground their methods in theoretical models of curiosity (e.g., Loewenstein, 1994; Litman, 2005; Gruber et al., 2014). In contrast, explicit curiosity-based interventions are designed to activate information-seeking behaviors and reward circuits through novelty, uncertainty, and meaningful exploration. These are well established in younger populations but underexplored in the context of pathological aging.

One promising direction involves adapting curiosity-enhancing strategies for individuals with pathological cognitive decline, such as those with Alzheimer's disease. For example, structured activities based on emotionally salient and personally meaningful stimuli, such as familiar photographs, music, or scents, can

be paired with open-ended prompts that invite exploration and imaginative engagement. Rather than focusing solely on memory recall, this approach encourages active participation through questions like “What do you think this reminds you of?” or “Who might have used this object?” Such methods may help preserve a sense of agency and stimulate residual cognitive and emotional pathways, suggesting a novel avenue for therapeutic intervention in neurodegenerative conditions. Bridging implicit and explicit approaches to curiosity could therefore enrich cognitive and psychosocial care for older adults and open new perspectives in the development of motivationally grounded interventions.

CHAPTER 3 – VALIDATION OF THE MAGICCATS DATASET IN THE ITALIAN CONTEXT: A STUDY ON EPISTEMIC EMOTIONS

3.1 Background & Summary

Philosophers and psychologists classify interest, surprise, and curiosity as epistemic emotions, due to their inherent connection to knowledge and understanding (Deigan & Piñeros Glasscock, 2024; Morton, 2009). These emotions are closely tied to cognitive processes that drive individuals to seek, acquire, and assimilate new information, making them essential for learning and intellectual growth (Oudeyer et al., 2016; Tyng et al., 2017). Indeed, curiosity, interest, and surprise play unique but interconnected roles in knowledge acquisition and they influence not only what we choose to learn but also how deeply we process information, serving as a bridge between motivation and cognition (Dietrich et al., 2020; Nerantzaki et al., 2021).

Although these three epistemic emotions may appear similar, they differ in their specific mechanisms. Curiosity is an intrinsic motivation that drives individuals to alleviate the discomfort of an "information gap" by actively seeking additional information or facts. It is often linked to a psychological interest in novel, surprising, or moderately complex activities and stimuli, particularly those that highlight gaps in personal knowledge (Litman, 2005; Litman & Jimerson, 2004; Litman & Spielberger, 2003; Loewenstein, 1994). Instead, interest is conceptualized in various ways: as an emotion (Silvia, 2006), as a relationship between a person and an object (Krapp, 2007), and as a motivational variable that influences learning and development (Hidi & Renninger, 2006). The terms curiosity and interest are often used interchangeably; in fact, they are frequently treated as synonyms in dictionaries. However, the distinction between curiosity and interest lies in their relationship to knowledge: curiosity is typically associated with a moderate level of information about something or someone (Litman & Jimerson, 2004), whereas interest can persist across both low and high levels of knowledge (Hidi & Renninger, 2006). Additionally, curiosity and interest differ in their underlying goals: curiosity is primarily driven by the need to reduce uncertainty and fill information gaps (Loewenstein, 1994), while interest is more closely tied to sustained attention and the pursuit of enjoyment (Hidi & Renninger, 2006).

Surprise, elicited by unexpected or novel events, serves as a key mechanism for cognitive re-evaluation and the updating of beliefs (Reisenzein et al., 2019). It arises from a mismatch between expectations and reality, prompting attentional and memory processes that facilitate the integration of new information (Meyer et al., 1997; Reisenzein et al., 2019). As a driver of adaptive learning, surprise not only motivates exploratory behaviour to resolve uncertainty but also plays a pivotal role in decision-making by recalibrating belief systems in dynamic environments (Hohwy, 2013; Itti & Baldi, 2009). Together, these emotions enhance attentional focus, promote deeper cognitive processing, and improve memory encoding (Fandakova & Gruber, 2021; Kang et al., 2009; McGillivray et al., 2015).

Epistemic emotions not only bridge motivation and cognition but also influence the neural mechanisms underlying learning. Research has shown that curiosity activates regions of the brain associated with the reward system, including the striatum and prefrontal cortex, both involved in motivation and reinforcement learning (Gruber et al., 2014; Kang et al., 2009). For example, Kang et al. (2009) demonstrated that epistemic curiosity, elicited through trivia questions, activates the nucleus caudatus and other reward-related cortical areas, enhancing memory retention for information presented during high curiosity states. The activation of the reward system not only fosters intrinsic motivation but also predicts the degree of memory improvement. Similarly, findings from Gruber et al. (2014) revealed that high curiosity states enhance activity in the dopaminergic circuit, which in turn strengthens memory encoding in the hippocampus. Importantly, this mechanism applies not only to information directly relevant to the source of curiosity but also to incidental materials encountered during high curiosity states. Interest and surprise further contribute to these neural mechanisms by modulating attentional and emotional processing. Interest sustains effort and persistence in cognitively demanding tasks, activating areas of the brain associated with executive function and sustained attention (Mannarelli et al., 2023; Silvia, 2006). Surprise engages the amygdala and hippocampus, key regions essential for memory processes. When confronted with unexpected stimuli, the brain reallocates attentional resources, enabling the integration of new and potentially significant information into existing cognitive frameworks (Danek & Wiley, 2017; Ranganath & Ritchey, 2012).

Together, these neural responses underscore the crucial role of epistemic emotions in optimizing cognitive processes.

Despite their significance, studying curiosity, surprise, and interest in controlled experimental settings has proven challenging, especially in the choice and design of stimuli to elicit these emotions. Traditional approaches often relied on perceptual puzzles and visual ambiguities to investigate how individuals respond to incomplete or ambiguous stimuli. Classic studies introduced ambiguous figures, such as Rubin's vase or the Necker cube, which create perceptual conflicts and stimulate cognitive efforts to reconcile competing interpretations (Berlyne, 1960; Gregory, 1975). Over time, researchers expanded their focus to include more dynamic perceptual challenges, such as visual illusions, ambiguous images and virtual environments to investigate how curiosity and interest operates in resolving perceptual ambiguity (Hidi & Renninger, 2006; Jepma et al., 2012; Long & Toppino, 2004). Among these, trivia questions have become one of the most widely used stimuli in experimental research on epistemic emotions due to their simplicity and adaptability. Trivia questions are particularly effective in creating information gaps, a core driver of curiosity, by presenting participants with knowledge they lack but find interesting or relevant (Loewenstein, 1994). This approach has allowed researchers to systematically manipulate curiosity levels and study its effects on learning, memory, and decision-making (Gruber et al., 2014; Kang et al., 2009; Marvin & Shohamy, 2016; Metcalfe et al., 2017; Mullaney et al., 2014; Murayama & Kuhbandner, 2011b; Padulo et al., 2022; Wade & Kidd, 2019). However, despite their utility, trivia questions are not without limitations. A key issue is their dependence on participants' prior knowledge and interest in the topics presented, which can lead to variability in curiosity responses (Padulo et al., 2022). Those with extensive knowledge may experience fewer information gaps, reducing curiosity, while individuals with limited background knowledge might find the questions irrelevant or overly challenging, resulting in disengagement. Additionally, questions on unappealing topics are less likely to elicit meaningful engagement, as personal interest plays a significant role in shaping responses (Loewenstein, 1994). Moreover, trivia-based tasks often focus on declarative factual knowledge, overlooking curiosity-driven scenarios that involve procedural learning or

conceptual understanding (Litman, 2005). This limitation reduces their ability to capture the dynamic and multifaceted nature of curiosity, which often involves active exploration and hypothesis testing in real-world contexts (Metcalfe & Xu, 2018). Furthermore, the static nature of trivia questions lacks the interactivity needed to explore curiosity as an evolving process, which is better suited to dynamic problem-solving tasks or adaptive learning environments (Murayama & Kuhbandner, 2011b). Lastly, trivia tasks can unintentionally provoke negative emotions, such as frustration or anxiety, especially when questions are perceived as too difficult or are associated with intellectual evaluation rather than playful exploration (Fastrich et al., 2018; Kang et al., 2009). These emotional responses may undermine the intrinsic motivation that curiosity seeks to foster, complicating the interpretation of experimental results.

Recognizing these limitations, an alternative and innovative approach is the Magic Curiosity Arousing Tricks (MagicCATs), dataset of 166 magic trick video clips specifically designed to evoke curiosity, surprise, and interest in controlled experimental settings (Ozono et al., 2021). Using MagicCATs for the study of epistemic emotions offers several methodological advantages. Firstly, the use of magic trick video clips ensures consistency in stimulus presentation, minimizing variability across experimental sessions and enhancing the reliability of experimental findings (Ozono et al., 2021). This standardized approach makes it easier to compare results across different studies and settings. Secondly, the ecological validity of MagicCATs represents a significant advancement in curiosity research. Unlike static stimuli, magic tricks enables the simultaneous elicitation of multiple epistemic emotions, fostering a rich and dynamic emotional experience that closely mirrors real-world scenarios (Bagienski, 2022). In fact, due to the violation of expectations, magic tricks create conflict between belief and reality, driving viewers to seek an explanation for the apparently impossible events (Danek et al., 2014; Kuhn et al., 2008). Additionally, the engaging and immersive nature of magic tricks helps sustain participants' attention over extended periods. This addresses a common limitation of traditional curiosity-inducing stimuli, such as trivia questions or puzzles, which may struggle to maintain prolonged focus. MagicCATs also facilitate the study of emotional interactions and their effects on

cognition. By integrating curiosity, surprise, and interest into a single controlled stimulus set, researchers can explore how these emotions interact and influence outcomes such as learning, memory, and decision-making. Finally, the standardization and reproducibility of MagicCATs ensure that they can be reliably employed across studies, fostering comparability, and supporting the development of cumulative research in the field of epistemic emotions and curiosity.

Given the importance of MagicCATs in advancing research on epistemic emotions and considering that emotional and cognitive responses to stimuli are often mediated by cultural frameworks that influence interpretations of novelty, violations of expectations, and complexity (Kitayama & Uskul, 2011), this study aims to validate and contextualize the dataset within an Italian sample, contributing to a deeper understanding of how curiosity, surprise, and interest are elicited across cultural contexts.

3.2 Materials and Methods

3.2.1 Participants

A total of 867 participants from central and southern Italy were initially recruited for the study. Participants were recruited through word of mouth, social media, and posted advertisements. Before the experimental session, participants aged 65 or older completed the Montreal Cognitive Assessment (MoCA) (Conti et al., 2015), and only those with scores above 24, reflecting the absence of significant cognitive impairments, were included in the study (Ilardi et al., 2023). Neuropsychological and demographic data are reported in *Table A1 (Appendix)*. All participants provided informed consent in accordance with the Declaration of Helsinki (World Medical Association, 2013), and the study received approval from the Institutional Review Board of Psychology (IRBP) of Department of Psychology, "G. d'Annunzio" University of Chieti-Pescara. In line with the study by Ozono and colleagues (2021), a rigorous screening process was conducted to ensure data integrity and reliability before proceeding with the main analysis, resulting in the exclusion of 213 participants who fell into the following categories. First, participants who took significantly longer than average to complete the experiment (more than +2 SD) were excluded, although no participant was excluded for

completing the experiment in less than -2 SD of the average time. Next, participants who gave identical ratings to more than three questions or displayed systematic errors across all trials were excluded. Additionally, we removed participants who responded "no" to the question assessing the "clarity of the trick" for each video, which evaluated whether they understood the nature of the perceptual illusions presented (see below). This comprehensive exclusion process resulted in a final sample of 654 participants, comprising 160 males and 494 females (mean age = 36.28, SD = 17.03, range = 18–86).

3.2.2 MagicCATs stimuli

The MagicCATs (Magic Curiosity Arousing Tricks) dataset, developed by Ozono et al. (2021), was employed as experimental stimuli in our study. This collection, as designed by Ozono et al. (2021), consists of 166 short magic trick video clips performed by professional magicians, specifically designed to elicit varying levels of epistemic emotions such as surprise, curiosity, and interest. The magicians carefully selected tricks to include a wide variety of materials, such as playing cards, coins, and sponges, and employed diverse techniques, including vanishing, transportation, and prediction. Since previous research on curiosity and interest has often focused on comparing stimuli that elicit either high or low levels of these emotions (Fastrich et al., 2018; Gruber et al., 2014; Kang et al., 2009), achieving sufficient inter-stimulus variability was essential. This variability was ensured by incorporating tricks that were not only highly surprising and engaging but also those that were relatively less impactful. Each video was carefully edited to ensure consistency in visual and technical attributes, including a standardized dark background, a resolution of 720 × 404 pixels, and framing that emphasized the trick. Audio was removed, and the magicians' faces were obscured as much as possible to minimize distractions. Additionally, English subtitles were added where necessary. For our study, these subtitles were translated into Italian. In some videos, subtitles were essential to understanding the magic trick, for instance, in cases where the magician asked someone to perform an action, such as writing on a banknote or thinking of a number. The dataset includes both long and short versions of 21 selected clips, providing flexibility for various experimental designs. Video

durations range from 8 to 155 seconds, with a mean length of 37.3 seconds (median = 31, SD = 23.5). Excluding the long versions, video durations range from 8 to 105 seconds, with a mean length of 33.1 seconds (median = 30, SD = 19.8).

Following the methodology established by Ozono et al. (2021), the 166 magic trick video clips were divided into nine distinct lists (Lists 1–9) to ensure systematic and balanced exposure across participants. Lists 1 and 2 were composed of 21 videos each, including both long and short versions of selected clips. To prevent overlap, the short version of a video was assigned to one list, while the corresponding long version was placed in the other. This careful distribution ensured that the total duration of these lists remained comparable, ranging from 16 to 17 minutes. The remaining 124 video clips were distributed across Lists 3–9, with each list containing 17 or 18 different clips, resulting in viewing durations between 9 and 10 minutes. The randomization of the presentation order within each list was implemented to minimize potential sequence effects and maintain stimulus variability.

Details of the MagicCATs stimuli can be found in *Table A2 (Appendix).*

A sample video is available at the following URL: https://youtu.be/ehgSKYxVL3M.

3.2.3 Normative rating procedure for MagicCATs

In summary, our database consists of nine different lists for a total of 166 videos. Each participants viewed only 2 of the 9 lists, with the presentation order of the videos randomized within each list. For each video clip, participants were asked to evaluate each video based on five dimensions: (a) whether the trick was clear and understandable (clarity of the trick), (b) the level of surprise elicited by the magic trick (surprise in response to the trick), (c) their interest in the trick, that is the participants' level of engagement with the magic trick (interest in the trick), (d) their confidence in deducing the solution, in other words, the perceived ability to solve the magic trick (confidence in the solution), and (e) their curiosity about how the trick was performed, (curiosity in the solution). Clarity of the trick was rated using a binary response scale (Yes/No) to assess participant comprehension of the magic trick and to be used as a criterion for excluding ambiguous responses. The other

four dimensions were rated on 10-point Likert scales, with 1 indicating "not at all" and 10 indicating "very much".

At the end of the session, participants provided additional ratings, reporting their general interest in magic tricks (how interested in the magic tricks) on a 10-point scale (1 = not at all, 10 = very much) and indicating whether they performed magic tricks themselves (performing magic tricks by themselves), rated on a 3-point scale (1 = not at all, 2 = a little bit, 3 = frequently). All participants confirmed they never seen this video before.

3.3 Data Records

The results of the MagicCATs Italian validation are organized into separate tables, each documenting distinct aspects of the dataset.

Table A1 (Appendix) contains neuropsychological and demographic data of participants. This dataset records variables such as each participant's unique ID, gender, age, and their Montreal Cognitive Assessment (MoCA) score, which was collected only for participants aged 65 and older. Additionally, the file includes self-reported measures of interest in magic tricks (Likert scale 1-10) and whether participants actively engage in performing magic tricks themselves (Likert scale 1-3).

Table A2 (Appendix) describes the details of the MagicCATs stimuli. It includes the name of the trick, the phenomena category of the magic trick performed, a brief description of the trick, the materials used, the duration, and the list ID in which the video is included. The table is reproduced from Ozono et al. (2021) under the Creative Commons Attribution license (CC BY).

Table A3 (Appendix) includes the rating Means and SD for individual magic tricks in MagicCATs, as well as the number of participants who successfully understood each magic trick video.

Finally, *Table 3.1* documents the distribution of the lists among participants, including the mean age, standard deviation of age, the number of female participants, and the number of male participants.

Together, these files provide a complete and transparent account of the data collected during the MagicCATs Italian validation, ensuring accessibility for replication and further analysis.

Table 3.1 Distribution of the lists among participants.

List ID	N of participants	Mean Age	SD Age	N. of females	N. of males
List1	103	35.35	16.68	79	24
List2	108	34.88	17.23	79	29
List3	113	34.10	16.23	92	21
List4	113	36.35	17.71	87	26
List5	110	37.55	17.61	87	23
List6	109	36.36	16.38	77	32
List7	109	38.05	17.53	80	29
List8	103	35.59	16.14	83	20
List9	113	37.59	18.26	89	24

Figure 3.1 - Each participants viewed 2 of the 9 lists, with the presentation order of the videos randomized within each list.

3.4 Technical Validation

The experimental procedure was administered using a laptop computer running E-Prime 3.0 software (Taylor & Marsh, 2017), which controlled the randomization of stimulus presentation as well as the collection of rating responses. Sessions were conducted individually in a laboratory room under similar lighting conditions, and the entire task lasted a maximum of 30 minutes. Each participant viewed between 34 and 39 video clips, randomly selected from two of the nine predefined lists. To avoid redundancy, participants were not assigned both Lists 1 and 2, as these contained the same magic tricks in different lengths (long and short versions). Each trial began with a preparatory slide displaying the instruction (“Please see the video and give a rating”). This slide remained visible until the experimenter confirmed that the participant had understood the task. The video was then presented for its full duration. Immediately after the video concluded, participants provided five distinct evaluations in the same order: clarity of the trick, surprise in response to the trick, interest in the trick, confidence in the solution, and curiosity about the solution. The clarity of the trick was rated using a binary response scale (Yes/No) by pressing the corresponding button, allowing the assessment of participants' comprehension of the magic trick and the exclusion of ambiguous responses from

the analysis. Ratings for the other dimensions were collected using a 10-point scale, where participants selected a value by pressing the corresponding button. This ensured consistency and comparability of responses across participants and videos. *Table A3 (Appendix)* shows the mean ratings for each video.

3.5 Usage Notes

The Magic Curiosity Arousing Tricks (MagicCATs) dataset, now validated within an Italian cultural context, provides a versatile and ecologically valid tool for investigating epistemic emotions, particularly curiosity, surprise, and interest, in experimental research. Its standardized and dynamic video-based format enables researchers to explore how these emotions influence core cognitive functions, such as attention, learning, memory encoding, and information retention. The validated Italian version of MagicCATs allows for culturally sensitive research designs and cross-cultural comparisons. Its use is especially well-suited for experimental paradigms aimed at examining how emotional engagement fosters deeper cognitive processing, supporting findings that link heightened curiosity to improved memory consolidation and retrieval (Gruber et al., 2014; Kang et al., 2009). Additionally, the capacity of these stimuli to reliably elicit surprise and interest enables researchers to study how these emotions contribute to sustained attention and motivational states (Reisenzein et al., 2019; Silvia, 2006). Beyond cognitive psychology, MagicCATs holds promising applications in the field of neuroscience. The dataset can be integrated with neuroimaging methods, such as functional magnetic resonance imaging (fMRI), electroencephalography (EEG), or pupillometry, to investigate the neural circuits and temporal dynamics associated with epistemic emotions. For example, future studies could explore how surprise and curiosity modulate activity in reward-related brain regions (e.g., the striatum, prefrontal cortex), or how these states impact memory-related structures such as the hippocampus. The engaging and immersive nature of the stimuli also makes MagicCATs particularly relevant for mental health research. Curiosity has been linked to resilience, psychological flexibility, and adaptive coping mechanisms (Kashdan et al., 2004). The dataset could be used to examine the relationship between reduced curiosity and affective disorders such as depression, anxiety, or

ADHD, potentially informing emotion-based interventions or cognitive-behavioral training programs. Moreover, MagicCATs enables the investigation of age-related differences in the experience and impact of epistemic emotions. Since curiosity and surprise may differentially affect memory and learning in younger vs. older adults, the dataset offers a promising avenue for studying cognitive aging and for identifying emotion-driven strategies to mitigate age-related decline (Fandakova & Gruber, 2021; McGillivray et al., 2015).

In summary, the Italian validation of the MagicCATs dataset marks a significant step forward in expanding its cross-cultural applicability. Its standardized format, rich emotional content, and flexible design support a wide range of applications across experimental psychology, neuroscience, education, and clinical research. MagicCATs serves as a robust platform for advancing our understanding of how epistemic emotions interact with cognition and behavior across the lifespan.

CHAPTER 4 – THE CURIOUS MIND: HOW IT IMPACTS MEMORY IN YOUNGER AND OLDER ADULTS

4.1 Introduction

Curiosity is an intrinsic motivation to acquire knowledge or insights about novel or uncertain information (Berlyne, 1954; Loewenstein, 1994). Unlike extrinsic motivation, driven by rewards or social pressures, curiosity is elicited by the pleasure of discovery and understanding (Ryan & Deci, 2000a). This is an epistemic emotion that motivates people to learn new things, seek new experiences, and expand their horizons (Kashdan & Silvia, 2009b). Over the years, a growing body of research has emphasized the critical role of curiosity in fostering learning, memory, and cognitive development (Gruber & Fandakova, 2021; Oudeyer, 2022; Sivashankar et al., 2024). However, while substantial research has examined curiosity's role in memory among younger populations, its effects on aging remain largely underexplored (Galli et al., 2018; Padulo et al., 2022). Understanding whether curiosity maintains its cognitive benefits across the lifespan is essential for identifying potential interventions to support learning and memory in older adults.

Neuroscientific research has demonstrated that curiosity is closely linked to brain circuits involved in motivation, reward, and memory. Dopaminergic activity, particularly in the ventral tegmental area (VTA), has been found to underlie motivational states, including curiosity, by reinforcing information-seeking behaviors (Schultz et al., 1997). Similarly, the hippocampus plays a key role in detecting and encoding novel stimuli, which are integral to curiosity-driven learning (Ranganath & Rainer, 2003). These findings suggest that curiosity is not only a psychological phenomenon but also a neurobiological mechanism that enhances cognitive engagement and information retention. Further evidence supporting the role of curiosity in memory processing comes from functional magnetic resonance imaging (fMRI) studies. Kang et al. (2009) demonstrated that curiosity activates reward-related brain regions, including the caudate nucleus and striatum, supporting the information-gap theory, which posits that curiosity arises from a discrepancy between known and unknown information (Loewenstein, 1994). Moreover, Gruber et al. (2014) found that high curiosity states enhance memory

retention not only for information directly related to curiosity but also for incidental material encountered in close temporal proximity. These findings suggest that curiosity optimizes cognitive resources, facilitating both focused learning and broader information integration. Building on these insights, Gruber and Ranganath (2019) proposed the PACE framework (Prediction, Appraisal, Curiosity, and Exploration) to explain how curiosity influences learning and memory. This model integrates a network of brain regions, including the anterior cingulate cortex (ACC), responsible for uncertainty detection; the hippocampus, which processes novelty and encodes information; and dopaminergic regions, which facilitate reward anticipation and exploratory behavior.

Traditional curiosity research has often relied on trivia-based paradigms to elicit curiosity and examine its effects on memory (e.g., Galli et al., 2018; Wade & Kidd, 2019). Galli et al. (2018) found that participants who were presented with trivia questions that stimulated curiosity demonstrated improved recall of both the correct answers and incidental information encountered within the same learning session. Their findings suggest that curiosity not only enhances memory for the sought-after information but also promotes broader memory consolidation. Similarly, Wade and Kidd (2019) explored the role of information gaps in curiosity-driven learning, revealing that participants retained information more effectively when they initially experienced uncertainty about an answer. Their findings support the notion that curiosity enhances attentional focus and motivates deeper cognitive processing, leading to stronger and more durable memory traces. However, trivia-based methods present limitations, as prior knowledge and interest in trivia topics can vary significantly across participants, affecting the degree to which curiosity influences cognitive outcomes (Ozono et al., 2021; Padulo et al., 2022). Additionally, curiosity is inherently dynamic, fluctuating over time, making it difficult to systematically measure its effects on memory retention. To address these methodological challenges, Ozono et al. (2021) developed the Magic Curiosity Arousing Tricks (MagicCATs) dataset, a collection of 166 magic trick videos designed to elicit curiosity, surprise, and interest in a controlled and engaging manner. Unlike trivia-based paradigms, magic tricks create expectation violations, compelling individuals to seek explanations and engage in deeper cognitive

processing (Rensink & Kuhn, 2015). This method provides a standardized and ecologically valid way to measure curiosity-driven learning and memory in diverse populations.

Following the pilot research detailed in Chapter 3, where we validated the MagicCATs dataset in an Italian context, we aim to explore how curiosity-driven memory processes vary across younger and older adults using magic trick video clips. Prior research suggests that high-curiosity states enhance memory retention not only for curiosity-related material but also for incidental information presented in close temporal proximity. However, little is known about whether this effect persists across different age groups. Investigating these mechanisms in both younger and older adults will provide valuable insights into the role of curiosity in cognitive aging and the potential for curiosity-based interventions to support lifelong learning and memory retention.

The Present Study

In the present study, we investigated the effects of curiosity on incidental memory in both younger and older adults. For this aim, we implemented an experimental paradigm in which participants viewed a series of magic trick videos designed to elicit high levels of curiosity, immediately followed by the presentation of neutral words (study phase). Subsequently, participants' memory for these words was assessed in a recognition test (recognition phase). In addition to expecting better memory performance in younger adults, we hypothesize that high curiosity participants would demonstrate improved word recognition compared to low-curiosity participants, in both age groups, highlighting the impact of epistemic emotions on memory. Furthermore, we explored the influence of individual differences, including sociodemographic variables, personality and affective traits and divergent thinking (DT) levels, on the relationship between curiosity states and memory performance drawing on evidence that personality and cognitive traits influence curiosity-driven learning (Litman & Spielberger, 2003; Silvia, 2006). These individual difference variables were included as covariates in our analyses.

4.2 Materials and Methods

4.2.1 Participants

The study was carried out on 109 participants from central and southern Italy: 57 younger adults, aged between 18 and 28 (mean age = 20,14, SD = 2,22), and 52 community-dwelling older adults, aged between 65 and 89 (mean age = 70,90, SD = 7,00). Participants were recruited through word of mouth, social media, and posted advertisements. All participants reported good physical and mental health, with no known memory impairments and normal or corrected-to-normal vision. For older adults, cognitive functioning was assessed using the Mini-Mental State Examination (MMSE) to check for the absence of cognitive impairments (Folstein et al., 1975). Only participants with scores above 24, indicative of no significant cognitive impairment, were included in the study. All participants provided informed consent in accordance with the Declaration of Helsinki (World Medical Association, 2013), and the study received approval from the local ethical committee.

Participants completed paper-and-pencil questionnaires, including the Positive and Negative Affect Schedule (PANAS), a 20-item scale assessing both positive and negative affective states (Watson et al., 1988), the Openness to Experience dimension of the Big Five Inventory (BFI), a 10-item scale measuring openness to new ideas and experiences (John et al., 2012) and the Alternative Uses Task (AUT), a test used to assess divergent thinking by asking participants to generate alternative uses for three common objects, such as a shoe, a brick, and a newspaper (Guilford, 1967). These measures were selected to further analyze individual differences in the relationship between curiosity and memory performance. Details regarding neuropsychological and demographic characteristics are reported in *Table 4.1.*

Table 4.1 - Neuropsychological and demographic data.

	Younger adults M (SD)			**Older adults** M (SD)		
	Low curiosity N=14 (7F)	High curiosity N=43 (31F)	TOT N=57 (38F)	Low curiosity N=22 (15F)	High curiosity N=30 (20F)	TOT N=52 (35F)
Curiosity	3.73 (1.05)	6.51 (1.03)	5.82 (1.59)	3.67 (0.87)	6.72 (1.29)	5.43 (1.89)
Age	19.57 (0.85)	20.33 (2.50)	20.14(2.22)	70.41 (7.62)	71. 27 (6.60)	70.90 (7.00)
Years of education	13.14 (0.36)	13.34 (0.75)	13.30 (0.68)	11.91 (4.77)	9.97 (4.01)	10.79 (4.41)
MMSE	-	-	-	26.37 (1.64)	26.84 (1.38)	26.64 (1.50)
BFI – Openess to experience	37.93 (4.68)	37.65 (5.03)	37.72 (4.91)	36.60 (6.74)	36.97 (6.70)	36.81 (6.65)
PANAS +	28 (5.62)	31.83 (7.38)	30.90 (7.14)	33.5 (7.84)	35.87 (6.66)	34.87 (7.21)
PANAS -	26.93 (10.62)	25.60 (7.40)	25.93 (8.22)	18.59 (7.46)	22.5 (8.91)	20.85 (8.48)
AUT_Fluency	20.86 (7.47)	19.86 (9.23)	20.11 (8.78)	25.10 (17.44)	17.47 (6.46)	20.69 (12.79)
AUT_Top 2 creativity	3.71 (0.89)	3.50 (0.88)	3.55 (0.88)	3.67 (1.14)	3.24 (8.87)	3.42 (1.00)

Note: PANAS = Positive and Negative Affect Schedule (Watson et al., 1988); BFI = Big Five Inventory (John et al., 2012); MMSE = Mini-Mental State Examination (Folstein et al., 1975); AUT = Alternative Uses Task (Guilford, 1967).

4.2.2 Materials

Based on the results presented in Chapter 3, in which all magic trick videos from the MagicCATs database (Ozono et al., 2021) were evaluated by an independent Italian sample (n = 654), we selected 45 videos that elicited high levels of curiosity. Specifically, we included only videos without subtitles, lasting between 15 and 60 seconds, that were understood in at least 80% of responses and had average curiosity ratings above 6 on a 10-point Likert scale.

We selected 90 words with neutral valence from the ANEW database (Montefinese et al., 2014) controlling for word length (6 to 10 letters), familiarity, arousal, and valence. Specifically, 45 words were used in the study phase for the incidental encoding, while the remaining 45 words were used as new items for the recognition phase. The video/word pairs were counterbalanced across participants, and the stimuli presentation was randomized.

4.2.3 Procedure

The experimental procedure was administered using a laptop computer running E-Prime 3.0 software (Taylor & Marsh, 2017) which controlled the randomization of stimulus presentation and the collection of responses. Sessions were conducted individually in a laboratory room under similar lighting conditions. The entire procedure lasted a maximum of 60 minutes, consisting of 40 minutes for the study phase, 10 minutes for the Alternative Uses Task (AUT) (Guilford, 1967), a 5-minute break, and 10 minutes for the recognition phase. A 15-minute interval was introduced between the study and recognition phases to allow for memory consolidation (Dewar et al., 2012).

In the study phase, each trial began with a magic trick video clip. After a 500 ms fixation cross, a neutral word appeared for 2000 ms, and participants were instructed to read the word aloud to ensure encoding of the word stimuli. At the end of each trial, participants were asked, “How curious are you about the trick?” and rated their curiosity levels on a Likert scale from 1 (Not at all) to 10 (Very much) using the corresponding button (see Figure 1 for an example of a trial). Two versions of the experiment were created, differing in the video/word pairs.

Participants were not informed of the subsequent recognition phase, which would assess incidental memory for the presented words.

After completing the study phase, participants performed the Alternative Uses Task (AUT), a divergent thinking (DT) test of creativity. In this task, participants were asked to list alternative uses for three common objects: shoes, bricks, and newspapers, each presented for 3 minutes. Participants were audio-recorded while listing the alternative uses to ensure accurate transcription and analysis of their responses. Performance on the Alternative Uses Task (AUT) was evaluated by three trained raters, who were blind to participants' identities, using two separate indices: creativity and fluency.

Creativity was assessed using the Top 2 scoring method (Silvia et al., 2008). After completing each task, participants were asked to circle the two responses they believed were their most creative. These responses were then rated independently by the raters on a 5-point scale (1 = not at all creative, 5 = highly creative), based on the criteria proposed by Wilson, Guilford, and Christensen (1953). Specifically, responses were judged along the dimensions of uncommonness, remoteness, and cleverness, with strength in one dimension allowed to compensate for weakness in another. The creativity score for each task was computed as the mean of the ratings for the two selected responses (Wilson et al., 1953).

Fluency was operationalized as the total number of responses generated by each participant for each task, with repeated responses not counted. This score reflects participants' ideational fluency, or their ability to generate multiple, distinct ideas, regardless of creative quality.

After a 5-minute break, the recognition phase was administered. It consisted of 90 words: 45 'old' words (previously presented during the study phase) and 45 'new' words. Participants were instructed to indicate whether each word had been presented before by pressing the corresponding button ('Yes' or 'No'). See *Figure 4.1* for an example of a trial.

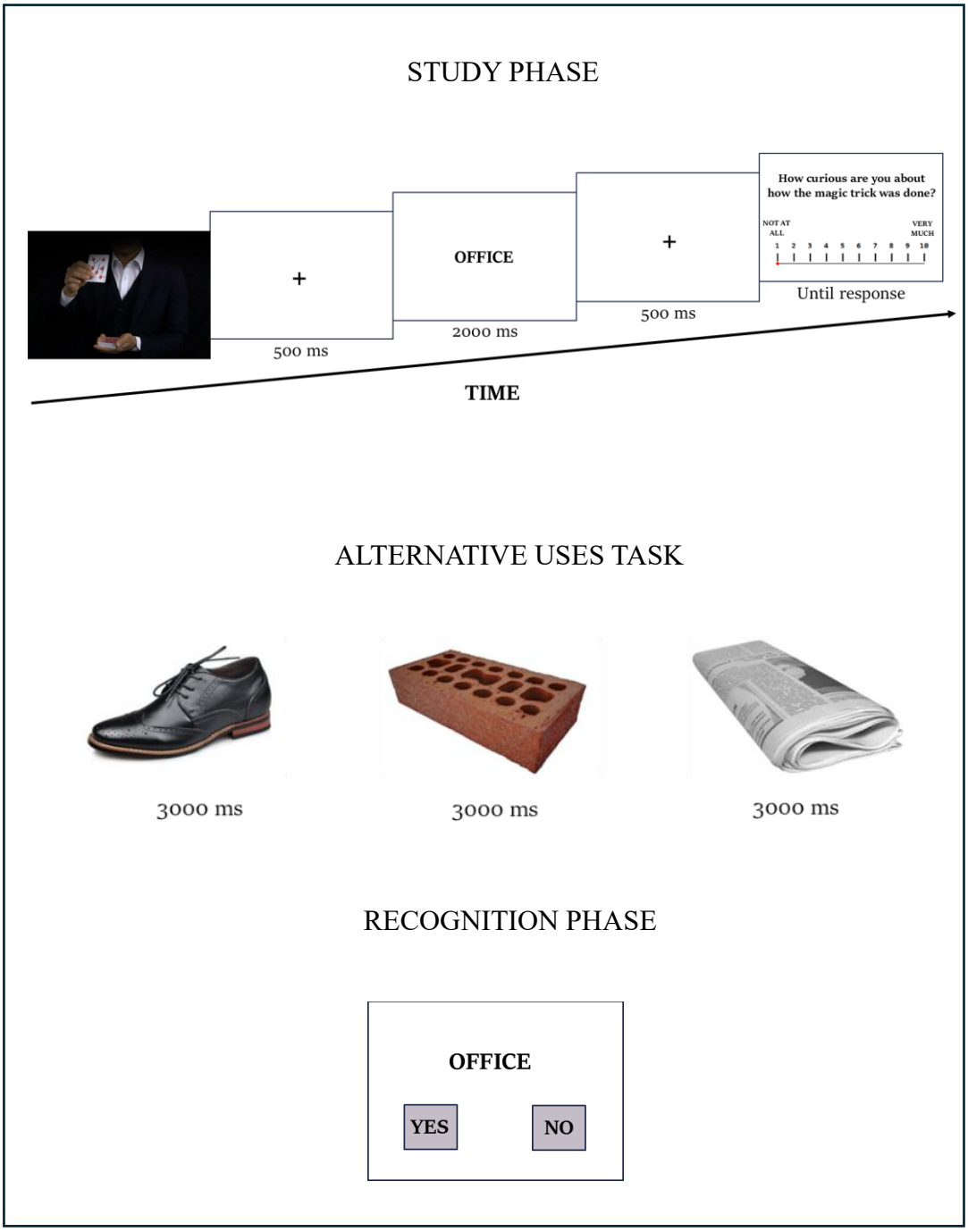

Figure 4.1 - Schematic illustration of the experimental procedure.

4.3 Results

The data analyses were conducted using Statistica 12.0 software (Weiß, 2007).

To examine the effects of curiosity on memory performance, we calculated the mean curiosity ratings provided by each participant for the magic trick videos. Based on these ratings, participants were divided into two groups: low-curiosity group (mean curiosity rating ≤ 5) and high-curiosity group (mean curiosity rating > 5). This classification allowed us to investigate whether higher curiosity levels were associated with enhanced word recognition performance across different age groups. Memory performance was assessed by calculating each participant's mean accuracy score for word recognition, using the formula: Accuracy= [(hits+ correct rejections)/90]. To examine the effects of curiosity on memory, A 2×2 factorial ANOVA was conducted, with age group (young vs. old) and condition (low-curiosity vs. high-curiosity) as between-subjects factors, and mean accuracy as dependent variable.

Main Effects and Interactions

The analysis revealed a significant main effect of Group ($F(1, 105) = 57.505$, $p < 0.001$, $\eta_p^2 = 0.353$, with a power to detect the effect of 1.000), indicating that younger participants exhibited significantly greater accuracy in word recognition compared to older participants. This finding is consistent with previous research on age-related memory decline, reinforcing the well-documented trend that younger individuals generally outperform older adults in recognition memory tasks (*Figure 4.2*).

A significant main effect of Curiosity was also observed ($F(1, 105) = 5.069$, $p = 0.03$, $\eta_p^2 = 0.05$, with a power to detect the effect of 0.61), suggesting that high-curiosity participants showed better word recognition accuracy compared to low-curiosity participants, regardless of age *(Figure 4.3)*.

Specifically, older adult participants in the high-curiosity condition demonstrated significantly better memory performance than those in the low-curiosity condition (see *Figure 4.4*).

Furthermore, an ANCOVA was conducted to examine the potential influence of additional covariates, including PANAS+, PANAS−, BFI, AUT_Fluency and

AUT_Creativity on memory performance. The results indicated no significant effects, suggesting that these factors did not meaningfully contribute to the observed variations in accuracy across age groups and curiosity conditions.

Post Hoc Analysis Interpretation

The Tukey HSD test was conducted to compare the accuracy scores (ACC) between different conditions:

- Age group: Younger vs. Older.
- Curiosity level: Low-curiosity vs. High-curiosity.

The key points from the post hoc results are:

1. Curiosity does not significantly affect accuracy in younger adults: the comparison between *low-curiosity* and *high-curiosity* within younger participants is not significant ($p = 0.96$). This suggests that younger participants performed similarly in both curiosity conditions, meaning curiosity did not substantially influence their word recognition accuracy.
2. Curiosity significantly improves memory performance in older adults: in older participants, accuracy was significantly higher in the high-curiosity condition compared to the low-curiosity condition ($p = 0.001$). This indicates that curiosity plays a crucial role in enhancing memory performance for older adults, potentially mitigating some age-related memory decline.
3. Younger participants outperform older participants in both curiosity conditions: the comparison between younger participants (low curiosity) and older participants (low curiosity) is highly significant ($p = 0.0001$). Similarly, the difference between younger participants (high curiosity) and older participants (high curiosity) is also significant ($p = 0.0002$). This confirms the main effect of age, where younger participants consistently exhibit higher recognition accuracy than older participants.

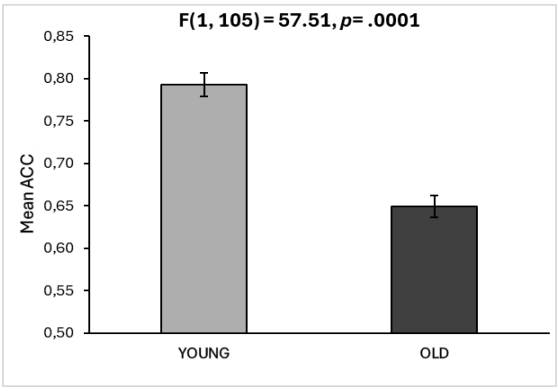

Figure 4.2 - Accuracy for memory of words: memory performance in young and older adults.

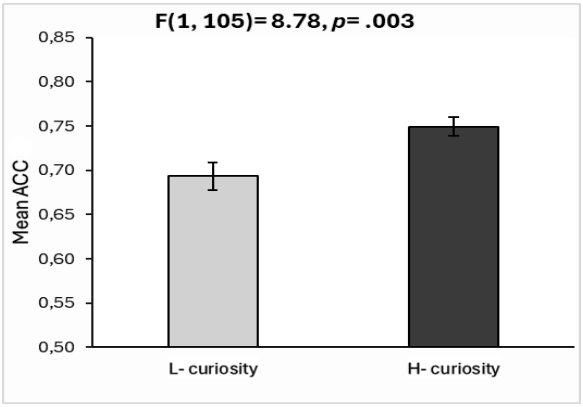

Figure 4.3 - Accuracy for memory of words: memory performance for levels of curiosity.

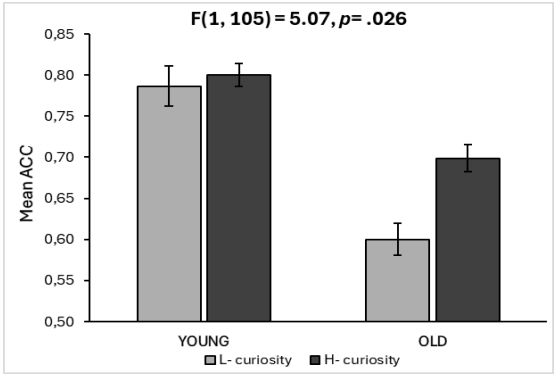

Figure 4.4 - Accuracy for memory of words: memory performance for levels of curiosity in young and older adults.

4.4 Discussion

The present study aims to investigate the effects of curiosity on incidental memory performance across younger and older adults using magic trick video clips as curiosity-eliciting stimuli. The key findings indicate that while younger adults exhibited overall superior word recognition performance compared to older adults, higher levels of curiosity were associated with enhanced memory performance in the older group.

Our results align with prior research demonstrating age-related memory decline, as younger adults exhibited significantly higher accuracy in word recognition than older adults (Craik & Salthouse, 2011; Salthouse, 2010). This finding is consistent with well-documented cognitive aging theories suggesting that episodic memory performance diminishes with age due to neurobiological changes affecting the hippocampus and prefrontal cortex (Nyberg et al., 2012). However, an important contribution of our study is the observation that curiosity plays a differential role across age groups, with older adults benefiting more from curiosity-driven memory enhancements than younger adults.

A significant main effect of curiosity was found, supporting previous studies that suggest curiosity facilitates memory retention by enhancing attention and encoding processes (Gruber et al., 2014; Kang et al., 2009). However, post hoc analyses revealed that this effect was particularly pronounced in older adults, as their word recognition accuracy significantly improved in high-curiosity conditions compared to low-curiosity conditions. This result suggests that curiosity may serve as a protective cognitive mechanism that helps mitigate some of the memory deficits associated with aging.

One possible explanation for this finding is that curiosity triggers dopaminergic activity, which has been shown to play a critical role in memory formation and consolidation (Schultz et al., 1997). Given that dopamine levels naturally decline with age (Abdulrahman et al., 2017), externally induced curiosity states might enhance neurochemical activity and optimize cognitive resources in older adults. This aligns with the PACE framework (Gruber & Ranganath, 2019), which posits that curiosity-related exploration engages a network of brain regions, including the

anterior cingulate cortex, hippocampus, and dopaminergic midbrain structures, ultimately promoting memory encoding and retention.

Interestingly, in younger adults, curiosity did not significantly influence memory performance, as they performed similarly in both high- and low-curiosity conditions. One explanation for this result may be that younger adults generally have higher baseline memory capacity and cognitive flexibility, making them less reliant on external motivational factors such as curiosity to enhance performance (Litman & Spielberger, 2003; Silvia, 2006). In contrast, older adults may require additional cognitive engagement to optimize learning, and curiosity-driven states might provide this additional support by enhancing attentional focus and deep encoding processes (Mather & Harley, 2016). The absence of curiosity-related benefit in younger adults may also reflect a ceiling effect, whereby their already high memory performance limited the potential for further improvement (Garin, 2014). Additionally, the absence of significant effects for individual difference variables, such as affective states (PANAS), personality traits (BFI), and divergent thinking as measured by the Alternative Uses Task (AUT), suggests that the observed benefits of curiosity on memory were not strongly modulated by general mood, personality dimensions, or creativity levels. This finding reinforces the notion that curiosity operates as a distinct epistemic emotion that directly influences cognitive processing, independent of broader personality traits and cognitive flexibility (Kashdan & Silvia, 2009b).

Our study offers several implications for understanding curiosity-driven learning and cognitive aging. The findings suggest that fostering curiosity through engaging and novel stimuli represent a promising avenue for memory interventions targeting older adults. By leveraging curiosity-inducing materials such as magic trick videos, educators and clinicians may develop effective strategies to enhance memory retention and lifelong learning in aging populations. Furthermore, the results highlight the importance of adopting ecologically valid curiosity paradigms, as traditional trivia-based tasks may fail to capture the dynamic nature of curiosity in real-world learning contexts (Ozono et al., 2021; Rensink & Kuhn, 2015). A key contribution of the present study lies in the potential compensatory role of curiosity in mitigating age-related memory decline. Our data suggest that curiosity may

enhance memory by improving two critical processes: (1) attentional focus, which promotes deeper encoding of stimuli, and (2) memory consolidation, potentially facilitated by dopaminergic system activation, which supports the transfer of information from short-term to long-term memory. However, further research is needed to determine whether these effects extend to free recall tasks, which place greater demands on memory retrieval processes compared to recognition and may provide a more stringent test of curiosity's cognitive benefits. In this perspective, magic-based interventions are emerging as an original and promising strategy. Recent studies and therapeutic practices have suggested that stimuli rich in surprise and perceptual incongruity, such as magic tricks and illusions, can be particularly effective in capturing attention and stimulating cognitive activation in older adults with cognitive impairment. The unpredictable nature of magic generates prediction errors and fosters curiosity, temporarily activating neural networks associated with attention and memory.

For example, one study demonstrated that a six-week magic-based program led to significant improvements in cognitive functions in older adults with mild cognitive impairment, suggesting a potential preventive role in delaying progression to dementia (Lee et al., 2022). Another study showed that a recreational magic program reduced depressive symptoms in institutionalized older adults, contributing to their emotional well-being (Lee et al., 2022). Finally, a systematic review highlighted that magic-based interventions, even outside clinical contexts, can improve self-efficacy, self-confidence, and social skills, which are all essential for well-being in later life (Wiseman & Watt, 2018).

In these studies, the stimuli primarily involved live performances and direct interaction with magic activities, rather than multimedia content. However, the use of magic trick videos represents a promising alternative modality, still underexplored in the scientific literature. Videos could offer a repeatable and accessible experience, especially in home-based or digital settings, while maintaining a high level of sensory and cognitive stimulation. This approach could therefore be tested in future studies as a way to promote curiosity, shared attention, and emotional responsiveness in people with cognitive impairment, particularly in contexts where live interaction is not feasible.

In individuals with dementia or mild cognitive impairment, such stimuli may provide a low demand but emotionally engaging cognitive challenge, promoting moments of focus, affective response, and social interaction, especially when offered in group settings. Although research in this area is still in its early stages, these findings suggest that magic-based interventions, even in the form of pre-recorded videos, may represent an innovative complement to more traditional practices such as reminiscence or cognitive stimulation—introducing an element of wonder, novelty, and active curiosity.

Limitations and Future Directions

While the study provides valuable insights into the relationship between curiosity and memory across different age groups, some limitations should be acknowledged. First, the sample size, though sufficient for detecting main effects, may limit the generalizability of the findings, particularly regarding individual differences in curiosity responsiveness. Future research should aim to replicate these results in larger and more diverse samples.

Second, the study focused solely on recognition memory, and it remains unclear whether curiosity-driven enhancements would extend to recall-based tasks, which typically require greater effortful retrieval processes. Future investigations should explore different memory modalities to determine the generalizability of curiosity effects across various cognitive functions.

Third, although the use of magic trick videos improves ecological validity compared to traditional trivia-based tasks, the experimental context remains relatively controlled and artificial. Future studies should consider incorporating curiosity-inducing materials into more naturalistic learning environments to further strengthen ecological validity.

Fourth, the present study focused exclusively on recognition-based memory performance. Future research should investigate whether the observed curiosity effects extend to other types of memory measures, such as free or delayed recall, to gain a more comprehensive understanding of curiosity's impact on memory encoding and retrieval processes.

Moreover, while we controlled various demographic and cognitive factors, we did not directly measure neural correlates of curiosity-driven memory enhancements. Neuroimaging studies using functional magnetic resonance imaging (fMRI) have shown that curiosity activates brain circuits associated with the reward system, particularly the hippocampus and the ventral striatum, thereby facilitating learning and memory (Gruber, Gelman, & Ranganath, 2014; Kang et al., 2009). These findings suggest that curiosity not only enhances attention but also engages deep motivational mechanisms that influence the effectiveness of memory encoding.

Moreover, recent electrophysiological studies have shown that curiosity modulates specific ERP components related to attentional, affective, and reward-related processing, such as the P300, the Late Positive Potential (LPP), and the Reward Positivity (RewP). For example, FitzGibbon et al. (2020) and Rüterbories et al. (2023) observed that the presentation or satisfaction of highly curiosity-inducing stimuli elicits amplified ERP responses, indicating increased attentional and emotional engagement during learning and memory encoding. The integration of high-temporal-resolution EEG techniques with fMRI may therefore offer a more comprehensive and multimodal understanding of the neural mechanisms underlying the beneficial effects of curiosity on memory, particularly in aging populations.

In summary, our findings demonstrate that curiosity enhances incidental memory, particularly in older adults, suggesting that curiosity-driven cognitive engagement may serve as a compensatory mechanism for age-related memory decline. These results contribute to a growing body of literature highlighting the importance of epistemic emotions in cognitive aging and underscore the potential for curiosity-based interventions to support lifelong learning and memory retention. Future research should continue exploring the neural and behavioral mechanisms through which curiosity modulates memory, with implications for education, aging, and cognitive rehabilitation.

4.5 Conclusion

This study examined the effect of curiosity on incidental memory in both younger and older adults, using magic trick videos to elicit high- and low-curiosity states. The findings indicate that while younger adults exhibited overall superior recognition memory performance compared to older adults, curiosity played a more significant role in enhancing memory in the older group. Specifically, older adults demonstrated improved word recognition accuracy in high-curiosity conditions, suggesting that curiosity may serve as a cognitive mechanism that helps counteract age-related memory decline.

The results may align with prior research on the neurobiological underpinnings of curiosity, reinforcing the role of dopaminergic activity in enhancing memory retention. Given that dopamine levels naturally decline with age, externally induced curiosity states may provide a means to optimize cognitive engagement and learning in aging populations. Interestingly, curiosity did not significantly impact memory performance in younger adults, possibly due to their higher baseline cognitive capacities and lower reliance on external motivational factors.

These findings have important implications for developing curiosity-driven interventions to support memory and lifelong learning, particularly in older adults. By leveraging engaging and curiosity-inducing materials, educators and cognitive researchers could design effective strategies to promote memory retention in aging populations. Future research should explore the neural mechanisms underlying these effects and investigate whether curiosity-induced memory benefits extend to different memory modalities and real-world learning scenarios.

CONCLUSION

This doctoral research has examined the role of curiosity as a motivational factor and the impact of social contexts, particularly in collaborative settings, on memory performance. It investigates how curiosity-driven engagement enhances memory retention and how social interactions shape encoding and recall strategies. The studies conducted provide empirical evidence on the role of curiosity in memory consolidation and the effects of social collaboration on recall, offering insights for training programs, risk preparedness, and public safety initiatives.

The first study, published in *Psychological Research*, investigated the effects of collaboration on memory performance, focusing on both encoding and retrieval phases. A categorization task involving emotionally valenced words was used to assess how memory was affected when participants worked individually versus in pairs. This task promoted discussion and interaction, allowing us to assess the impact of collaboration on memory organization and retention. This design encouraged active discussion and collaboration, enabling an assessment of how social interactions influence recall organization. The results demonstrated that participants who encoded information collaboratively recalled fewer words compared to those who encoded individually, indicating a collaborative encoding deficit. This impairment persisted during the individual retrieval phase, suggesting that divided attention during encoding reduced learning efficiency. Additionally, when participants recalled information collaboratively, they performed worse than those who recalled individually, confirming the collaborative inhibition effect. This inhibition persisted even when the same pairs encoded and retrieved together, indicating that factors beyond retrieval disorganization, such as interference and divided attention, contributed to the memory deficit. However, recalling with the same partner reduced disorganization, mitigating some negative effects of collaboration. This study confirms prior findings on collaborative inhibition and encoding deficits while introducing new evidence on the role of divided attention in memory impairment. It highlights the complexities of social interactions in memory performance, offering insights for optimizing group learning and training strategies.

The second study, published in *Brain Sciences* and presented at the 15th Annual Conference of the Italian Society of Aging Psychology (SIPI) in Padua in 2022, examined the effects of high-curiosity states on memory performance. Specifically, it investigated how curiosity-driven engagement impacts incidental learning across different age groups. Participants were exposed to trivia questions designed to evoke varying levels of curiosity before being presented with unrelated, incidental information. The findings confirmed that heightened curiosity not only enhances recall for the primary information but also facilitates the retention of incidental details, suggesting that curiosity amplifies attentional and encoding mechanisms. These results provide valuable insights into how curiosity can be strategically leveraged in educational and training contexts to improve memory retention and knowledge acquisition. The results confirmed that curiosity enhances recall for both targeted and incidental information, reinforcing the idea that curiosity-driven cognitive engagement optimizes memory performance.

The third study focused on the validation of the MagicCATS dataset for use in the Italian context, ensuring its applicability for future research on epistemic emotions and learning processes. The study involved adapting the dataset to linguistic and cultural differences and results indicated that the dataset provides a standardized tool for further investigation of curiosity's role in educational and psychological research. This validation ensured the dataset's cultural appropriateness and reliability for future research on epistemic emotions and learning processes in the Italian contexts.

The fourth study investigated the effects of curiosity on incidental memory in young adults and older adults. Participants watched a series of magic trick videos designed to evoke curiosity, followed by the presentation of neutral words. Later, their memory for these words was assessed through a recognition test. The results revealed several key findings: younger adults demonstrated higher word recognition accuracy compared to older adults, confirming the well-documented decline in memory with age. Higher curiosity levels were associated with improved memory performance in both age groups; however, this effect was significant only in older adults. This suggests that curiosity may play a crucial role in mitigating age-related memory decline. In younger adults, curiosity did not significantly

impact memory performance, possibly because their cognitive abilities are already optimal for learning, regardless of motivational factors. Overall, the study highlights the potential of curiosity as a cognitive tool to enhance memory retention, particularly in older adults. These findings suggest that curiosity-based learning strategies can be optimized for different age groups by tailoring content to maximize engagement and cognitive processing efficiency.

The implications of these findings extend to both theoretical frameworks in cognitive psychology and practical applications in risk communication and public safety strategies.

Theoretical Contributions

This research contributes to the growing body of literature on motivation and memory by emphasizing curiosity as a key driver of cognitive engagement. It supports the information-gap theory (Loewenstein, 1994), reinforcing the idea that the perception of missing knowledge generates a motivational state that enhances memory consolidation. Moreover, these findings contribute to collaborative memory research by highlighting how deficits in collaborative encoding and the effects of collaborative inhibition may serve as constraints on memory processes in group learning and training contexts. Additionally, this work expands on aging research by demonstrating that curiosity benefits memory in older adults, albeit to a lesser extent than in younger individuals (Sakaki et al., 2018; Galli et al., 2018). These findings align with the broader literature on aging and cognitive plasticity, suggesting that fostering curiosity-based learning could help counteract some of the cognitive declines associated with aging (Mather & Carstensen, 2005b; Park & Reuter-Lorenz, 2009).

Practical Applications

One of the most significant practical implications of this research concerns emergency preparedness and risk communication. Given that memory retention of critical information is essential for effective decision-making in hazardous situations, leveraging curiosity-driven learning strategies could enhance public safety measures. Specifically, training programs designed to improve emergency preparedness might benefit from incorporating curiosity-inducing techniques to increase retention of evacuation protocols, risk awareness, and response strategies.

For example, curiosity-enhanced educational materials, such as interactive quizzes, gamified learning experiences, and question-driven training sessions, could improve knowledge retention among populations at risk, particularly older adults.

Limitations and Future Directions

Despite its contributions, this research has certain limitations that should be addressed in future studies. One limitation pertains to the generalizability of the findings. The studies were conducted primarily in controlled experimental settings with university students and older adults from specific geographical regions. Future research should aim to replicate these findings in diverse cultural and socioeconomic contexts to determine whether curiosity-driven memory benefits extend across different populations. Future studies should investigate the neural mechanisms underlying curiosity-driven memory enhancement, explore intervention strategies to optimize curiosity-based learning, and assess how curiosity can be applied in real-world learning environments.

In conclusion, this dissertation underscores the crucial role of curiosity in shaping memory processes and highlights its potential applications in enhancing public safety and risk preparedness. By demonstrating that curiosity enhances both targeted and incidental learning, and by identifying its varying effects across different age groups, this research contributes to the broader understanding of motivational factors in memory science.

APPENDIX

Table A1 - Neuropsychological and demographic data.

Participant ID	Age	Gender	How interested in the magic tricks	Performing magic tricks by themselves	MOCA
1	52	Male	10	1	
2	21	Female	2	1	
3	18	Female	1	1	
4	57	Male	3	1	
5	20	Female	8	1	
6	51	Male	9	2	
7	78	Male	5	1	30
8	53	Female	7	1	
9	42	Female	5	1	
10	20	Female	7	2	
11	21	Female	8	1	
12	20	Female	10	1	
13	19	Female	5	1	
14	45	Female	2	1	
15	22	Male	6	2	
16	30	Male	6	1	
17	20	Male	1	1	
18	19	Male	2	1	
19	41	Female	1	1	
20	32	Female	1	1	
21	20	Female	6	1	
22	19	Female	5	1	
23	20	Female	1	1	
24	19	Female	1	1	
25	56	Female	3	1	
26	19	Female	8	1	
27	45	Male	1	1	
28	46	Male	7	1	
29	53	Female	8	1	
30	20	Female	9	1	
31	21	Female	1	1	
32	19	Female	5	1	
33	22	Female	8	1	
34	25	Female	8	1	
35	20	Female	9	3	
36	19	Female	8	1	
37	18	Female	6	1	
38	54	Female	7	1	
39	19	Female	3	1	
40	22	Female	6	1	
41	52	Male	1	1	
42	54	Male	9	1	
43	50	Male	2	1	
44	49	Female	3	2	
45	34	Female	1	1	
46	52	Female	1	1	
47	20	Female	8	1	
48	49	Female	5	1	
49	51	Female	7	2	
50	20	Female	3	1	
51	20	Female	5	1	
52	19	Female	9	1	
53	55	Female	6	1	
54	50	Male	8	2	
55	57	Male	6	2	

Participant ID	Age	Gender	How interested in the magic tricks	Performing magic tricks by themselves	MOCA
56	52	Male	5	2	
57	57	Male	5	1	
58	20	Female	9	1	
59	24	Female	1	1	
60	19	Female	7	1	
61	56	Female	6	1	
62	56	Female	7	1	
63	54	Female	4	1	
64	19	Female	6	1	
65	60	Female	1	1	
66	20	Female	6	1	
67	20	Female	1	1	
68	54	Female	1	1	
69	49	Female	1	1	
70	42	Female	1	2	
71	51	Female	5	1	
72	46	Female	7	1	
73	64	Female	9	1	
74	51	Female	1	1	
75	53	Female	9	1	
76	51	Female	5	1	
77	19	Female	1	1	
78	54	Female	6	2	
79	56	Female	7	1	
80	51	Female	3	1	
81	40	Female	1	1	
82	34	Female	3	1	
83	60	Female	2	1	
84	53	Female	5	1	
85	22	Male	9	1	
86	58	Male	6	2	
87	82	Female	1	1	27
88	65	Female	7	1	28
89	54	Male	1	1	
90	20	Male	8	1	
91	21	Male	8	2	
92	60	Male	1	1	
93	57	Male	3	1	
94	48	Male	7	1	
95	52	Male	10	2	
96	54	Male	2	1	
97	48	Female	1	1	
98	52	Female	1	1	
99	22	Female	1	1	
100	20	Female	7	1	
101	19	Female	4	1	
102	20	Female	7	1	
103	20	Female	7	1	
104	70	Female	3	1	26
105	47	Female	5	1	
106	20	Female	7	2	
107	19	Female	5	1	
108	19	Female	9	1	
109	21	Female	7	1	
110	19	Female	7	1	
111	53	Female	5	1	
112	44	Female	8	1	
113	20	Female	1	1	
114	19	Female	4	1	

Participant ID	Age	Gender	How interested in the magic tricks	Performing magic tricks by themselves	MOCA
115	19	Female	1	1	
116	20	Female	7	1	
117	20	Female	6	1	
118	52	Female	6	1	
119	48	Female	8	1	
120	22	Female	4	1	
121	30	Male	3	1	
122	56	Female	5	1	
123	23	Female	4	1	
124	56	Female	8	1	
125	20	Female	9	1	
126	20	Female	5	1	
127	54	Female	1	1	
128	25	Male	5	2	
129	31	Male	7	1	
130	32	Female	6	2	
131	22	Female	2	1	
132	19	Female	8	1	
133	20	Female	3	1	
134	21	Female	6	1	
135	50	Female	5	1	
136	18	Male	6	1	
137	46	Female	5	1	
138	52	Female	7	2	
139	35	Male	5	2	
140	19	Female	1	1	
141	49	Female	7	1	
142	42	Female	2	1	
143	56	Female	7	1	
144	20	Female	9	2	
145	20	Female	7	1	
146	20	Female	3	1	
147	18	Female	4	1	
148	23	Female	5	1	
149	20	Female	3	1	
150	64	Female	10	1	
151	19	Female	4	1	
152	56	Female	4	1	
153	50	Female	3	1	
154	18	Female	4	1	
155	19	Female	2	1	
156	19	Female	8	1	
157	20	Female	5	2	
158	24	Female	5	1	
159	30	Female	9	1	
160	58	Male	7	1	
161	19	Female	6	1	
162	55	Female	8	1	
163	57	Female	5	1	
164	48	Female	6	1	
165	52	Female	3	1	
166	22	Female	8	1	
167	60	Male	8	1	
168	19	Female	4	1	
169	54	Female	9	1	
170	20	Female	8	1	
171	45	Female	8	1	
172	57	Female	4	1	
173	43	Female	5	2	

Participant ID	Age	Gender	How interested in the magic tricks	Performing magic tricks by themselves	MOCA
174	51	Male	7	1	
175	19	Female	7	1	
176	54	Female	5	1	
177	53	Male	6	1	
178	32	Male	2	1	
179	23	Male	8	1	
180	19	Male	2	1	
181	19	Female	5	3	
182	24	Female	8	1	
183	19	Female	7	2	
184	19	Female	2	1	
185	19	Female	9	1	
186	19	Female	7	1	
187	58	Male	6	1	
188	53	Female	1	1	
189	50	Male	8	1	
190	51	Male	2	1	
191	62	Male	6	1	
192	75	Male	5	2	27
193	50	Male	9	2	
194	23	Female	10	1	
195	51	Female	9	1	
196	50	Female	8	1	
197	54	Female	7	1	
198	48	Female	5	2	
199	62	Female	7	1	
200	20	Female	8	1	
201	19	Female	4	1	
202	19	Female	8	2	
203	20	Female	6	1	
204	21	Female	9	1	
205	20	Female	8	2	
206	21	Female	5	1	
207	19	Female	8	1	
208	54	Female	2	1	
209	20	Female	3	1	
210	19	Male	2	1	
211	49	Male	6	1	
212	74	Female	6	2	24
213	39	Male	1	1	
214	53	Male	8	2	
215	70	Female	3	1	30
216	71	Male	8	1	26
217	50	Male	7	1	
218	49	Female	6	1	
219	20	Female	5	1	
220	20	Female	4	1	
221	19	Female	10	2	
222	48	Female	8	1	
223	50	Female	5	1	
224	32	Male	1	2	
225	57	Male	7	1	
226	20	Female	7	1	
227	20	Female	3	1	
228	19	Female	3	1	
229	31	Female	6	1	
230	19	Female	5	2	
231	52	Male	10	1	
232	56	Female	1	1	

Participant ID	Age	Gender	How interested in the magic tricks	Performing magic tricks by themselves	MOCA
233	55	Female	5	1	
234	19	Female	7	1	
235	19	Female	7	2	
236	55	Male	5	1	
237	19	Female	7	1	
238	21	Female	7	2	
239	41	Female	7	1	
240	19	Female	4	1	
241	20	Female	7	1	
242	20	Female	10	1	
243	19	Female	7	1	
244	20	Female	3	1	
245	33	Female	1	2	
246	20	Male	10	2	
247	55	Male	6	1	
248	19	Male	7	1	
249	45	Male	5	1	
250	24	Male	6	2	
251	54	Male	4	1	
252	30	Male	8	1	
253	31	Male	1	1	
254	20	Male	6	2	
255	39	Male	2	1	
256	42	Male	1	1	
257	59	Male	3	1	
258	59	Male	7	1	
259	31	Male	5	1	
260	39	Male	1	1	
261	39	Male	1	1	
262	19	Male	8	2	
263	34	Male	1	1	
264	29	Male	7	1	
265	39	Male	8	1	
266	47	Male	9	1	
267	19	Male	2	1	
268	53	Male	1	3	
269	29	Male	6	1	
270	46	Female	7	1	
271	37	Male	3	1	
272	28	Male	1	1	
273	62	Male	4	1	
274	51	Female	8	1	
275	51	Female	1	1	
276	29	Female	2	1	
277	21	Female	5	1	
278	47	Female	4	1	
279	63	Female	5	1	
280	45	Male	8	2	
281	20	Female	6	1	
282	20	Female	3	1	
283	20	Female	2	1	
284	20	Female	10	1	
285	19	Female	2	1	
286	20	Female	8	1	
287	20	Female	1	1	
288	40	Female	2	1	
289	20	Male	8	1	
290	57	Male	8	1	
291	20	Male	8	2	

Participant ID	Age	Gender	How interested in the magic tricks	Performing magic tricks by themselves	MOCA
292	19	Female	10	1	
293	21	Female	7	1	
294	19	Female	2	1	
295	30	Male	9	1	
296	52	Male	2	1	
297	58	Male	10	1	
298	32	Male	1	1	
299	19	Female	7	1	
300	53	Male	7	1	
301	48	Male	5	2	
302	19	Female	6	1	
303	19	Female	5	1	
304	20	Female	6	1	
305	20	Female	10	1	
306	20	Female	1	1	
307	50	Female	4	1	
308	20	Female	4	1	
309	21	Female	8	1	
310	18	Female	5	2	
311	20	Female	4	1	
312	20	Female	6	1	
313	19	Female	6	1	
314	20	Female	9	1	
315	21	Male	2	2	
316	48	Male	1	1	
317	19	Male	8	1	
318	50	Male	5	1	
319	81	Male	1	1	24
320	46	Male	9	1	
321	19	Female	5	1	
322	62	Male	5	1	
323	22	Female	9	1	
324	20	Female	1	1	
325	20	Female	7	1	
326	21	Female	8	1	
327	30	Female	4	1	
328	45	Female	1	1	
329	24	Female	3	3	
330	19	Female	6	1	
331	54	Female	7	1	
332	20	Female	9	1	
333	24	Female	4	1	
334	24	Female	4	1	
335	20	Female	1	1	
336	20	Female	7	2	
337	20	Female	6	1	
338	20	Male	9	1	
339	20	Female	8	2	
340	21	Female	7	1	
341	20	Female	5	1	
342	50	Female	4	1	
343	44	Female	9	1	
344	20	Female	4	1	
345	57	Female	5	1	
346	57	Female	2	1	
347	56	Female	9	1	
348	20	Female	1	1	
349	19	Female	6	1	
350	45	Female	1	1	

Participant ID	Age	Gender	How interested in the magic tricks	Performing magic tricks by themselves	MOCA
351	22	Female	4	1	
352	48	Female	10	1	
353	20	Female	6	1	
354	46	Male	8	1	
355	55	Male	4	1	
356	49	Male	9	1	
357	19	Female	3	1	
358	55	Female	6	1	
359	59	Female	8	1	
360	58	Female	5	1	
361	49	Female	1	1	
362	25	Male	8	2	
363	27	Male	10	1	
364	52	Male	7	1	
365	47	Female	8	1	
366	58	Female	7	1	
367	53	Female	4	1	
368	55	Female	3	1	
369	33	Female	3	1	
370	20	Female	3	1	
371	55	Female	1	1	
372	18	Female	7	1	
373	20	Female	6	1	
374	20	Female	7	1	
375	43	Male	8	1	
376	51	Male	3	1	
377	20	Female	7	1	
378	20	Female	9	1	
379	54	Female	1	1	
380	48	Female	5	1	
381	24	Female	4	1	
382	24	Female	7	1	
383	22	Male	9	2	
384	59	Female	8	1	
385	19	Female	9	1	
386	19	Female	8	1	
387	19	Female	6	1	
388	47	Male	9	2	
389	20	Male	5	1	
390	19	Male	1	1	
391	49	Female	4	1	
392	56	Male	6	1	
393	33	Male	7	1	
394	33	Male	10	1	
395	19	Female	2	1	
396	45	Female	7	1	
397	83	Female	8	2	27
398	58	Female	5	1	
399	18	Female	3	1	
400	21	Female	4	1	
401	22	Female	1	1	
402	20	Female	7	1	
403	53	Female	1	1	
404	47	Female	3	1	
405	49	Female	8	1	
406	53	Female	3	1	
407	82	Female	1	1	27
408	19	Female	8	1	
409	48	Female	9	1	

Participant ID	Age	Gender	How interested in the magic tricks	Performing magic tricks by themselves	MOCA
410	20	Female	3	1	
411	53	Female	8	1	
412	53	Female	8	1	
413	18	Female	3	1	
414	34	Female	6	1	
415	76	Female	1	1	25
416	20	Female	5	1	
417	47	Female	2	1	
418	49	Female	7	1	
419	44	Female	7	1	
420	53	Female	5	1	
421	47	Female	9	1	
422	20	Female	8	1	
423	30	Female	1	1	
424	20	Female	7	1	
425	19	Female	8	1	
426	53	Female	1	1	
427	59	Female	3	1	
428	53	Female	7	1	
429	58	Female	1	1	
430	21	Female	4	1	
431	19	Female	7	1	
432	59	Female	5	2	
433	39	Female	5	1	
434	19	Female	8	1	
435	18	Female	8	1	
436	19	Female	8	1	
437	51	Female	6	1	
438	50	Female	2	1	
439	63	Female	5	1	
440	59	Female	8	2	
441	55	Female	7	1	
442	19	Female	8	2	
443	19	Female	6	1	
444	19	Female	6	1	
445	20	Female	1	1	
446	29	Female	1	1	
447	19	Female	8	1	
448	19	Female	6	1	
449	20	Female	8	1	
450	22	Female	8	1	
451	19	Female	7	2	
452	46	Female	7	1	
453	56	Male	4	1	
454	52	Male	6	1	
455	18	Female	9	1	
456	20	Male	8	1	
457	19	Male	6	1	
458	22	Male	8	1	
459	19	Male	6	1	
460	22	Female	5	1	
461	39	Female	2	1	
462	20	Female	8	1	
463	18	Female	1	1	
464	20	Female	9	1	
465	19	Female	7	1	
466	19	Female	1	1	
467	20	Female	3	1	
468	20	Female	4	1	

Participant ID	Age	Gender	How interested in the magic tricks	Performing magic tricks by themselves	MOCA
469	24	Male	8	1	
470	54	Male	5	2	
471	53	Female	4	1	
472	42	Female	1	1	
473	20	Female	8	1	
474	20	Female	9	1	
475	50	Female	1	1	
476	49	Male	5	1	
477	51	Female	4	1	
478	56	Female	8	3	
479	52	Female	4	1	
480	21	Female	10	1	
481	52	Female	1	1	
482	48	Female	8	1	
483	44	Female	1	1	
484	50	Female	8	1	
485	53	Male	1	1	
486	21	Male	9	2	
487	50	Female	3	1	
488	55	Female	1	1	
489	57	Male	6	1	
490	54	Female	7	1	
491	19	Female	7	1	
492	55	Female	2	1	
493	54	Male	1	1	
494	25	Male	2	1	
495	31	Male	6	1	
496	52	Male	4	1	
497	18	Female	3	1	
498	20	Female	6	1	
499	20	Female	9	1	
500	19	Female	8	1	
501	18	Female	8	2	
502	20	Female	7	1	
503	20	Female	9	1	
504	22	Female	1	1	
505	19	Female	8	2	
506	19	Female	5	1	
507	18	Female	9	1	
508	28	Female	1	1	
509	19	Female	5	1	
510	20	Female	6	1	
511	20	Female	9	2	
512	45	Female	1	1	
513	26	Female	1	1	
514	50	Female	6	1	
515	56	Female	3	1	
516	52	Female	5	1	
517	35	Female	4	1	
518	49	Female	5	1	
519	19	Female	1	2	
520	20	Female	4	1	
521	45	Male	6	1	
522	58	Female	6	1	
523	58	Female	1	2	
524	26	Female	1	1	
525	56	Female	1	1	
526	56	Female	1	1	
527	50	Female	1	1	

Participant ID	Age	Gender	How interested in the magic tricks	Performing magic tricks by themselves	MOCA
528	20	Female	10	2	
529	31	Male	6	1	
530	58	Male	8	1	
531	51	Male	3	1	
532	19	Male	7	1	
533	41	Female	5	1	
534	20	Female	7	1	
535	56	Female	7	1	
536	86	Female	8	1	26
537	46	Female	4	1	
538	21	Female	9	1	
539	55	Male	10	1	
540	20	Male	5	1	
541	53	Male	5	1	
542	56	Female	1	1	
543	45	Female	5	1	
544	19	Female	1	1	
545	20	Female	2	1	
546	51	Female	9	1	
547	37	Female	3	1	
548	57	Male	8	1	
549	60	Male	8	1	
550	53	Male	7	1	
551	48	Female	1	1	
552	56	Male	10	1	
553	19	Female	8	1	
554	57	Male	8	1	
555	82	Female	7	1	24
556	80	Female	3	1	24
557	70	Female	4	1	28
558	53	Female	4	1	
559	56	Female	6	2	
560	45	Female	9	1	
561	64	Female	1	1	
562	20	Female	3	1	
563	53	Female	5	1	
564	58	Female	7	1	
565	45	Female	5	1	
566	19	Female	8	1	
567	54	Female	7	1	
568	45	Female	3	1	
569	31	Female	6	2	
570	18	Female	9	2	
571	43	Female	8	1	
572	19	Female	7	1	
573	48	Female	10	1	
574	62	Female	3	1	
575	18	Female	8	1	
576	48	Female	1	1	
577	57	Female	1	1	
578	48	Male	9	1	
579	59	Female	7	1	
580	19	Female	4	1	
581	19	Female	7	1	
582	20	Female	9	2	
583	19	Female	4	1	
584	22	Female	5	1	
585	50	Female	9	1	
586	55	Female	9	1	

Participant ID	Age	Gender	How interested in the magic tricks	Performing magic tricks by themselves	MOCA
587	20	Female	7	1	
588	20	Female	3	1	
589	47	Female	5	1	
590	20	Male	4	1	
591	22	Female	2	1	
592	56	Female	1	1	
593	53	Female	8	1	
594	20	Female	1	1	
595	46	Female	1	1	
596	18	Female	8	1	
597	19	Female	7	1	
598	20	Female	5	2	
599	20	Female	7	1	
600	21	Female	5	1	
601	20	Female	6	1	
602	56	Female	1	1	
603	20	Female	5	1	
604	49	Female	9	1	
605	50	Female	3	1	
606	29	Male	7	1	
607	48	Male	8	1	
608	20	Male	3	1	
609	24	Female	4	1	
610	19	Female	8	1	
611	19	Female	6	1	
612	19	Female	9	2	
613	23	Female	10	1	
614	20	Female	6	1	
615	19	Female	7	1	
616	20	Female	4	2	
617	48	Female	1	1	
618	19	Female	7	1	
619	49	Female	7	1	
620	43	Female	8	1	
621	47	Female	5	1	
622	50	Female	9	1	
623	54	Female	7	1	
624	48	Female	9	1	
625	19	Female	7	1	
626	57	Male	6	1	
627	49	Male	6	2	
628	21	Male	8	1	
629	48	Female	6	1	
630	55	Female	1	1	
631	56	Female	3	1	
632	32	Male	6	1	
633	67	Male	7	2	30
634	75	Male	4	1	26
635	65	Male	7	2	30
636	57	Male	9	1	
637	46	Female	1	1	
638	48	Female	2	1	
639	19	Female	4	2	
640	18	Female	3	1	
641	19	Female	6	1	
642	20	Female	10	2	
643	20	Female	2	1	
644	20	Female	1	1	
645	22	Female	1	1	

Participant ID	Age	Gender	How interested in the magic tricks	Performing magic tricks by themselves	MOCA
646	20	Female	7	1	
647	69	Female	8	1	29
648	50	Male	5	1	
649	50	Male	3	1	
650	18	Female	9	1	
651	19	Female	1	1	
652	56	Male	6	1	
653	21	Female	5	1	
654	19	Female	6	1	

Table A2 - Details of the MagicCATs stimuli.

Magic ID	Name	Credit	Phenomena Category	Materials	Length	Subtitle	Brief description	List ID
H1	Reduction	Nicholas Lawrence	Disappearance	Cards	00:00:12	No	A deck of cards reduced to 10	List6
H10	God hand	Lubor Fiedler	Restoration	Cards	00:00:20	No	Card that's split into four pieces is magically put back together	List7
H11	V-Rank Card	Katsuya Masuda	Other	Cards	00:00:25	No	Magician shows a card with a red back and a blank back. Then he changes the blank back into the red back and vice versa	List8
H12	One hand color change	Shin Lim	Color Change	Cards	00:00:08	No	The magician waves his hand over the card placed on the table which changes to a different card	List9
H13	Frozen	Adam Grace	Other	Coin	00:01:09	Yes	Magician takes a coin from volunteer and freezes it in a paper napkin.	List3
H14	Insane	Andy Newman	Prediction	Cards	00:01:11	Yes	Magician has the King of hearts as a prediction and asks the volunteer to shuffle the deck. He then asks her to deal cards and stop when she likes. The card she stopped is the King of hearts.	List8
H15	Unbalance	Creis Co. ltd	Other	Toothpick	00:00:31	No	Magician is able to balance a toothpick on a deck of cards, but the volunteer cannot	List5
H16	Healed and sealed	Anders Moden	Restoration	Can	00:00:33	No	Magician pours coke into glass from an empty can	List6
H17	guillotine	unknown	Other	Guillotine	00:00:46	No	The magician uses a guillotine to slice breadsticks, then asks the volunteer to put her finger in. He slices the breadstick but not her finger	List7
H18	Fish Appearance	unknown	Appearance	Fish/ Bill	00:00:24	No	The magician unfolds a £10 note and drops a fish into a glass of water	List8

H19	Sponge appearanc e	Tani Hideki	Appearance	Sponge	00:00:20	No	Magician places ball of paper in participants hand and sets it alight, revealing a red sponge ball	List9
H2	The brade	Katsuya Masuda	Restoration	Cutter knife/Bill	00:00:46	No	Magician folds a £10 note in a piece of paper and cuts through them with a knife. He reveals that the £10 is still intact afterwards	List7
H20	Sponge routine	unknown	Transportation	Sponge	00:00:20	No	Magician places on ball in the volunteer's hand and one in his own hand but reveals that both end up in the volunteer's hand.	List3
H21	Mind power deck	John Kennedy	Mind reading	Cards	00:01:01	Yes	Volunteers each remember one specific card from the deck shown to them by the Magician. The magician then reads (out loud) the names of the cards that the volunteers remembered	List4
H22	Sixth sense	Henry Evans	Mind reading	Cards	00:01:26	Yes	This one is labelled as take 1	List5
H24	Self-folding bill	Stefan Schutzer	Psychokinesis	Bill	00:00:13	No	A £10 note folds itself into half	List6
H25	X change	Julio Montoro	Materializatio n	Cards/Coi n	00:00:59	Yes	Volunteer signs card and magician then draws a coin on the back. The picture of the coin then turns into a real-life coin	List7
H26	Tagged	Richard Sanders	Penetration	Cards/ Necklace	00:00:39	No	Volunteer selects a card which then sticks to the magician’s necklace at the end	List8
H27	UFO card	unknown	Floating	Cards	00:00:08	No	Card flies around magician in a circle	List4
H28	Cardcase color change	Shin Lim	Color Change	Card case	00:00:15	No	Card case changes color	List3
H29	4 by 4	Shin Lim	Color Change	Cards	00:00:20	No	four red cards change into four blue ones	List9
H3	Coin assembly	unknown	Assembly	Coins/ Cards	00:00:24	No	Magician hides four coins under four cards and reveals that the coins swap places under the cards in several different ways.	List8
H31	Big bang	Krisjian Pipho	Psychokinesis	Light Bulb	00:00:16	No	Magician breaks light bulb in a bag	List5
H32	Tanging	unknown	Disappearance	Cigarette	00:00:22	No	Magician makes a cigarette disappear and then reappear	List6

H33	Envy-lope	Brandon David and Chris Turchi	Disappearance	Cards	00:00:42	No	Volunteer signs a card which the magician then ends up pulling out of an envelope	List7
H34	iVanish	Ben Seidman	Disappearance	Coin	00:00:25	No	Magician places coin into eye and then pulls it out of the other one	List8
H35	indecent	Wayne Houchin	Penetration	Cards/ Ziplock	00:00:36	No	Volunteer signs card which the magician ends up pulling out of a Ziploc bag	List9
H36	Macro psychic	Creis Co. ltd	Psychokinesis	Bolt	00:00:28	No	Screw and bolt unscrew itself	List3
H37	Finger drop revolution	PROMA Web Shop	Other	Finger	00:00:28	No	Magician unscrews his finger and then shakes it back into place	List4
H38	Floating cigarette	Steve Fearson	Floating	Cigarette	00:00:24	No	A cigarette floats around the magician	List5
H39	Passin' Thru	Kevin Parker	Penetration	Coin/ Bottle	00:00:31	No	Magician puts coin into a glass bottle without it breaking	List6
H4_Long	Coin assembly & Reverse	unknown	Assembly	Coin/Cards	00:00:57	No	Magician has four coins and two cards. He places the coins in each corner of the table and places two cards on top of the two top coins. He picks up one of the two remaining coins and makes it disappear from his hand and then reveals it is now underneath one of the cards with the other coin.	List2
H4_Short	Coin assembly & Reverse	unknown	Assembly	Coin/Cards	00:00:21	No	Magician has four coins and two cards. He places the coins in each corner of the table and places two cards on top of the two top coins. He picks up one of the two remaining coins and makes it disappear from his hand and then reveals it is now underneath one of the cards with the other coin.	List1
H40	Levitator	Andrew Mayne	Floating	Body	00:00:14	No	Magician levitates from on top of a box to the ground	List7
H41	Sandwich Vanish	Shin Lim	Disappearance	Cards	00:00:16	No	Card on the table is magically changed into a different card with a quick gesture	List8

H5	the ten count	unknown	Transportation	Sponge	00:00:12	No	Two sponge balls each behind one hand end up in one hand	List9
H6	Ball to Cube sponge	unknown	Change	Sponge	00:00:15	No	Two sponge balls turn into a cube	List3
H7	Salt and Silver	Giovanni Livera	Transportation	Coin	00:00:33	No	Coin appears everywhere around the salt case.	List4
H8	Capture	Luke Dancy	Other	Coin/ Smartphone	00:00:40	Yes	Magician puts coin into phone and then the coin comes out of the phone and into the volunteers' hand	List5
H9	Touch	Hanson Chien	Transportation	Rubber band	00:00:18	No	The magician has an elastic band on his hand which then magically ends up on the volunteers' hand	List6
K1	Deck vanish	unknown	Disappearance	Cards	00:00:18	No	The deck vanishes into a black box	List3
K10	linking pin	Dan Garrett	Penetration	Safety pin	00:00:31	No	Safety pins magically interlock without breaking the seal	List5
K11	Stargazer	Alan Wong	Change	Rubber band	00:00:25	No	Magician has two elastic bands. He makes several star shapes using them and then produces a star shaped elastic band	List6
K12	Card toon	Dan Harlan	Take one	Cards	00:00:33	Yes	Volunteer chooses 7 of hearts. The magician then shows the audience the flip book story on the cards which shows that a fairy also chooses the 7 of hearts	List7
K13	Crazy Man's Handcuffs	Michael Ammar	Penetration	Rubber band	00:00:19	No	Magician has two elastic bands and tangles them up. They then become untwisted	List8
K14	Quick as a wink	unknown	Take one	Cards	00:00:35	No	Volunteer selects 2 of diamonds and places it back in the deck. Then he sandwiches the deck with a Joker on each end. Then he throws the card from one hand to the other and sandwiched between the two Jokers is the volunteer's selected card.	List9
K15_Long	Chicago Opener	Al Leech and Frank Everhart	Take one/ color change	Cards	00:01:13	Yes	Volunteer selects a card and put it back to a deck then this card becomes a colored card.	List1

K15_Short	Chicago Opener	Al Leech and Frank Everhart	Take one/ color change	Cards	00:00:37	Yes	Volunteer selects a card and put it back to a deck then this card becomes a colored card.	List2
K16_Long	Ambitious Card	Gustav Alberti	Transportation	Cards	00:01:12	No	Volunteer selects and signs a card. Magician put it inside the deck and the signed card appeared on the top repeatedly	List2
K16_Short	Ambitious Card	Gustav Alberti	Transportation	Cards	00:00:31	No	Volunteer selects and signs a card. Magician put it inside the deck and the signed card appeared on the top repeatedly	List1
K17	Slop Shuffle	Sid Lorraine	Take one	Cards	00:00:46	No	Volunteer selects a card, and the magician shuffled a deck. This card is the only one that has the opposite side.	List3
K18	3D advertising	Henry Evans	Materialization	Cards	00:00:22	No	Pack of cards comes out of a piece of paper	List4
K19_Long	Chop Cup	Al Wheatley	Transportation	Cups and balls	00:00:31	No	balls in a cup warp and turns into a toy rabbit.	List1
K19_Short	Chop Cup	Al Wheatley	Transportation	Cups and balls	00:00:19	No	balls in a cup warp and turns into a toy rabbit.	List2
K2	Color changing book	unknown	Color Change	Book	00:00:26	No	The sweets from a page in a children's story book are poured out onto the table from it.	List4
K21_Long	Bizarre Twist_ver1	Paul Harris	Color change	Cards	00:00:43	No	A card flips with a shorthand gesture	List2
K21_Short	Bizarre Twist_ver1	Paul Harris	Color change	Cards	00:00:17	No	A card flips with a shorthand gesture	List1
K22_Long	Three-card Monte	Shoji Takahito	Exchange	Cards	00:00:43	Yes	Volunteer is shown three cards: one red and two black cards. The magician places the cards face down on to the table in the same order that he presented the cards to the volunteer. The magician then asks the volunteer to point to the red card but when the magician turns the card over it is in fact a black card.	List1

K22_Short	Three-card Monte	Shoji Takahito	Exchange	Cards	00:00:23	Yes	Volunteer is shown three cards: one red and two black cards. The magician places the cards face down on to the table in the same order that he presented the cards to the volunteer. The magician then asks the volunteer to point to the red card but when the magician turns the card over it is in fact a black card.	List2
K23	Wonder Pen A Tration	Doug Edwards	Penetration	Pen/ Bill	00:00:35	No	Magician puts a hole through the money bill but then reveals that the hole disappears	List5
K24	Bill switch	unknown	Color change	Bill	00:00:24	No	£10 note is transformed into a £20	List6
K25	Spellbound	Dai Vernon	Color change	Coin	00:00:15	No	Coin is changed back and forth from silver to copper	List7
K27	Rising card	unknown	Psychokinesis	Cards	00:00:26	Yes	Volunteer is asked to choose a card from the deck. They choose a card and then place it back into the middle of the deck. The magician then shuffles the card and waves his hand over the deck as the chosen cards rises from the pack.	List8
K28	Bottle from paper bag	unknown	Appearance	Bottle	00:00:13	No	Magician produces a water bottle from a paper bag	List9
K29	Bottle production 1	unknown	Appearance	Bottle	00:00:15	No	Magician produces a water bottle from a silk	List3
K3	Ladybag magic (Paddle move)	unknown	Color Change	Knife	00:00:25	No	A magician has a leaf on which two ladybirds appear on either side before magically disappearing.	List6
K30	Bottle production 2	unknown	Appearance	Bottle	00:00:13	No	Magician produces a water bottle from his jacket	List9
K31	HANASAKI-crystal	Sugawara Shigeru	Appearance	Flower	00:00:12	No	Magician produces a flower from a glass box	List5
K32	Billiard Ball 1	unknown	Appearance	Billiard Ball	00:00:11	No	Magician produces a red ball from his hand	List5

K33	Billiard Ball 2	unknown	Color change	Billiard Ball	00:00:11	No	Magician turns a red ball into a white one using hand gestures. Then he turns it back into the red one.	List7
K34	Rope through body	unknown	Penetration	Rope	00:00:11	No	Magician ties rope around neck but manages to untie it	List4
K35_Long	Professor's nightmare	Bob Carver and Hen Fetsch	Other	Rope	00:00:27	No	Magician has three ropes of various lengths and manages to make them all the same size	List2
K35_Short	Professor's nightmare	Bob Carver and Hen Fetsch	other	Rope	00:00:13	No	Magician has three ropes of various lengths and manages to make them all the same size	List1
K4	insta cube	Craig Nichols	Other	Rubix cube	00:00:30	No	The magician magically solves the rubix cube by spinning it in the air	List6
K5	The Last Trick of Dr. Daley_ver 1	Jacob Daley	Exchange	Cards	00:00:35	No	Magician has four aces and places the two red cards on the table but when he reveals the cards, he is holding the red cards, and the black cards are on the table.	List7
K6	Ace assembly	Alex Elmsley	Transportation	Cards	00:00:41	No	An ace is placed onto the table and three cards on top - all of which turn out to be aces.	List8
K7	Card Warp	Roy Walton	Other	Cards	00:00:33	No	Magician has a black and a red card. He folds the red card in half and then does the same with the black card before slotting the black card in between the folding of the red one. He folds the cards back on themselves and then pulls the card in the middle out revealing that the middle card is now the red one. He folds them back once again, revealing that it is in fact the black card in the middle.	List9
K8	Card Change	unknown	Color change	Cards	00:00:08	No	Card changes with a small gesture	List3
K9	Four aces location	unknown	Assembly	Cards	00:00:50	No	Magician deals four decks onto the table each starting with an ace. It turns out all the aces end up in one pile and the others are made up of the same cards	List4

S1	Play it straight	John Bannon	Take one	Cards	00:00:52	No	Magician shuffles card, revealing one suit is facing upwards throughout the deck and is in order	List9
S10	Ultra Visual Nightshades	Mark Allen and Paul Harris	Transportation	Bill	00:00:33	No	Magician draws glasses onto Queen on £10 note and then makes the glasses move	List3
S11	Cigarette through the coin	unknown	Penetration	Cigarette/ Coin	00:00:24	No	Magician pushes a cigarette through a coin and then reveals that there is no hole	List4
S12	Moving a hole	L. Vosburgh Lyons	Transportation	Cards	00:00:41	No	A hole is hole-punched into the corner of a card. The magician then moves the hole to a different corner and then reveals that it's a black spot on the card	List5
S13	Coins across	unknown	Transportation	Coin	00:00:14	No	Magician has a coin in each of his hands. They both end up in one hand	List6
S14	powder sugar to block sugar	unknown	Change	Sugar	00:00:26	Yes	Magician turns powdered sugar into a block of sugar	List7
S15	Ring through the glass	unknown	Penetration	Ring/ Grass	00:00:31	No	Magician places ring on the stem of a glass without breaking it	List8
S16	Gipsy thread	unknown	Restoration	Thread	00:00:45	No	Magician cuts piece of string in several places and then magically puts it back together whole.	List9
S17	multum in parvo	Bazar de Magia	Other	Milk/ Grass	00:01:14	No	Magician pours milk from a small glass into a bigger one but still manages to fill the bigger glass full of milk. He continues this process with bigger glasses each time and still manages to fill the bigger glasses.	List4
S18	Boxes from Paperbag	unknown	Appearance	Box	00:00:31	Yes	Magician pulls out 3 boxes with flowers in from a paper bag	List4
S19	flow	Dan Hauss	Other	Bottle	00:00:44	No	Magician asks volunteer to hold hand over a water bottle. When turned upside down the water does not pour out until the magician gestures	List5

S2	Quick Coincidence	unknown	Take one	Cards	00:00:32	Yes	Volunteer selects four cards, all of which turn out to be the aces	List3
S20	Giant Appearing Straw	unknown	Appearance	Straw	00:00:18	No	Two magicians pull out giant straw from a brown paper bag	List6
S21	Spoon bending	unknown	Bending	Spoon	00:00:21	No	Magician bends a spoon using fingers	List7
S22	Bill in lemon	Emil Jarrow and Doc Eason	Transportation	Bill/Lemon	00:01:10	No	Magician asks volunteer to sign piece of paper which then magically appears inside a lemon	List8
S23	Thunderbird	Lee Asher	Appearance	Cards	00:00:16	No	Cards magical appear in magicians' hand	List3
S25	Handkerchief in Bread	unknown	Transportation	Handkerchief/Bread	00:00:52	No	Handkerchief appears from bread	List3
S26	Rope act	unknown	Restoration	Rope	00:00:24	No	Magician cuts rope with fingers and then mends the broken rope	List4
S27	Water Vanish	unknown	Disappearance	Water	00:00:31	No	Magician pours water into cup from bottle and then pours the water into another cup but when he tips it upside down, no water spills out.	List5
S28	Dresscode	Calen Morelli	Change	T-shirts	00:00:16	No	Magician changes t-shirts very quickly when he turns around	List6
S29	sticky situation	Andy Leviss	Restoration	Chewing gum	00:00:25	No	Magician transforms a chewed piece of gum back into its packaging	List7
S3_Long	Bizarre Twist_ver 2	Paul Harris	Color change	Cards	00:00:38	No	Card flips or changes to another color with a quick gesture.	List1
S3_Short	Bizarre Twist_ver 2	Paul Harris	Color change	Cards	00:00:20	No	Card flips or changes to another color with a quick gesture.	List2

S30	Chinese Stick	Unknnown	Other	Sticks	00:00:25	No	Magician pulls strings through a stick which makes the other string in the other stick move	List8
S31	Wari-vanish	Takahito Shoji	Disappearance	Chopsticks	00:00:19	No	Magician places a pair of chopsticks into envelope and proceeds to crush the envelope and its contents into a paper ball	List9
S32	Self Tying Shoelace	Jay Noblezada	Other	Shoes	00:00:14	No	Magician ties his shoelace without using his hands	List3
S33_Long	Swallowing balloon	Steve Bedwell	Other	Balloon	00:00:52	No	Magician eats a long balloon while it is full of air	List2
S33_Short	Swallowing balloon	Steve Bedwell	Other	Balloon	00:00:45	No	Magician eats a long balloon while it is full of air	List1
S4	Torn & Restored Transpo	David Williamson	Restoration/Take one	Cards	00:00:46	Yes	Magician shows the audience a card which he then rips up. Then he shows the audience another card, but this time waves the card over the ripped up one, revealing that the two cards have swapped places.	List4
S5	Drible force	unknown	Mind reading	Cards	00:00:22	Yes	The magician verbally points to the card that was seen by volunteer.	List5
S6	1 to 4	unknown	Appearance	Cards	00:00:21	No	Volunteer selects one card which then magically turns into four - all of which are the same e.g. all Queens	List6
S7	Four cards change	unknown	Change	Cards	00:00:13	No	Four different cards change to four kings	List7
S8	Princess card trick	Henry Hardin	Mind reading	Cards	00:00:34	Yes	Six cards are placed on the table and the audience is asked to remember one of the cards. The magician then removes all of the cards from the table, laying one of the cards to the side but face down. He then places the cards back down on the table again revealing that the audience member's chosen card is no longer in the deck.	List8
S9	Blanc Deck	unknown	Color change	Cards	00:00:32	No	Magician turns a deck of cards into a blank deck.	List9
Trick1	How to cheat at poker	Alvaro Argente	Color Change	Cards	00:00:30	No	The magician shuffles the cards and turns four random cards into 4 kings	List9

Trick10	Aces color change	Edward Marlo and Alvaro Argente	Color change	Cards	00:00:52	No	The magician has four aces with red backs. He then turns the back color to blue. Eventually he reveals that all of the aces have a different color back	List8
Trick11	Poker face	W. Ciuro	Take one	Cards	00:01:18	Yes	The volunteer selects a card and places it back into the deck. The magician shuffles the cards and then places four cards on the table. One of the cards is the selected card. The magician then places a further 4 cards on the table and reveals that the 4th card is actually the selected card. Then he reveals that the other cards are not the selected card.	List9
Trick12_Long	Sandwich effect	Harry Lorayne	Transportation	Cards	00:01:46	No	The magician reveals that the selected card is sandwiched between two cards	List2
Trick12_Short	Sandwich effect	Harry Lorayne	Transportation	Cards	00:00:34	No	The magician reveals that the selected card is sandwiched between two cards	List1
Trick13	Inside a box	Dani Daortiz	Take one	Cards	00:00:44	No	The volunteer examines an empty card box and then chooses a card from the magicians' deck. With a gesture, the magician reveals that the card was in the box	List3
Trick14_Long	Rub-a-dub Vanish	Paul Stadleman	Take one/Disappearance	Cards	00:00:47	No	The volunteer chooses a card and places it back into the deck. With a gesture, the magician reveals the selected card. The magician then makes the selected card disappear	List1
Trick14_Short	Rub-a-dub Vanish	Paul Stadleman	Take one	Cards	00:00:37	No	The volunteer chooses a card and places it back into the deck. With a gesture, the magician reveals the selected card	List2
Trick15	Invisible deck	Jor Berg	Prediction	Cards	00:00:37	No	Card a volunteer picked up. In another deck, the card appeared face down while the other cards are face up.	List4
Trick16_Long	Signed Transpo	Alvaro Argente	Take one	Cards	00:01:42	Yes	Four cards (two red and two black) are placed on top of the table. A participant signs a card and places it back into the pile. Then with a gesture, the magician flicks the signed card into the four cards on the table. The magician then loses the car and finds it again in his pocket.	List2
Trick16_Short	Signed Transpo	Alvaro Argente	Take one	Cards	00:00:59	Yes	Four cards (two red and two black) are placed on top of the table. A participant signs a card and places it back into the pile. Then with a gesture, the magician flicks the signed card into the four cards on the table.	List1

Trick17	MST	Mathew Dowden	Other	Cards	00:01:55	No	Volunteer signs the front of one card and the back of another. The magician transfers the signatures onto the front and back of one card	List6
Trick18_Long	Ambitious card	Gustav Alberti	Transportation	Cards	00:01:22	No	The magician signs a card and returns it to the middle of the deck. He clicks his fingers and reveals the card is now on top. Then he bends the card and places it back into the middle. After a gesture, the card ends up on top again.	List1
Trick18_Short	Ambitious card	Gustav Alberti	Transportation	Cards	00:00:31	No	The magician signs a card and returns it to the middle of the deck. He clicks his fingers and reveals the card is now on top. Then he bends the card and places it back into the middle. After a gesture, the card ends up on top again.	List2
Trick19	Card in the mouth	Unknown	Transportation	Cards	00:01:03	No	The volunteers selected card appears in the magician's mouth	List6
Trick2	Finding aces with mistake	Alvaro Argente	Assembly	Cards	00:00:53	No	The magician shuffles the cards and finds the four aces in the pack	List3
Trick20_Long	Nut and rope	Giovanni Livera	Penetration	Nut/ Rope	00:01:17	No	The magician shows a metal nut and rope. It doesn’t matter how many times he secures the nut with the rope, it always scape.	List2
Trick20_Short	Nut and rope	Giovanni Livera	Penetration	Nut/ Rope	00:00:36	No	The magician shows a metal nut and rope. It doesn’t matter how many times he secures the nut with the rope, it always scape.	List1
Trick21	Magic ring	Wayne Dobson	Penetration	Ring/ Key	00:01:09	No	The magician links the volunteers ring onto a key and then unlinks it	List7
Trick22_Long	Cups&Balls	David Forrest	Penetration	Cups and balls	00:01:06	No	Three shot glasses are placed on the table and small pieces of paper scrunched into balls are put on top. The magician then shuffles the shot glasses around revealing the fire paper underneath has multiplied. Eventually he reveals a red ball underneath one of the shot glasses.	List1
Trick22_Short	Cups&Balls	David Forrest	Penetration	Cups and balls	00:00:33	No	Three shot glasses are placed on the table and small pieces of paper scrunched into balls are put on top. The magician then shuffles the shot glasses around revealing the fire paper underneath has multiplied. Eventually he reveals a red ball underneath one of the shot glasses.	List2

Trick23_Long	Ace to King	Pepe Carroll and Alvaro Argente	Other	Cards	00:02:35	No	Four aces and two jacks are removed from the deck. One ace is placed on the table and the magician then finds the next cards and places them in order starting from the ace.	List1
Trick23_Short	Ace to King	Pepe Carroll and Alvaro Argente	Other	Cards	00:00:28	No	Four aces and two jacks are removed from the deck. One ace is placed on the table and the magician then finds the next cards and places them in order starting from the ace.	List2
Trick24	Cut by the card	Unknown	Take one	Cards	00:00:29	No	Find a card that the volunteer picked up	List8
Trick25	Do as I do	Vicente Canuto	Take one	Cards	00:01:12	Yes	The magician gets the volunteer to copy his card shuffling and cutting. The volunteer ends up finding their card in the opposite deck.	List9
Trick26	Copy cat	Unknown	Take one	Cards	00:00:53	No	The magician searches spectator's card by cutting deck.	List3
Trick27	Bell on a card	Alvaro Argente	Transportation	Cards	00:01:02	No	The volunteers selected card appears under the bell	List4
Trick28	Chinese linking rings	Unknown	Penetration	Rings	00:00:44	No	Magician links and unlinks several silver rings	List5
Trick29	Scotch and Soda	Richard Himber	Transportation / Disappearance	Coins	00:01:05	No	The magician shows a silver and a copper coin. Every time he puts a coin in his pocket, the coin appears again in his hand. In the end, all the coins disappear from his hand	List6
Trick3	triumph	Dai Vernon	Take one	Cards	00:00:50	No	A card trick where some of the cards end up face down and the other half face up and the chosen card is found in the middle.	List4
Trick30	Mental Bend	Unknown	Bending	Coin	00:00:56	Yes	The magician asks the audience for a coin. They signed it to be sure that is in fact their coin. Then the coins magically bend inside the closed fist of the audience.	List7
Trick31	Coin detection	Unknown	Take one	Cards/ Coin	00:00:38	No	A card is selected and lost in the deck. Then, the magician shows a coin and makes it disappear. When the cards are spread on the table, the coin can be seen in the middle of the extension… marking where the selected card is	List8

Trick32_Long	One coin routine	David Roth	Transportation	Coin	00:00:42	No	The magician makes a silver coin disappear and reappear several times	List1
Trick32_Short	One coin routine	David Roth	Transportation	Coin	00:00:12	No	The magician makes a silver coin disappear and reappear several times	List2
Trick33	Pixel:	David Jade	Take one	Cards/ Rubber band	00:00:48	No	A card is selected and lost in the deck. Then, the magician found a selected card using rubber band	List9
Trick34	Omni deck	Paul Harris	Change	Cards	00:00:55	No	Volunteer chooses and signs a card. The magician then places the deck in the volunteer's hand and finds the missing card. When the volunteer reveals the deck, it is in fact a clear block in the shape of a deck of cards.	List3
Trick35	Three card monte	Unknown	Transportation	Cards	00:00:20	Yes	The volunteer has to track a card, and the magician keeps swapping it to the middle	List4
Trick36_Long	Four Kings	Eddie Fetcher and Joshua Jay	Color Change	Cards	00:01:00	No	Two kings change into two jokers. Then, the magician finds four kings in the deck and finally he reveals that the color of the deck is different.	List2
Trick36_Short	Four Kings	Eddie Fetcher	Color Change	Cards	00:02:08	No	Two kings change into two jokers.	List1
Trick37	Impossible escape bands	Unknown	Transportation	Rubber bands	00:00:51	No	An elastic band visually travels from finger to finger, then it travels again even when the fingers are secured with another elastic band.	List5
Trick38	Classic Disappearance	Milbourne Christopher	Disappearance / Appearance	Handkerchief	00:00:32	No	The magician closes his left fit around a silk, and makes it disappear. Then, he makes it appear from his right fist.	List6
Trick39	Tiny Plunger	Mathieu Bich and Jon Armstrong	Take One	Cards/ Tiny plunger	00:00:51	No	The magician uses small plunger to pick out the card	List7
Trick4	Pressure	Daniel Garcia	Penetration	Balloon/ Smart phone	00:00:42	No	The magician puts a mobile phone inside a balloon with a simple gesture of his hands.	List5

Trick40	Coin bite	Roy Kueppers	Restoration	Coin	00:00:23	No	The magician borrows a coin and visually “bites” a piece of it. Then, in a gesture, the coin is restored.	List8
Trick41	Silk Transformation	Russ Walsh	Change	Silk/ Cane	00:00:13	No	The magician shows a silk, and in a gesture, turns it into a metal cane.	List9
Trick5	Smoke in the veins	Alan Rorrison	Other	Smoke	00:00:25	No	The magician draws a dot on the palm of his hand and then uses a lighter to make a gesture under his hand. The smoke then travels up his arm and out through his mouth.	List5
Trick6_Long	Chop cup	Don Alan	Transportation	Cup and ball	00:01:04	No	The classic cup and ball routine using only 1 cup and an egg	List1
Trick6_Short	Chop cup	Don Alan	Transportation	Cup and ball	00:00:27	No	The classic cup and ball routine using only 1 cup and an egg	List2
Trick7_Long	Multiplying sponge balls	Lybarger	Transportation	Sponge	00:00:34	No	The magician gets the volunteer to hold a foam ball which then doubles into two. He repeats the trick, and they then turn into three.	List2
Trick7_Short	Multiplying sponge balls	Lybarger	Transportation	Sponge	00:00:20	No	The magician gets the volunteer to hold a foam ball which then doubles into two. He repeats the trick, and they then turn into three.	List1
Trick8_Long	Icebreaker	Alvaro Argente	Take one	Cards	00:00:56	No	The volunteer chooses a card and places it into the deck. The magician then shuffles the card, revealing to the camera that the selected card is not on the top nor the bottom. Then with a gesture of his hand, he transforms the top card into the selected card.	List1
Trick8_Short	Icebreaker	Alvaro Argente	Take one	Cards	00:00:39	No	The volunteer chooses a card and places it into the deck. The magician then shuffles the card, revealing to the camera that the selected card is not on the top nor the bottom. Then with a gesture of his hand, he transforms the top card into the selected card.	List2
Trick9	The Last Trick of Dr. Daley	Jacob Daley	Exchange	Cards	00:00:26	Yes	The magician places two red cards down and then reveals that they are two black cards	List7

Table A3 – The rating Means and SDs for individual magic tricks.

Magic ID	All data											
	Mean						SD					
	N of participants	Clarity of the trick	Surprise in response to the trick	Interest in the trick	Confidence in the solution	Curiosity in the solution	Clarity of the trick	Surprise in response to the trick	Interest in the trick	Confidence in the solution	Curiosity in the solution
H1	109	0.47	3.94	3.83	2.76	5.01	0.50	2.74	2.72	2.24	3.09
H2	109	0.87	4.25	4.49	4.73	5.22	0.34	2.37	2.42	3.12	2.83
H3	103	0.79	5.51	5.41	3.39	6.26	0.41	2.44	2.51	2.67	2.58
H5	113	0.88	5.30	5.10	3.65	5.73	0.32	2.48	2.50	2.58	2.69
H6	113	0.93	5.95	5.61	3.05	6.47	0.26	2.46	2.45	2.46	2.70
H7	113	0.76	6.93	6.51	2.42	6.80	0.43	2.19	2.44	1.88	2.67
H8	110	0.85	5.45	5.56	3.58	6.24	0.35	2.54	2.63	2.65	2.86
H9	109	0.83	4.94	4.62	4.06	5.54	0.38	2.48	2.49	2.80	2.83
H10	109	0.89	5.79	5.69	2.55	6.13	0.31	2.39	2.56	2.15	2.84
H11	103	0.83	5.93	5.80	3.17	6.26	0.37	2.47	2.57	2.44	2.70
H12	113	0.67	4.88	4.60	3.58	5.37	0.47	2.61	2.62	2.70	2.90
H13	113	0.86	6.98	6.71	2.65	7.29	0.35	2.53	2.77	2.42	2.64
H14	103	0.85	5.85	5.95	2.70	6.46	0.35	2.55	2.58	1.98	2.74
H15	110	0.73	4.31	4.08	3.47	4.93	0.45	2.44	2.38	2.54	2.77
H16	109	0.87	6.04	5.83	3.55	6.47	0.34	2.62	2.66	2.64	2.79
H17	109	0.94	5.34	5.51	4.63	6.09	0.25	2.67	2.63	2.93	2.87
H18	103	0.81	6.83	6.51	2.94	7.15	0.40	2.35	2.37	2.48	2.61
H19	113	0.85	6.57	6.53	3.62	6.83	0.36	2.57	2.60	2.78	2.81
H20	113	0.91	5.69	5.53	3.57	6.37	0.29	2.49	2.45	2.81	2.50

H21	113	0.74	6.26	6.12	3.02	6.27		0.44	2.96	2.95	2.49	3.04
H22	110	0.85	6.23	6.19	3.06	6.60		0.36	2.57	2.80	2.20	2.72
H24	109	0.79	5.25	5.05	3.47	5.78		0.41	2.49	2.71	2.19	2.71
H25	109	0.84	4.70	4.77	3.89	5.66		0.36	2.36	2.37	2.98	2.74
H26	103	0.83	6.00	5.84	2.72	6.47		0.37	2.35	2.54	2.11	2.65
H27	113	0.70	4.87	4.81	3.91	5.05		0.46	2.70	2.68	2.89	2.61
H28	113	0.79	5.08	4.63	2.40	5.49		0.41	2.53	2.55	1.85	2.80
H29	113	0.79	5.64	5.30	3.03	5.76		0.41	2.27	2.46	2.40	2.78
H31	110	0.84	5.39	5.18	3.51	5.74		0.37	2.28	2.35	2.37	2.77
H32	109	0.87	4.98	4.67	5.48	5.29		0.34	2.61	2.67	3.16	2.89
H33	109	0.80	6.16	5.74	2.48	6.40		0.40	2.66	2.86	2.17	2.99
H34	103	0.90	5.17	5.26	3.94	6.09		0.30	2.66	2.61	2.80	2.74
H35	113	0.86	6.99	6.75	2.31	7.14		0.35	2.21	2.30	1.89	2.55
H36	113	0.65	4.36	4.21	2.89	4.89		0.48	2.63	2.61	2.26	2.90
H37	113	0.92	5.36	5.32	4.94	6.04		0.27	2.81	2.76	3.12	2.78
H38	110	0.92	4.82	4.85	4.81	5.75		0.28	2.53	2.51	2.98	2.85
H39	109	0.90	4.94	4.78	4.72	5.72		0.30	2.55	2.56	2.72	2.89
H40	109	0.64	3.98	3.96	3.76	4.84		0.48	2.34	2.34	2.92	2.83
H41	103	0.79	5.36	5.13	2.76	6.00		0.41	2.25	2.36	2.14	2.72
H4_Long	108	0.85	7.21	7.27	3.06	7.22		0.36	2.37	2.30	2.43	2.76
H4_Short	103	0.78	5.17	5.13	3.42	5.68		0.42	2.31	2.25	2.36	2.69
K1	113	0.81	5.96	5.46	2.79	6.14		0.39	2.59	2.83	2.31	2.84
K2	113	0.81	5.88	5.68	3.88	6.27		0.40	2.65	2.80	2.85	2.58
K3	109	0.85	4.79	4.48	3.92	5.08		0.36	2.32	2.46	2.59	2.69
K4	109	0.83	5.78	5.72	2.81	6.34		0.38	2.65	2.66	2.15	2.66
K5	109	0.65	4.60	4.50	2.89	5.65		0.48	2.43	2.59	2.38	2.68

K6	103	0.60	5.12	4.75	2.41	5.50		0.49	2.45	2.51	1.92	2.80
K7	113	0.74	5.41	5.37	3.14	5.81		0.44	2.51	2.52	2.31	2.79
K8	113	0.50	3.93	3.71	2.46	4.32		0.50	2.48	2.45	2.10	2.80
K9	113	0.64	5.18	5.07	3.04	5.32		0.48	2.50	2.52	2.38	2.61
K10	110	0.93	5.25	5.21	3.84	5.72		0.26	2.23	2.18	2.66	2.74
K11	109	0.86	5.58	5.39	4.27	5.82		0.35	2.66	2.54	2.88	2.87
K12	109	0.77	6.24	6.06	3.24	6.61		0.42	2.96	2.94	2.85	2.88
K13	103	0.86	4.62	4.87	4.23	5.45		0.34	2.47	2.52	2.76	2.97
K14	113	0.80	5.61	5.70	2.94	6.22		0.40	2.28	2.25	2.26	2.44
K15_Long	103	0.83	6.44	6.41	2.57	6.77		0.38	2.60	2.63	2.04	2.70
K15_Short	108	0.89	6.09	5.91	3.05	6.32		0.32	2.54	2.62	2.23	2.75
K16_Long	108	0.82	6.33	6.15	2.99	6.60		0.38	2.77	2.95	2.46	3.14
K16_Short	103	0.74	5.17	4.99	2.83	5.63		0.44	2.58	2.56	2.27	2.89
K17	113	0.93	6.21	5.90	2.52	6.55		0.26	2.36	2.52	1.97	2.52
K18	113	0.63	4.54	4.25	3.04	4.89		0.49	2.57	2.53	2.49	2.81
K19_Long	103	0.72	6.33	6.12	3.32	6.53		0.45	2.61	2.39	2.54	2.65
K19_Short	108	0.88	5.50	5.50	4.08	6.42		0.33	2.66	2.68	2.90	2.92
K21_Long	108	0.71	5.30	5.12	2.85	5.87		0.45	2.63	2.86	2.11	2.99
K21_Short	103	0.58	4.22	3.90	3.16	4.66		0.50	2.56	2.55	2.41	2.78
K22_Long	103	0.84	6.10	6.35	4.24	6.52		0.36	2.45	2.44	2.78	2.65
K22_Short	108	0.92	5.24	5.33	4.96	5.65		0.28	2.71	2.72	3.11	2.98
K23	110	0.93	6.13	6.10	3.29	6.64		0.26	2.36	2.42	2.42	2.57
K24	109	0.78	4.92	4.70	3.06	5.57		0.42	2.32	2.41	2.28	2.74
K25	109	0.62	3.60	3.59	3.97	4.46		0.49	2.30	2.35	3.12	2.75
K27	103	0.88	5.05	5.21	3.84	6.00		0.32	2.40	2.40	2.52	2.49
K28	113	0.86	4.94	5.00	3.96	5.62		0.35	2.56	2.65	2.91	2.97

K29	113	0.91	5.47	5.06	3.04	6.02		0.29	2.60	2.60	2.34	2.64
K30	113	0.76	4.42	4.17	4.16	4.93		0.43	2.67	2.65	2.74	2.82
K31	110	0.86	4.74	4.75	4.63	5.35		0.34	2.66	2.46	2.95	2.96
K32	110	0.81	3.98	3.87	4.75	4.76		0.39	2.20	2.25	2.87	2.77
K33	109	0.85	4.77	4.75	3.83	5.69		0.36	2.42	2.36	2.86	2.61
K34	113	0.82	5.27	5.01	3.98	6.28		0.38	2.30	2.54	2.67	2.58
K35_Long	108	0.59	4.94	4.81	3.08	5.86		0.49	2.46	2.66	2.45	2.91
K35_Short	103	0.62	4.47	4.59	3.68	5.43		0.49	2.41	2.50	2.64	2.93
S1	113	0.77	6.52	6.06	2.48	6.55		0.42	2.46	2.70	2.13	2.78
S2	113	0.83	5.50	5.12	3.11	5.98		0.38	2.51	2.63	2.48	2.67
S3_Long	103	0.62	4.91	4.70	3.05	5.16		0.49	2.33	2.28	2.26	2.56
S3_Short	108	0.67	4.33	4.52	3.19	5.06		0.47	2.49	2.54	2.49	2.82
S4	113	0.84	7.45	7.33	2.27	7.46		0.37	2.11	2.13	1.91	2.39
S5	110	0.85	5.31	5.22	3.45	5.85		0.35	2.58	2.66	2.63	2.93
S6	109	0.80	4.94	4.79	3.75	5.41		0.40	2.53	2.35	2.66	2.85
S7	109	0.57	4.25	4.20	2.39	4.82		0.50	2.63	2.69	1.84	2.91
S8	103	0.87	5.67	5.99	3.38	6.54		0.33	3.02	2.91	2.81	2.94
S9	113	0.81	6.93	6.59	2.54	6.84		0.40	2.51	2.47	2.24	2.86
S10	113	0.90	6.88	6.69	2.65	7.09		0.30	2.42	2.50	2.27	2.59
S11	113	0.88	5.69	5.81	4.05	6.40		0.32	2.53	2.47	2.78	2.52
S12	110	0.91	5.85	6.08	4.27	6.36		0.29	2.45	2.42	2.96	2.69
S13	109	0.84	5.01	4.82	4.22	5.29		0.36	2.53	2.31	2.67	2.71
S14	109	0.87	5.19	4.96	3.89	5.90		0.34	2.64	2.53	2.96	2.82
S15	103	0.93	4.69	5.02	5.74	5.98		0.25	2.61	2.57	3.03	2.75
S16	113	0.96	5.90	6.11	3.64	6.55		0.21	2.74	2.66	2.64	2.75
S17	113	0.95	3.78	4.13	7.45	4.90		0.23	2.79	2.61	3.10	3.18

S18	113	0.84	6.01	5.89	3.63	6.33		0.37	2.51	2.48	2.68	2.54
S19	110	0.88	5.19	5.36	4.55	5.95		0.32	2.63	2.57	2.82	2.77
S20	109	0.84	4.34	4.33	5.27	5.25		0.36	2.50	2.45	2.94	2.95
S21	109	0.90	4.63	4.76	4.88	5.78		0.30	2.74	2.62	3.16	2.77
S22	103	0.91	6.41	6.46	3.20	6.95		0.28	2.48	2.44	2.49	2.58
S23	113	0.85	4.39	4.19	3.75	5.36		0.36	2.43	2.46	2.70	2.59
S25	113	0.96	5.23	5.41	4.78	6.50		0.19	2.68	2.65	2.89	2.50
S26	113	0.84	5.56	5.39	3.49	5.81		0.37	2.51	2.54	2.51	2.53
S27	110	0.92	5.58	5.60	3.72	6.16		0.28	2.10	2.09	2.64	2.68
S28	109	0.86	3.81	3.70	5.06	4.74		0.35	2.51	2.45	2.92	2.78
S29	109	0.88	4.96	4.90	4.27	5.81		0.33	2.58	2.57	3.18	2.72
S30	103	0.88	5.22	5.31	4.44	6.28		0.32	2.40	2.43	2.92	2.50
S31	113	0.82	5.09	4.87	4.14	5.59		0.38	2.47	2.53	2.76	2.70
S32	113	0.91	6.11	6.15	2.96	6.74		0.29	2.85	2.71	2.48	2.80
S33_Long	108	0.88	5.31	5.44	5.31	6.19		0.33	2.99	2.93	3.21	3.03
S33_Short	103	0.84	4.69	4.42	5.31	5.78		0.36	2.68	2.60	3.13	2.88
Trick1	113	0.65	5.34	4.97	2.30	5.48		0.48	2.46	2.59	2.20	2.86
Trick2	113	0.78	5.88	5.55	2.44	6.24		0.42	2.65	2.65	1.99	2.81
Trick3	113	0.77	5.96	5.50	2.90	6.10		0.42	2.36	2.49	2.39	2.64
Trick4	110	0.85	4.54	4.95	4.63	5.15		0.36	2.74	2.66	3.24	3.19
Trick5	110	0.78	4.81	4.88	4.45	5.47		0.41	2.64	2.71	2.99	2.98
Trick6_Long	103	0.76	5.66	5.73	3.80	6.06		0.43	2.53	2.62	2.57	2.78
Trick6_Short	108	0.90	5.56	5.83	3.82	6.64		0.30	2.50	2.38	2.42	2.30
Trick7_Long	108	0.92	5.09	5.55	5.19	6.03		0.28	2.61	2.40	3.07	2.82
Trick7_Short	103	0.75	3.93	4.06	4.83	4.88		0.44	2.68	2.61	3.37	2.83
Trick8_Long	103	0.71	5.60	5.48	2.98	5.99		0.46	2.49	2.41	2.06	2.79

Trick8_Short	108	0.85	5.73	5.69	3.34	6.23		0.36	2.42	2.39	2.49	2.55
Trick9	109	0.80	5.69	5.32	3.11	6.07		0.40	2.72	2.76	2.55	2.76
Trick10	103	0.61	5.23	5.09	2.48	5.83		0.49	2.68	2.77	2.02	2.95
Trick11	113	0.85	6.99	6.55	2.36	6.88		0.36	2.38	2.49	1.97	2.75
Trick12_Long	108	0.86	6.45	6.14	2.45	6.61		0.35	2.74	2.78	1.94	2.83
Trick12_Short	103	0.74	4.74	4.58	3.30	5.52		0.44	2.50	2.44	2.40	2.73
Trick13	113	0.90	5.76	5.69	2.88	6.20		0.30	2.49	2.63	2.18	2.61
Trick14_Long	103	0.76	4.82	4.95	3.36	5.23		0.43	2.30	2.20	2.44	2.80
Trick14_Short	108	0.72	5.06	4.88	3.45	5.56		0.45	2.58	2.57	2.56	2.55
Trick15	113	0.81	5.17	4.96	2.98	5.52		0.40	2.33	2.36	2.32	2.60
Trick16_Long	108	0.68	6.18	5.68	2.28	6.35		0.47	2.82	2.85	1.90	2.87
Trick16_Short	103	0.70	5.42	5.15	3.00	5.83		0.46	2.39	2.41	2.16	2.59
Trick17	109	0.69	5.87	5.70	2.46	6.00		0.47	2.78	2.82	1.99	3.06
Trick18_Long	103	0.70	5.39	5.10	2.95	5.56		0.46	2.83	2.70	2.19	3.10
Trick18_Short	108	0.81	5.61	5.38	3.19	6.20		0.40	2.60	2.57	2.57	2.76
Trick19	109	0.84	7.05	6.53	2.58	7.15		0.36	2.57	2.71	1.94	2.72
Trick20_Long	108	0.90	6.39	6.34	3.92	6.75		0.30	2.59	2.78	2.73	2.81
Trick20_Short	103	0.80	5.98	5.86	3.77	6.37		0.40	2.53	2.54	2.74	2.79
Trick21	109	0.83	5.26	5.11	3.70	5.79		0.38	2.50	2.62	2.69	2.74
Trick22_Long	103	0.77	6.02	5.78	3.96	6.46		0.42	2.57	2.73	2.78	2.78
Trick22_Short	108	0.87	4.98	5.18	4.99	5.82		0.34	2.56	2.58	2.93	2.90
Trick23_Long	103	0.60	5.48	5.03	2.18	5.67		0.49	2.74	2.90	1.63	2.95
Trick23_Short	108	0.44	4.44	4.44	2.41	4.98		0.50	2.74	2.71	1.94	2.97
Trick24	103	0.82	4.77	4.77	2.84	5.59		0.39	2.35	2.43	2.11	2.70
Trick25	113	0.83	6.54	6.37	2.70	6.68		0.38	2.22	2.27	2.07	2.57
Trick26	113	0.90	5.50	5.05	2.42	5.86		0.30	2.31	2.55	1.66	2.78

Trick27	113	0.81	6.85	6.43	2.60	6.72		0.39	2.26	2.38	1.91	2.57
Trick28	110	0.90	5.12	5.20	4.54	5.70		0.30	2.47	2.50	2.83	2.74
Trick29	109	0.83	5.57	5.44	3.31	6.10		0.37	2.69	2.55	2.19	2.84
Trick30	109	0.74	6.30	6.10	2.77	6.29		0.44	2.42	2.47	2.39	2.97
Trick31	103	0.76	5.60	5.45	2.95	6.04		0.43	2.37	2.44	2.17	2.65
Trick32_Long	103	0.83	4.77	5.07	4.68	5.48		0.37	2.47	2.42	2.88	2.80
Trick32_Short	108	0.81	4.50	4.72	4.78	5.46		0.39	2.43	2.52	2.87	2.92
Trick33	113	0.74	6.41	6.13	2.50	6.44		0.44	2.46	2.45	2.07	2.64
Trick34	113	0.74	6.74	6.02	2.02	6.73		0.44	2.21	2.72	1.60	2.68
Trick35	113	0.83	5.63	5.42	4.22	6.05		0.38	2.33	2.40	2.81	2.50
Trick36_Long	108	0.57	6.27	5.98	2.31	6.20		0.50	2.90	2.98	2.06	3.16
Trick36_Short	103	0.57	4.96	4.60	2.80	5.36		0.50	2.63	2.61	2.22	2.69
Trick37	110	0.85	5.25	5.37	3.80	5.85		0.36	2.62	2.54	2.77	2.95
Trick38	109	0.90	4.88	4.76	4.35	5.51		0.30	2.46	2.45	2.77	2.74
Trick39	109	0.75	5.04	5.14	3.02	5.68		0.43	2.55	2.39	2.50	2.81
Trick40	103	0.86	4.75	4.60	3.83	5.78		0.34	2.67	2.69	2.73	2.77
Trick41	113	0.82	5.22	5.15	4.04	5.81		0.38	2.71	2.64	2.92	2.85

Magic ID	**Removing the trials that were unclear to participants**									
	Mean					**SD**				
	N of participants	Surprise in response to the trick	Interest in the trick	Confidence in the solution	Curiosity in the solution	Surprise in response to the trick	Interest in the trick	Confidence in the solution	Curiosity in the solution
H1	51	5.18	5.10	3.76	6.14	2.53	2.60	2.40	2.84
H2	95	4.20	4.67	5.11	5.40	2.32	2.31	3.05	2.76
H3	81	5.59	5.51	3.74	6.56	2.40	2.41	2.86	2.30

H5	100	5.34	5.18	3.74	5.78		2.47	2.46	2.60	2.67
H6	105	6.00	5.67	3.10	6.61		2.42	2.42	2.49	2.67
H7	86	7.02	6.66	2.37	7.02		2.02	2.25	1.80	2.45
H8	94	5.73	5.95	3.87	6.50		2.39	2.39	2.67	2.71
H9	90	5.21	4.91	4.34	5.69		2.50	2.51	2.88	2.81
H10	97	5.93	5.89	2.60	6.48		2.34	2.43	2.16	2.63
H11	86	5.99	5.87	3.24	6.45		2.33	2.45	2.48	2.52
H12	76	5.38	5.12	3.80	5.92		2.57	2.58	2.71	2.62
H13	97	7.14	6.89	2.71	7.43		2.43	2.68	2.35	2.52
H14	88	5.99	6.16	2.69	6.82		2.42	2.45	1.90	2.48
H15	80	4.76	4.56	4.04	5.51		2.33	2.23	2.60	2.57
H16	95	6.28	6.18	3.57	6.76		2.50	2.48	2.58	2.62
H17	102	5.31	5.52	4.69	6.23		2.61	2.57	2.90	2.79
H18	83	6.86	6.67	3.12	7.28		2.25	2.19	2.62	2.32
H19	96	6.66	6.64	3.78	6.93		2.55	2.64	2.81	2.75
H20	103	5.74	5.57	3.63	6.50		2.56	2.49	2.85	2.48
H21	84	6.44	6.36	3.20	6.54		3.00	2.94	2.70	3.02
H22	93	6.48	6.33	3.14	6.82		2.38	2.72	2.23	2.62
H24	86	5.52	5.37	3.59	6.05		2.43	2.65	2.22	2.62
H25	92	4.83	5.01	4.18	5.79		2.36	2.35	3.03	2.74
H26	86	6.12	5.98	2.79	6.63		2.34	2.53	2.20	2.61
H27	79	5.32	5.25	4.42	5.23		2.69	2.60	2.91	2.58
H28	89	5.64	5.25	2.70	6.25		2.31	2.39	1.95	2.47
H29	89	5.92	5.61	3.07	6.02		2.20	2.34	2.43	2.75
H31	92	5.46	5.40	3.65	5.83		2.23	2.38	2.41	2.80
H32	95	4.97	4.67	5.81	5.40		2.64	2.70	3.07	2.89

H33	87	6.46	6.06	2.63	6.64		2.57	2.74	2.34	2.94
H34	93	5.20	5.38	4.02	6.15		2.64	2.59	2.84	2.71
H35	97	7.18	7.02	2.29	7.38		2.07	2.01	1.74	2.33
H36	74	5.20	4.92	3.01	5.92		2.48	2.56	2.04	2.51
H37	104	5.35	5.30	5.13	6.06		2.74	2.69	3.10	2.69
H38	101	4.75	4.77	4.91	5.72		2.57	2.51	3.00	2.86
H39	98	5.01	4.83	4.91	5.94		2.60	2.56	2.69	2.81
H40	70	4.36	4.37	4.50	5.46		2.22	2.23	2.88	2.79
H41	81	5.65	5.46	2.69	6.23		2.13	2.28	2.07	2.65
H4_Long	92	7.43	7.46	3.09	7.50		2.24	2.14	2.53	2.58
H4_Short	80	5.33	5.31	3.59	5.95		2.36	2.33	2.46	2.78
K1	92	6.15	5.73	2.89	6.41		2.48	2.75	2.41	2.70
K2	91	6.05	5.96	4.02	6.45		2.68	2.80	2.94	2.65
K3	93	4.88	4.66	4.06	5.22		2.31	2.44	2.64	2.65
K4	90	6.19	6.12	2.82	6.67		2.57	2.49	2.12	2.54
K5	71	5.20	5.10	3.25	6.17		2.18	2.38	2.54	2.41
K6	62	5.94	5.44	2.79	6.29		1.96	2.32	2.13	2.54
K7	84	5.99	5.94	3.26	6.21		2.20	2.24	2.31	2.56
K8	57	4.95	4.93	3.14	5.82		2.04	2.23	2.26	2.44
K9	72	5.83	5.75	3.35	5.81		2.21	2.24	2.44	2.44
K10	102	5.14	5.10	3.89	5.56		2.24	2.09	2.68	2.76
K11	94	5.79	5.60	4.35	6.01		2.68	2.52	2.95	2.85
K12	84	6.55	6.43	3.60	6.99		2.83	2.74	3.02	2.74
K13	89	4.81	5.11	4.37	5.70		2.43	2.46	2.74	2.87
K14	90	5.80	5.91	3.10	6.48		2.25	2.12	2.32	2.40
K15_Long	85	6.62	6.56	2.78	6.85		2.42	2.56	2.14	2.69

K15_Short	96	6.24	6.08	3.04	6.50		2.55	2.64	2.27	2.74
K16_Long	89	6.76	6.63	3.20	7.15		2.60	2.72	2.55	2.85
K16_Short	76	5.34	5.22	3.17	5.91		2.39	2.32	2.39	2.67
K17	105	6.25	5.90	2.62	6.62		2.36	2.52	2.01	2.45
K18	71	5.01	4.68	3.49	5.20		2.42	2.42	2.68	2.74
K19_Long	74	6.38	6.41	3.70	6.58		2.55	2.21	2.65	2.55
K19_Short	95	5.59	5.67	4.27	6.59		2.64	2.69	2.90	2.82
K21_Long	77	5.81	5.62	3.14	6.32		2.51	2.75	2.20	2.76
K21_Short	60	4.75	4.42	3.93	5.17		2.33	2.46	2.47	2.74
K22_Long	87	5.98	6.30	4.32	6.56		2.38	2.41	2.77	2.63
K22_Short	99	5.19	5.42	4.97	5.72		2.75	2.73	3.15	2.91
K23	102	6.05	6.07	3.30	6.63		2.36	2.40	2.43	2.58
K24	85	5.33	5.06	3.34	5.82		2.07	2.31	2.41	2.49
K25	68	3.90	3.97	5.15	4.97		2.30	2.29	3.11	2.75
K27	91	5.12	5.35	4.08	6.08		2.41	2.39	2.57	2.57
K28	97	5.30	5.38	4.00	5.93		2.45	2.55	2.84	2.82
K29	103	5.57	5.17	3.19	6.17		2.58	2.57	2.38	2.58
K30	86	4.71	4.56	4.50	5.51		2.66	2.56	2.73	2.59
K31	95	4.63	4.73	4.82	5.38		2.65	2.50	2.99	3.00
K32	89	4.19	4.13	5.09	5.18		2.16	2.24	2.82	2.77
K33	93	4.98	4.90	4.18	5.92		2.32	2.31	2.91	2.49
K34	93	5.19	4.96	4.11	6.17		2.29	2.45	2.70	2.48
K35_Long	64	5.81	5.75	3.80	6.66		2.14	2.42	2.57	2.48
K35_Short	64	4.75	4.97	4.14	5.28		2.31	2.38	2.77	2.86
S1	87	6.85	6.41	2.33	6.86		2.27	2.58	2.06	2.65
S2	94	5.83	5.39	3.24	6.16		2.34	2.57	2.53	2.59

S3_Long	64	5.34	5.16	3.58	5.44		2.21	2.23	2.49	2.66
S3_Short	72	5.10	5.28	3.92	5.89		2.35	2.31	2.69	2.54
S4	95	7.54	7.39	2.34	7.36		2.05	2.12	1.99	2.44
S5	94	5.52	5.46	3.64	6.16		2.59	2.66	2.75	2.79
S6	87	5.34	5.01	3.98	5.57		2.44	2.27	2.76	2.87
S7	62	5.24	5.15	2.85	5.65		2.37	2.51	2.06	2.77
S8	90	5.72	6.12	3.58	6.62		3.02	2.81	2.90	2.92
S9	91	7.18	6.78	2.60	6.97		2.29	2.39	2.38	2.78
S10	102	7.01	6.81	2.81	7.21		2.32	2.37	2.33	2.45
S11	100	5.76	5.80	4.33	6.44		2.48	2.45	2.81	2.52
S12	100	5.96	6.17	4.38	6.48		2.42	2.42	2.96	2.68
S13	92	5.08	4.93	4.40	5.52		2.56	2.31	2.71	2.59
S14	95	5.03	4.96	3.88	5.88		2.64	2.51	2.92	2.83
S15	96	4.56	4.97	5.88	5.95		2.59	2.57	3.02	2.77
S16	108	5.95	6.15	3.65	6.59		2.77	2.67	2.66	2.75
S17	107	3.75	4.14	7.62	4.93		2.76	2.62	2.99	3.17
S18	95	6.03	5.93	3.77	6.44		2.60	2.50	2.74	2.52
S19	97	5.22	5.38	4.79	5.97		2.67	2.56	2.86	2.84
S20	92	4.51	4.42	5.52	5.32		2.50	2.50	2.99	2.89
S21	98	4.59	4.65	5.14	5.78		2.71	2.58	3.13	2.80
S22	94	6.48	6.48	3.23	6.97		2.35	2.36	2.52	2.55
S23	96	4.67	4.54	4.17	5.71		2.41	2.43	2.69	2.48
S25	109	5.27	5.44	4.88	6.56		2.64	2.61	2.87	2.42
S26	95	5.65	5.47	3.56	5.80		2.51	2.57	2.52	2.55
S27	101	5.52	5.54	3.84	6.07		2.11	2.10	2.63	2.70
S28	94	4.07	3.96	5.35	5.12		2.55	2.48	2.81	2.72

S29	96	4.89	4.99	4.46	5.90		2.53	2.47	3.17	2.62
S30	91	5.38	5.55	4.63	6.45		2.29	2.29	2.92	2.46
S31	93	5.11	4.88	4.34	5.76		2.38	2.49	2.72	2.68
S32	103	6.18	6.26	3.09	6.87		2.86	2.71	2.55	2.74
S33_Long	95	5.55	5.73	5.49	6.46		2.96	2.81	3.21	2.99
S33_Short	87	4.72	4.60	5.76	5.90		2.70	2.63	3.02	2.89
Trick1	73	5.86	5.71	2.55	6.33		2.26	2.33	2.29	2.70
Trick2	88	6.20	5.78	2.55	6.59		2.51	2.59	2.06	2.75
Trick3	87	6.09	5.71	3.26	6.14		2.19	2.40	2.56	2.48
Trick4	93	4.66	5.08	4.89	5.24		2.78	2.69	3.21	3.18
Trick5	86	5.13	5.33	4.74	5.81		2.57	2.58	2.94	2.90
Trick6_Long	78	5.92	6.01	4.14	6.49		2.44	2.50	2.68	2.60
Trick6_Short	97	5.65	5.98	4.01	6.76		2.44	2.25	2.47	2.21
Trick7_Long	99	5.21	5.71	5.41	6.15		2.56	2.33	3.09	2.81
Trick7_Short	77	3.81	4.03	5.49	4.97		2.68	2.60	3.35	2.86
Trick8_Long	73	5.96	5.77	3.27	6.40		2.18	2.24	2.02	2.60
Trick8_Short	92	6.09	6.04	3.57	6.58		2.30	2.24	2.59	2.41
Trick9	87	5.85	5.64	3.43	6.30		2.52	2.66	2.67	2.60
Trick10	63	5.92	5.83	2.70	6.70		2.38	2.39	2.15	2.33
Trick11	96	7.09	6.59	2.42	6.95		2.25	2.43	1.93	2.78
Trick12_Long	93	6.69	6.32	2.53	6.67		2.61	2.70	2.01	2.79
Trick12_Short	76	4.89	4.72	3.70	5.62		2.40	2.38	2.55	2.69
Trick13	102	5.91	5.84	2.99	6.31		2.41	2.60	2.24	2.57
Trick14_Long	78	4.86	5.03	3.73	5.40		2.19	2.20	2.54	2.80
Trick14_Short	78	5.68	5.42	3.91	6.00		2.38	2.50	2.71	2.43
Trick15	91	5.30	5.13	3.34	5.53		2.09	2.19	2.40	2.45

Trick16_Long	73	7.07	6.49	2.52	6.82		2.41	2.57	2.01	2.70
Trick16_Short	72	5.60	5.47	3.46	6.18		2.21	2.10	2.19	2.35
Trick17	75	6.56	6.44	2.77	6.63		2.43	2.53	2.21	2.81
Trick18_Long	72	5.85	5.58	3.22	6.31		2.73	2.68	2.23	2.89
Trick18_Short	87	5.98	5.72	3.43	6.59		2.43	2.48	2.69	2.59
Trick19	92	7.35	6.87	2.66	7.45		2.42	2.57	2.01	2.56
Trick20_Long	97	6.53	6.52	4.15	6.92		2.53	2.69	2.76	2.78
Trick20_Short	82	5.88	5.90	4.15	6.30		2.47	2.53	2.83	2.71
Trick21	90	5.32	5.12	3.80	5.91		2.46	2.62	2.69	2.71
Trick22_Long	79	6.16	5.90	4.48	6.71		2.36	2.58	2.87	2.63
Trick22_Short	94	5.16	5.41	5.26	6.12		2.55	2.52	2.94	2.81
Trick23_Long	62	6.31	5.82	2.35	6.55		2.35	2.75	1.65	2.58
Trick23_Short	47	5.83	5.74	2.98	6.04		2.46	2.44	2.03	2.64
Trick24	84	4.82	4.89	3.00	5.79		2.38	2.43	2.17	2.68
Trick25	94	6.70	6.53	2.55	6.90		2.04	2.19	2.00	2.52
Trick26	102	5.72	5.26	2.54	6.00		2.15	2.49	1.70	2.71
Trick27	92	7.04	6.71	2.61	6.93		2.02	2.06	1.89	2.44
Trick28	99	5.10	5.18	4.66	5.80		2.48	2.52	2.88	2.76
Trick29	91	5.62	5.58	3.56	6.23		2.57	2.48	2.27	2.80
Trick30	81	6.51	6.33	2.88	6.64		2.28	2.29	2.38	2.78
Trick31	78	5.95	5.92	3.18	6.38		2.19	2.28	2.25	2.53
Trick32_Long	86	4.81	5.17	5.09	5.62		2.49	2.46	2.88	2.81
Trick32_Short	88	4.76	5.08	5.10	5.84		2.41	2.54	2.91	2.85
Trick33	84	6.63	6.25	2.64	6.69		2.17	2.31	2.17	2.50
Trick34	84	6.93	6.25	2.02	6.95		2.12	2.67	1.53	2.67
Trick35	94	5.70	5.57	4.41	6.28		2.21	2.33	2.84	2.33

Trick36_Long	62	7.03	6.82	2.71	6.98		2.59	2.68	2.36	2.64
Trick36_Short	59	5.58	5.19	3.41	6.00		2.38	2.53	2.32	2.57
Trick37	93	5.39	5.56	3.87	6.10		2.63	2.55	2.81	2.86
Trick38	98	4.77	4.80	4.57	5.59		2.40	2.38	2.80	2.69
Trick39	82	5.52	5.66	3.33	6.32		2.34	2.15	2.63	2.63
Trick40	89	4.87	4.67	4.07	5.92		2.66	2.69	2.79	2.69
Trick41	93	5.40	5.43	4.22	6.09		2.71	2.62	2.94	2.83

REFERENCES

Abdulrahman, H., Fletcher, P. C., Bullmore, E., & Morcom, A. M. (2017). Dopamine and memory dedifferentiation in aging. *NeuroImage*, *153*, 211–220. https://doi.org/10.1016/j.neuroimage.2015.03.031

Alexander, P. A. (2003). The Development of Expertise: The Journey From Acclimation to Proficiency. *Educational Researcher*, *32*(8), 10–14. https://doi.org/10.3102/0013189X032008010

Ancoli-Israel, S., Cole, R., Alessi, C., Chambers, M., Moorcroft, W., & Pollak, C. P. (2003). The role of actigraphy in the study of sleep and circadian rhythms. *Sleep*, *26*(3), 342–392. https://doi.org/10.1093/sleep/26.3.342

Anderson, M. C., Bjork, R. A., & Bjork, E. L. (1994). Remembering can cause forgetting: Retrieval dynamics in long-term memory. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *20*(5), 1063–1087. https://doi.org/10.1037/0278-7393.20.5.1063

Anderson, N. D., Craik, F. I. M., & Naveh-Benjamin, M. (1998). The attentional demands of encoding and retrieval in younger and older adults: I. Evidence from divided attention costs. *Psychology and Aging*, *13*(3), 405–423. https://doi.org/10.1037/0882-7974.13.3.405

Andersson, J., Hitch, G., & Meudell, P. (2006). Effects of the timing and identity of retrieval cues in individual recall: An attempt to mimic cross-cueing in collaborative recall. *Memory*, *14*(1), 94–103. https://doi.org/10.1080/09658210444000557

Andersson, J., & Rönnberg, J. (1995). Recall suffers from collaboration: Joint recall effects of friendship and task complexity. *Applied Cognitive Psychology*, *9*(3), 199–211. https://doi.org/10.1002/acp.2350090303

Baddeley, A. D., Thomson, N., & Buchanan, M. (1975). Word length and the structure of short-term memory. *Journal of Verbal Learning and Verbal Behavior*, *14*(6), 575–589. https://doi.org/10.1016/S0022-5371(75)80045-4

Baddeley, A., Lewis, V., Eldridge, M., & Thomson, N. (1984). Attention and retrieval from long-term memory. *Journal of Experimental Psychology: General*, *113*(4), 518–540. https://doi.org/10.1037/0096-3445.113.4.518

Bagienski, S. E. (2022). *Becoming Impossible: The Social and Emotional Experiences of Watching and Learning to Perform Magic* [Goldsmiths, University of London]. https://doi.org/10.25602/GOLD.00032305

Baranes, A., Oudeyer, P.-Y., & Gottlieb, J. (2015). Eye movements reveal epistemic curiosity in human observers. *Vision Research*, *117*, 81–90. https://doi.org/10.1016/j.visres.2015.10.009

Barber, S. J., Castrellon, J. J., Opitz, P., & Mather, M. (2017). Younger and older adults' collaborative recall of shared and unshared emotional pictures. *Memory & Cognition*, *45*(5), 716–730. https://doi.org/10.3758/s13421-017-0694-3

Barber, S. J., Rajaram, S., & Aron, A. (2010). When two is too many: Collaborative encoding impairs memory. *Memory & Cognition*, *38*(3), 255–264. https://doi.org/10.3758/MC.38.3.255

Barber, S. J., Rajaram, S., & Fox, E. B. (2012). Learning and Remembering with Others: The Key Role of Retrieval in Shaping Group Recall and Collective Memory. *Social Cognition*, *30*(1), 121–132. https://doi.org/10.1521/soco.2012.30.1.121

Bärthel, G. A., Wessel, I., Huntjens, R. J. C., & Verwoerd, J. (2017). Collaboration enhances later individual memory for emotional material. *Memory*, *25*(5), 636–646. https://doi.org/10.1080/09658211.2016.1208248

Basden, B. H., Basden, D. R., Bryner, S., & Thomas, R. L. (1997). A comparison of group and individual remembering: Does collaboration disrupt retrieval strategies?

Journal of Experimental Psychology: Learning, Memory, and Cognition, *23*(5), 1176–1189. https://doi.org/10.1037/0278-7393.23.5.1176

Basden, B. H., Basden, D. R., & Henry, S. (2000). Costs and benefits of collaborative remembering. *Applied Cognitive Psychology*, *14*(6), 497–507. https://doi.org/10.1002/1099-0720(200011/12)14:6<497:AID-ACP665>3.0.CO;2-4

Basden, B. H., Reysen, M. B., & Basden, D. R. (2002). Transmitting False Memories in Social Groups. *The American Journal of Psychology*, *115*(2), 211. https://doi.org/10.2307/1423436

Bäuml, K.-H. (2008). Inhibitory Processes. In *Learning and Memory: A Comprehensive Reference* (pp. 195–220). Elsevier. https://doi.org/10.1016/B978-012370509-9.00155-8

Bäuml, K.-H., & Aslan, A. (2004). Part-list cuing as instructed retrieval inhibition. *Memory & Cognition*, *32*(4), 610–617. https://doi.org/10.3758/BF03195852

Benjamini, Y., & Yekutieli, D. (2001). The control of the false discovery rate in multiple testing under dependency. *The Annals of Statistics*, *29*(4). https://doi.org/10.1214/aos/1013699998

Berlyne, D. E. (1954). A THEORY OF HUMAN CURIOSITY. *British Journal of Psychology. General Section*, *45*(3), 180–191. https://doi.org/10.1111/j.2044-8295.1954.tb01243.x

Berlyne, D. E. (1960). *Conflict, arousal, and curiosity.* McGraw-Hill Book Company. https://doi.org/10.1037/11164-000

Berlyne, D. E. (1966). Curiosity and Exploration: Animals spend much of their time seeking stimuli whose significance raises problems for psychology. *Science*, *153*(3731), 25–33. https://doi.org/10.1126/science.153.3731.25

Bradley Margaret M. & Lang Peter J. (1999). *Affective Norms for English Words (ANEW): Instruction Manual and Affective Ratings* (Technical Report c–1). The Center for Research in Psychophysiology, University of Florida.

Brown, D. S. (2003). High School Biology: A Group Approach to Concept Mapping. *The American Biology Teacher*, *65*(3), 192–197. https://doi.org/10.2307/4451473

Carós, M., Garolera, M., Radeva, P., & Giro-i-Nieto, X. (2020). Automatic Reminiscence Therapy for Dementia. *Proceedings of the 2020 International Conference on Multimedia Retrieval*, 383–387. https://doi.org/10.1145/3372278.3391927

Carstensen, L. L. (1992). Social and emotional patterns in adulthood: Support for socioemotional selectivity theory. *Psychology and Aging*, *7*(3), 331–338. https://doi.org/10.1037/0882-7974.7.3.331

Carstensen, L. L. (2006). The Influence of a Sense of Time on Human Development. *Science*, *312*(5782), 1913–1915. https://doi.org/10.1126/science.1127488

Catricalà, B., Ledda, M., Manca, M., Paternò, F., Santoro, C., & Zedda, E. (2023). *Biography-based Robot Games for Older Adults* (Versione 1). arXiv. https://doi.org/10.48550/ARXIV.2305.19849

Coman, A., & Hirst, W. (2015). Social identity and socially shared retrieval-induced forgetting: The effects of group membership. *Journal of Experimental Psychology: General*, *144*(4), 717–722. https://doi.org/10.1037/xge0000077

Congleton, A. R., & Rajaram, S. (2011). The influence of learning methods on collaboration: Prior repeated retrieval enhances retrieval organization, abolishes collaborative inhibition, and promotes post-collaborative memory. *Journal of Experimental Psychology: General*, *140*(4), 535–551. https://doi.org/10.1037/a0024308

Congleton, A. R., & Rajaram, S. (2014). Collaboration changes both the content and the structure of memory: Building the architecture of shared representations. *Journal of Experimental Psychology: General*, *143*(4), 1570–1584. https://doi.org/10.1037/a0035974

Conti, S., Bonazzi, S., Laiacona, M., Masina, M., & Coralli, M. V. (2015). Montreal Cognitive Assessment (MoCA)-Italian version: Regression based norms and equivalent scores. *Neurological Sciences*, *36*(2), 209–214. https://doi.org/10.1007/s10072-014-1921-3

Cowan, N. (2010). The Magical Mystery Four: How Is Working Memory Capacity Limited, and Why? *Current Directions in Psychological Science*, *19*(1), 51–57. https://doi.org/10.1177/0963721409359277

Craik, F. I. M., Govoni, R., Naveh-Benjamin, M., & Anderson, N. D. (1996). The effects of divided attention on encoding and retrieval processes in human memory. *Journal of Experimental Psychology: General*, *125*(2), 159–180. https://doi.org/10.1037/0096-3445.125.2.159

Craik, F. I. M., & Salthouse, T. A. (A c. Di). (2011). *The Handbook of Aging and Cognition* (0 ed.). Psychology Press. https://doi.org/10.4324/9780203837665

Cuc, A., Koppel, J., & Hirst, W. (2007). Silence Is Not Golden: A Case for Socially Shared Retrieval-Induced Forgetting. *Psychological Science*, *18*(8), 727–733. https://doi.org/10.1111/j.1467-9280.2007.01967.x

Danek, A. H., Fraps, T., Von Müller, A., Grothe, B., & Öllinger, M. (2014). It's a kind of magic—What self-reports can reveal about the phenomenology of insight problem solving. *Frontiers in Psychology*, *5*. https://doi.org/10.3389/fpsyg.2014.01408

Danek, A. H., & Wiley, J. (2017). What about False Insights? Deconstructing the Aha! Experience along Its Multiple Dimensions for Correct and Incorrect Solutions Separately. *Frontiers in Psychology*, *7*. https://doi.org/10.3389/fpsyg.2016.02077

Davis, S. D., & Meade, M. L. (2013). Both young and older adults discount suggestions from older adults on a social memory test. *Psychonomic Bulletin & Review*, *20*(4), 760–765. https://doi.org/10.3758/s13423-013-0392-5

Deci, E. L., & Ryan, R. M. (1985). The general causality orientations scale: Self-determination in personality. *Journal of Research in Personality*, *19*(2), 109–134. https://doi.org/10.1016/0092-6566(85)90023-6

Deigan, M., & Piñeros Glasscock, J. S. (2024). A Fitting Definition of Epistemic Emotions. *The Philosophical Quarterly*, *74*(3), 777–798. https://doi.org/10.1093/pq/pqad096

Dewar, M., Alber, J., Butler, C., Cowan, N., & Della Sala, S. (2012). Brief Wakeful Resting Boosts New Memories Over the Long Term. *Psychological Science*, *23*(9), 955–960. https://doi.org/10.1177/0956797612441220

Dietrich, E., Fields, C., Hoffman, D. D., & Prentner, R. (2020). Editorial: Epistemic Feelings: Phenomenology, Implementation, and Role in Cognition. *Frontiers in Psychology*, *11*, 606046. https://doi.org/10.3389/fpsyg.2020.606046

Duan, H., Fernández, G., Van Dongen, E., & Kohn, N. (2020). The effect of intrinsic and extrinsic motivation on memory formation: Insight from behavioral and imaging study. *Brain Structure and Function*, *225*(5), 1561–1574. https://doi.org/10.1007/s00429-020-02074-x

Ebner, N. C., Riediger, M., & Lindenberger, U. (2010a). FACES--a database of facial expressions in young, middle-aged, and older women and men: Development and validation. *Behavior Research Methods*, *42*(1), 351–362. https://doi.org/10.3758/BRM.42.1.351

Ebner, N. C., Riediger, M., & Lindenberger, U. (2010b). FACES—A database of facial expressions in young, middle-aged, and older women and men: Development and validation. *Behavior Research Methods*, *42*(1), 351–362. https://doi.org/10.3758/BRM.42.1.351

English, T., & Carstensen, L. L. (2015). Does positivity operate when the stakes are high? Health status and decision making among older adults. *Psychology and Aging*, *30*(2), 348–355. https://doi.org/10.1037/a0039121

Fairfield, B., Mammarella, N., & Domenico, A. D. (2013). Centenarians' "Holy" Memory: Is Being Positive Enough? *The Journal of Genetic Psychology*, *174*(1), 42–50. https://doi.org/10.1080/00221325.2011.636399

Fairfield, B., Padulo, C., Bortolotti, A., Perfetti, B., Mammarella, N., & Balsamo, M. (2022). Do Older and Younger Adults Prefer the Positive or Avoid the Negative? *Brain Sciences*, *12*(3), 393. https://doi.org/10.3390/brainsci12030393

Fandakova, Y., & Gruber, M. J. (2021). States of curiosity and interest enhance memory differently in adolescents and in children. *Developmental Science*, *24*(1), e13005. https://doi.org/10.1111/desc.13005

Fastrich, G. M., Kerr, T., Castel, A. D., & Murayama, K. (2018). The role of interest in memory for trivia questions: An investigation with a large-scale database. *Motivation Science*, *4*(3), 227–250. https://doi.org/10.1037/mot0000087

Fernandes, M. A., & Moscovitch, M. (2000). Divided attention and memory: Evidence of substantial interference effects at retrieval and encoding. *Journal of Experimental Psychology: General*, *129*(2), 155–176. https://doi.org/10.1037/0096-3445.129.2.155

Ferré, P., Fraga, I., Comesaña, M., & Sánchez-Casas, R. (2015). Memory for emotional words: The role of semantic relatedness, encoding task and affective valence. *Cognition and Emotion*, *29*(8), 1401–1410. https://doi.org/10.1080/02699931.2014.982515

Finlay, F., Hitch, G. J., & Meudell, P. R. (2000). Mutual inhibition in collaborative recall: Evidence for a retrieval-based account. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *26*(6), 1556–1567. https://doi.org/10.1037/0278-7393.26.6.1556

FitzGibbon, L., Lau, J. K. L., & Murayama, K. (2020). The seductive lure of curiosity: Information as a motivationally salient reward. *Current Opinion in Behavioral Sciences*, *35*, 21–27. https://doi.org/10.1016/j.cobeha.2020.05.014

Folstein, M. F., Folstein, S. E., & McHugh, P. R. (1975). "Mini-mental state". *Journal of Psychiatric Research*, *12*(3), 189–198. https://doi.org/10.1016/0022-3956(75)90026-6

Fung, H. H., & Carstensen, L. L. (2003). Sending memorable messages to the old: Age differences in preferences and memory for advertisements. *Journal of Personality and Social Psychology*, *85*(1), 163–178. https://doi.org/10.1037/0022-3514.85.1.163

Galli, G., Sirota, M., Gruber, M. J., Ivanof, B. E., Ganesh, J., Materassi, M., Thorpe, A., Loaiza, V., Cappelletti, M., & Craik, F. I. M. (2018). Learning facts during aging: The benefits of curiosity. *Experimental Aging Research*, *44*(4), 311–328. https://doi.org/10.1080/0361073X.2018.1477355

Garin, O. (2014). Ceiling Effect. In A. C. Michalos (A c. Di), *Encyclopedia of Quality of Life and Well-Being Research* (pp. 631–633). Springer Netherlands. https://doi.org/10.1007/978-94-007-0753-5_296

Goodale, G. (2003). Curiosity: A cultural history of early modern inquiry (review). *Journal of Social History*, *36*(3), 771–773. https://doi.org/10.1353/jsh.2003.0051

Gregory, R. L. (1975). *The intelligent eye* (Repr). Weidenfeld & Nicolson.

Grossnickle, E. M. (2016). Disentangling curiosity: Dimensionality, definitions, and distinctions from interest in educational contexts. *Educational Psychology Review*, *28*(1), 23–60. https://doi.org/10.1007/s10648-014-9294-y

Gruber, M. J., & Fandakova, Y. (2021). Curiosity in childhood and adolescence—What can we learn from the brain. *Current Opinion in Behavioral Sciences*, *39*, 178–184. https://doi.org/10.1016/j.cobeha.2021.03.031

Gruber, M. J., Gelman, B. D., & Ranganath, C. (2014). States of Curiosity Modulate Hippocampus-Dependent Learning via the Dopaminergic Circuit. *Neuron*, *84*(2), 486–496. https://doi.org/10.1016/j.neuron.2014.08.060

Gruber, M. J., & Ranganath, C. (2019). How Curiosity Enhances Hippocampus-Dependent Memory: The Prediction, Appraisal, Curiosity, and Exploration (PACE) Framework. *Trends in Cognitive Sciences*, *23*(12), 1014–1025. https://doi.org/10.1016/j.tics.2019.10.003

Guilford, J. P. (1967). Creativity: Yesterday, Today and Tomorrow. *The Journal of Creative Behavior*, *1*(1), 3–14. https://doi.org/10.1002/j.2162-6057.1967.tb00002.x

Hall, G. S., & Smith, T. L. (1903). Curiosity and Interest. *The Pedagogical Seminary*, *10*(3), 315–358. https://doi.org/10.1080/08919402.1903.10532722

Harlow, H. F. (1950). Learning and satiation of response in intrinsically motivated complex puzzle performance by monkeys. *Journal of Comparative and Physiological Psychology*, *43*(4), 289–294. https://doi.org/10.1037/h0058114

Harris, C. B., Barnier, A. J., & Sutton, J. (2012). Consensus Collaboration Enhances Group and Individual Recall Accuracy. *Quarterly Journal of Experimental Psychology*, *65*(1), 179–194. https://doi.org/10.1080/17470218.2011.608590

Harris, C. B., Barnier, A. J., & Sutton, J. (2013). Shared encoding and the costs and benefits of collaborative recall. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *39*(1), 183–195. https://doi.org/10.1037/a0028906

Hidi, S., & Renninger, K. A. (2006). The Four-Phase Model of Interest Development. *Educational Psychologist*, *41*(2), 111–127. https://doi.org/10.1207/s15326985ep4102_4

Hohwy, J. (2013). *The Predictive Mind*. Oxford University Press. https://doi.org/10.1093/acprof:oso/9780199682737.001.0001

Huff, M. J., Davis, S. D., & Meade, M. L. (2013). The effects of initial testing on false recall and false recognition in the social contagion of memory paradigm. *Memory & Cognition*, *41*(6), 820–831. https://doi.org/10.3758/s13421-013-0299-4

Ilardi, C. R., Menichelli, A., Michelutti, M., Cattaruzza, T., & Manganotti, P. (2023). Optimal MoCA cutoffs for detecting biologically-defined patients with MCI and early dementia. *Neurological Sciences*, *44*(1), 159–170. https://doi.org/10.1007/s10072-022-06422-z

Itti, L., & Baldi, P. (2009). Bayesian surprise attracts human attention. *Vision Research*, *49*(10), 1295–1306. https://doi.org/10.1016/j.visres.2008.09.007

Jepma, M., Verdonschot, R. G., Van Steenbergen, H., Rombouts, S. A. R. B., & Nieuwenhuis, S. (2012). Neural mechanisms underlying the induction and relief of perceptual curiosity. *Frontiers in Behavioral Neuroscience*, *6*. https://doi.org/10.3389/fnbeh.2012.00005

John, O. P., Donahue, E. M., & Kentle, R. L. (2012). *Big Five Inventory* [Dataset]. https://doi.org/10.1037/t07550-000

Kalantari, S., Bill Xu, T., Mostafavi, A., Lee, A., Barankevich, R., Boot, W. R., & Czaja, S. J. (2022). Using a Nature-Based Virtual Reality Environment for Improving Mood States and Cognitive Engagement in Older Adults: A Mixed-Method Feasibility Study. *Innovation in Aging*, *6*(3), igac015. https://doi.org/10.1093/geroni/igac015

Kang, M. J., Hsu, M., Krajbich, I. M., Loewenstein, G., McClure, S. M., Wang, J. T., & Camerer, C. F. (2009). The Wick in the Candle of Learning: Epistemic Curiosity Activates Reward Circuitry and Enhances Memory. *Psychological Science*, *20*(8), 963–973. https://doi.org/10.1111/j.1467-9280.2009.02402.x

Kashdan, T. B., Rose, P., & Fincham, F. D. (2004). Curiosity and Exploration: Facilitating Positive Subjective Experiences and Personal Growth Opportunities. *Journal of Personality Assessment*, *82*(3), 291–305. https://doi.org/10.1207/s15327752jpa8203_05

Kashdan, T. B., & Steger, M. F. (2007). Curiosity and pathways to well-being and meaning in life: Traits, states, and everyday behaviors. *Motivation and Emotion*, *31*(3), 159–173. https://doi.org/10.1007/s11031-007-9068-7

Kashdan, T. B., & Silvia, P. J. (2009a). Curiosity and Interest: The Benefits of Thriving on Novelty and Challenge. In S. J. Lopez & C. R. Snyder (A c. Di), *The Oxford Handbook of Positive Psychology* (pp. 366–374). Oxford University Press. https://doi.org/10.1093/oxfordhb/9780195187243.013.0034

Kashdan, T. B., & Silvia, P. J. (2009b). Curiosity and Interest: The Benefits of Thriving on Novelty and Challenge. In S. J. Lopez & C. R. Snyder (A c. Di), *The Oxford Handbook of Positive Psychology* (pp. 366–374). Oxford University Press. https://doi.org/10.1093/oxfordhb/9780195187243.013.0034

Kashdan, T. B., & Steger, M. F. (2007). Curiosity and pathways to well-being and meaning in life: Traits, states, and everyday behaviors. *Motivation and Emotion*, *31*(3), 159–173. https://doi.org/10.1007/s11031-007-9068-7

Kashdan, T. B., Stiksma, M. C., Disabato, D. J., McKnight, P. E., Bekier, J., Kaji, J., & Lazarus, R. (2018). The five-dimensional curiosity scale: Capturing the bandwidth of curiosity and identifying four unique subgroups of curious people. *Journal of Research in Personality*, *73*, 130–149. https://doi.org/10.1016/j.jrp.2017.11.011

Kensinger, E. A., & Schacter, D. L. (2008). Neural Processes Supporting Young and Older Adults' Emotional Memories. *Journal of Cognitive Neuroscience*, *20*(7), 1161–1173. https://doi.org/10.1162/jocn.2008.20080

Kidd, C., & Hayden, B. Y. (2015). The Psychology and Neuroscience of Curiosity. *Neuron*, *88*(3), 449–460. https://doi.org/10.1016/j.neuron.2015.09.010

Kitayama, S., & Uskul, A. K. (2011). Culture, Mind, and the Brain: Current Evidence and Future Directions. *Annual Review of Psychology*, *62*(1), 419–449. https://doi.org/10.1146/annurev-psych-120709-145357

Krapp, A. (2007). An educational–psychological conceptualisation of interest. *International Journal for Educational and Vocational Guidance*, *7*(1), 5–21. https://doi.org/10.1007/s10775-007-9113-9

Kuhn, G., Amlani, A. A., & Rensink, R. A. (2008). Towards a science of magic. *Trends in Cognitive Sciences*, *12*(9), 349–354. https://doi.org/10.1016/j.tics.2008.05.008

Labouvie-Vief, G., Grühn, D., & Studer, J. (2010). Dynamic Integration of Emotion and Cognition: Equilibrium Regulation in Development and Aging. In R. M. Lerner, M. E. Lamb, & A. M. Freund (A c. Di), *The Handbook of Life-Span Development* (1ª ed.). Wiley. https://doi.org/10.1002/9780470880166.hlsd002004

Lakens, D. (2022). Sample Size Justification. *Collabra: Psychology*, *8*(1), 33267. https://doi.org/10.1525/collabra.33267

Lang, P. J., Bradley, M. M., & Cuthbert, B. N. (1999). *International affective picture system (IAPS): Instruction manual and affective ratings. Technical Report A-4.* The Center for Research in Psychophysiology.

Lau, J. K. L., Ozono, H., Kuratomi, K., Komiya, A., & Murayama, K. (2020). Shared striatal activity in decisions to satisfy curiosity and hunger at the risk of electric shocks. *Nature Human Behaviour*, *4*(5), 531–543. https://doi.org/10.1038/s41562-020-0848-3

Lee, K.-T., Wang, W.-L., Lin, W.-C., Yang, Y.-C., & Tsai, C.-L. (2022). The Effects of a Magic Intervention Program on Cognitive Function and Neurocognitive Performance in Elderly Individuals With Mild Cognitive Impairment. *Frontiers in Aging Neuroscience*, *14*, 854984. https://doi.org/10.3389/fnagi.2022.854984

Lee, K.-T., Wang, W.-L., & Yang, Y.-C. (2022). Impact of a magic recreation program on older adults with minor depressive symptoms in a long-term care facility: A pilot randomized controlled trial. *Geriatric Nursing*, *48*, 169–176. https://doi.org/10.1016/j.gerinurse.2022.09.014

Litman, J. (2005). Curiosity and the pleasures of learning: Wanting and liking new information. *Cognition and Emotion*, *19*(6), 793–814. https://doi.org/10.1080/02699930541000101

Litman, J. A. (2008). Interest and deprivation factors of epistemic curiosity. *Personality and Individual Differences*, *44*(7), 1585–1595. https://doi.org/10.1016/j.paid.2008.01.014

Litman, J. A., & Jimerson, T. L. (2004). The Measurement of Curiosity As a Feeling of Deprivation. *Journal of Personality Assessment*, *82*(2), 147–157. https://doi.org/10.1207/s15327752jpa8202_3

Litman, J. A., & Silvia, P. J. (2006). The Latent Structure of Trait Curiosity: Evidence for Interest and Deprivation Curiosity Dimensions. *Journal of Personality Assessment*, *86*(3), 318–328. https://doi.org/10.1207/s15327752jpa8603_07

Litman, J. A., & Spielberger, C. D. (2003). Measuring Epistemic Curiosity and Its Diversive and Specific Components. *Journal of Personality Assessment*, *80*(1), 75–86. https://doi.org/10.1207/S15327752JPA8001_16

Litman, J., Hutchins, T., & Russon, R. (2005). Epistemic curiosity, feeling-of-knowing, and exploratory behaviour. *Cognition & Emotion*, *19*(4), 559–582. https://doi.org/10.1080/02699930441000427

Livio, M. (2017). *Why? What makes us curious*. Simon & Schuster.

Loewenstein, G. (1994). The psychology of curiosity: A review and reinterpretation. *Psychological Bulletin*, *116*(1), 75–98. https://doi.org/10.1037/0033-2909.116.1.75

Long, G. M., & Toppino, T. C. (2004). Enduring Interest in Perceptual Ambiguity: Alternating Views of Reversible Figures. *Psychological Bulletin*, *130*(5), 748–768. https://doi.org/10.1037/0033-2909.130.5.748

Mannarelli, D., Pauletti, C., Missori, P., Trompetto, C., Cotellessa, F., Fattapposta, F., & Currà, A. (2023). Cerebellum's Contribution to Attention, Executive Functions and

Timing: Psychophysiological Evidence from Event-Related Potentials. *Brain Sciences*, *13*(12), 1683. https://doi.org/10.3390/brainsci13121683

Marion, S. B., & Thorley, C. (2016). A meta-analytic review of collaborative inhibition and postcollaborative memory: Testing the predictions of the retrieval strategy disruption hypothesis. *Psychological Bulletin*, *142*(11), 1141–1164. https://doi.org/10.1037/bul0000071

Marvin, C. B., & Shohamy, D. (2016). Curiosity and reward: Valence predicts choice and information prediction errors enhance learning. *Journal of Experimental Psychology: General*, *145*(3), 266–272. https://doi.org/10.1037/xge0000140

Mather, M. (2006). Why Memories May Become More Positive as People Age. In B. Uttl, N. Ohta, & A. L. Siegenthaler (A c. Di), *Memory and Emotion* (1ª ed., pp. 135–158). Wiley. https://doi.org/10.1002/9780470756232.ch7

Mather, M., & Carstensen, L. L. (2005a). Aging and motivated cognition: The positivity effect in attention and memory. *Trends in Cognitive Sciences*, *9*(10), 496–502. https://doi.org/10.1016/j.tics.2005.08.005

Mather, M., & Carstensen, L. L. (2005b). Aging and motivated cognition: The positivity effect in attention and memory. *Trends in Cognitive Sciences*, *9*(10), 496–502. https://doi.org/10.1016/j.tics.2005.08.005

Mather, M., & Harley, C. W. (2016). The Locus Coeruleus: Essential for Maintaining Cognitive Function and the Aging Brain. *Trends in Cognitive Sciences*, *20*(3), 214–226. https://doi.org/10.1016/j.tics.2016.01.001

McGillivray, S., Murayama, K., & Castel, A. D. (2015). Thirst for knowledge: The effects of curiosity and interest on memory in younger and older adults. *Psychology and Aging*, *30*(4), 835–841. https://doi.org/10.1037/a0039801

McNabb, J. C., & Meade, M. L. (2014). Correcting socially introduced false memories: The effect of re-study. *Journal of Applied Research in Memory and Cognition*, *3*(4), 287–292. https://doi.org/10.1016/j.jarmac.2014.05.007

Meade, M. L., & Roediger, H. L. (2002). Explorations in the social contagion of memory. *Memory & Cognition*, *30*(7), 995–1009. https://doi.org/10.3758/BF03194318

Metcalfe, J., Schwartz, B. L., & Bloom, P. A. (2017). The tip-of-the-tongue state and curiosity. *Cognitive Research: Principles and Implications*, *2*(1), 31. https://doi.org/10.1186/s41235-017-0065-4

Metcalfe, J., & Xu, J. (2018). Learning from one's own errors and those of others. *Psychonomic Bulletin & Review*, *25*(1), 402–408. https://doi.org/10.3758/s13423-017-1287-7

Meyer, W.-U., Reisenzein, R., & Schützwohl, A. (1997). [No title found]. *Motivation and Emotion*, *21*(3), 251–274. https://doi.org/10.1023/A:1024422330338

Miller, G. A. (1956). The magical number seven, plus or minus two: Some limits on our capacity for processing information. *Psychological Review*, *63*(2), 81–97. https://doi.org/10.1037/h0043158

Montefinese, M., Ambrosini, E., Fairfield, B., & Mammarella, N. (2014). The adaptation of the Affective Norms for English Words (ANEW) for Italian. *Behavior Research Methods*, *46*(3), 887–903. https://doi.org/10.3758/s13428-013-0405-3

Morton, A. (2009). *Epistemic Emotions*. Oxford University Press. https://doi.org/10.1093/oxfordhb/9780199235018.003.0018

Mullaney, K. M., Carpenter, S. K., Grotenhuis, C., & Burianek, S. (2014). Waiting for feedback helps if you want to know the answer: The role of curiosity in the delay-of-feedback benefit. *Memory & Cognition*, *42*(8), 1273–1284. https://doi.org/10.3758/s13421-014-0441-y

Murayama, K., & Kuhbandner, C. (2011a). Money enhances memory consolidation – But only for boring material. *Cognition*, *119*(1), 120–124. https://doi.org/10.1016/j.cognition.2011.01.001

Murayama, K., & Kuhbandner, C. (2011b). Money enhances memory consolidation – But only for boring material. *Cognition*, *119*(1), 120–124. https://doi.org/10.1016/j.cognition.2011.01.001

Murphy, C., Dehmelt, V., Yonelinas, A. P., Ranganath, C., & Gruber, M. J. (2021). Temporal proximity to the elicitation of curiosity is key for enhancing memory for incidental information. *Learning & Memory*, *28*(2), 34–39. https://doi.org/10.1101/lm.052241.120

Naveh-Benjamin, M., Craik, F. I. M., Guez, J., & Dori, H. (1998). Effects of divided attention on encoding and retrieval processes in human memory: Further support for an asymmetry. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *24*(5), 1091–1104. https://doi.org/10.1037/0278-7393.24.5.1091

Naveh-Benjamin, M., Craik, F. I. M., Perretta, J. G., & Tonev, S. T. (2000). The Effects of Divided Attention on Encoding and Retrieval Processes: The Resiliency of Retrieval Processes. *The Quarterly Journal of Experimental Psychology Section A*, *53*(3), 609–625. https://doi.org/10.1080/713755914

Nerantzaki, K., Efklides, A., & Metallidou, P. (2021). Epistemic emotions: Cognitive underpinnings and relations with metacognitive feelings. *New Ideas in Psychology*, *63*, 100904. https://doi.org/10.1016/j.newideapsych.2021.100904

Nickerson, R. S. (1984). Retrieval inhibition from part-set cuing: A persisting enigma in memory research. *Memory & Cognition*, *12*(6), 531–552. https://doi.org/10.3758/BF03213342

Nyberg, L., Lövdén, M., Riklund, K., Lindenberger, U., & Bäckman, L. (2012). Memory aging and brain maintenance. *Trends in Cognitive Sciences*, *16*(5), 292–305. https://doi.org/10.1016/j.tics.2012.04.005

O'Reilly, J. X., Schüffelgen, U., Cuell, S. F., Behrens, T. E. J., Mars, R. B., & Rushworth, M. F. S. (2013). Dissociable effects of surprise and model update in parietal and anterior cingulate cortex. *Proceedings of the National Academy of Sciences*, *110*(38). https://doi.org/10.1073/pnas.1305373110

Oudeyer, P.-Y. (2022). Curiosity-Driven Learning in Development: Computational Theories and Educational Applications. In O. Houdé & G. Borst (A c. Di), *The Cambridge Handbook of Cognitive Development* (1ª ed., pp. 644–661). Cambridge University Press. https://doi.org/10.1017/9781108399838.036

Oudeyer, P.-Y., Gottlieb, J., & Lopes, M. (2016). Intrinsic motivation, curiosity, and learning. In *Progress in Brain Research* (Vol. 229, pp. 257–284). Elsevier. https://doi.org/10.1016/bs.pbr.2016.05.005

Oudeyer, P.-Y., Kaplan, F., & Hafner, V. V. (2007). Intrinsic Motivation Systems for Autonomous Mental Development. *IEEE Transactions on Evolutionary Computation*, *11*(2), 265–286. https://doi.org/10.1109/TEVC.2006.890271

Ozono, H., Komiya, A., Kuratomi, K., Hatano, A., Fastrich, G., Raw, J. A. L., Haffey, A., Meliss, S., Lau, J. K. L., & Murayama, K. (2021). Magic Curiosity Arousing Tricks (MagicCATs): A novel stimulus collection to induce epistemic emotions. *Behavior Research Methods*, *53*(1), 188–215. https://doi.org/10.3758/s13428-020-01431-2

Padulo, C., Mammarella, N., Brancucci, A., & Fairfield, B. (2021). Memory for item–location bindings is enhanced in older adults with appetitive motivationally laden pictures. *Psychological Research*, *85*(3), 951–957. https://doi.org/10.1007/s00426-020-01312-5

Padulo, C., Marascia, E., Conte, N., Passarello, N., Mandolesi, L., & Fairfield, B. (2022). Curiosity Killed the Cat but Not Memory: Enhanced Performance in High-Curiosity States. *Brain Sciences*, *12*(7), 846. https://doi.org/10.3390/brainsci12070846

Park, D. C., & Reuter-Lorenz, P. (2009). The Adaptive Brain: Aging and Neurocognitive Scaffolding. *Annual Review of Psychology*, *60*(1), 173–196. https://doi.org/10.1146/annurev.psych.59.103006.093656

Pepe, N. W., Wang, Q., & Rajaram, S. (2021). Collaborative remembering in ethnically uniform and diverse group settings. *Journal of Applied Research in Memory and Cognition*, *10*(1), 95–103. https://doi.org/10.1016/j.jarmac.2020.08.001

Pereira-Pasarin, L. P., & Rajaram, S. (2011). Study repetition and divided attention: Effects of encoding manipulations on collaborative inhibition in group recall. *Memory & Cognition*, *39*(6), 968–976. https://doi.org/10.3758/s13421-011-0087-y

Rajaram, S. (2011). Collaboration Both Hurts and Helps Memory: A Cognitive Perspective. *Current Directions in Psychological Science*, *20*(2), 76–81. https://doi.org/10.1177/0963721411403251

Rajaram, S., & Pereira-Pasarin, L. P. (2010). Collaborative Memory: Cognitive Research and Theory. *Perspectives on Psychological Science*, *5*(6), 649–663. https://doi.org/10.1177/1745691610388763

Ranganath, C., & Rainer, G. (2003). Neural mechanisms for detecting and remembering novel events. *Nature Reviews Neuroscience*, *4*(3), 193–202. https://doi.org/10.1038/nrn1052

Ranganath, C., & Ritchey, M. (2012). Two cortical systems for memory-guided behaviour. *Nature Reviews Neuroscience*, *13*(10), 713–726. https://doi.org/10.1038/nrn3338

Redondo, J., Fraga, I., Padrón, I., & Comesaña, M. (2007). The Spanish adaptation of ANEW (Affective Norms for English Words). *Behavior Research Methods*, *39*(3), 600–605. https://doi.org/10.3758/BF03193031

Reed, A. E., Chan, L., & Mikels, J. A. (2014). Meta-analysis of the age-related positivity effect: Age differences in preferences for positive over negative information. *Psychology and Aging*, *29*(1), 1–15. https://doi.org/10.1037/a0035194

Reio, T. G., & Wiswell, A. (2000). Field investigation of the relationship among adult curiosity, workplace learning, and job performance. *Human Resource Development Quarterly*, *11*(1), 5–30. https://doi.org/10.1002/1532-1096(200021)11:1<5::AID-HRDQ2>3.0.CO;2-A

Reisenzein, R., Horstmann, G., & Schützwohl, A. (2019). The Cognitive-Evolutionary Model of Surprise: A Review of the Evidence. *Topics in Cognitive Science*, *11*(1), 50–74. https://doi.org/10.1111/tops.12292

Renner, B. (2006). Curiosity About People: The Development of a Social Curiosity Measure in Adults. *Journal of Personality Assessment*, *87*(3), 305–316. https://doi.org/10.1207/s15327752jpa8703_11

Rensink, R. A., & Kuhn, G. (2015). A framework for using magic to study the mind. *Frontiers in Psychology*, *5*. https://doi.org/10.3389/fpsyg.2014.01508

Robinson, O. C., Demetre, J. D., & Litman, J. A. (2017). Adult life stage and crisis as predictors of curiosity and authenticity: Testing inferences from Erikson's lifespan theory. *International Journal of Behavioral Development*, *41*(3), 426–431. https://doi.org/10.1177/0165025416645201

Roediger, H. L., & McDermott, K. B. (1995). Creating false memories: Remembering words not presented in lists. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *21*(4), 803–814. https://doi.org/10.1037/0278-7393.21.4.803

Roediger, H. L., Meade, M. L., & Bergman, E. T. (2001). Social contagion of memory. *Psychonomic Bulletin & Review*, *8*(2), 365–371. https://doi.org/10.3758/BF03196174

Roenker, D. L., Thompson, C. P., & Brown, S. C. (1971). Comparison of measures for the estimation of clustering in free recall. *Psychological Bulletin*, *76*(1), 45–48. https://doi.org/10.1037/h0031355

Rueterbories, T., Mecklinger, A., Eschmann, K. C. J., Crivelli-Decker, J., Ranganath, C., & Gruber, M. J. (2023). *Curiosity satisfaction increases event-related potentials sensitive to reward*. https://doi.org/10.1101/2023.05.17.540372

Rundus, D. (1973). Negative effects of using list items as recall cues. *Journal of Verbal Learning and Verbal Behavior*, *12*(1), 43–50. https://doi.org/10.1016/S0022-5371(73)80059-3

Ryan, R. M., & Deci, E. L. (2000a). Intrinsic and Extrinsic Motivations: Classic Definitions and New Directions. *Contemporary Educational Psychology*, *25*(1), 54–67. https://doi.org/10.1006/ceps.1999.1020

Ryan, R. M., & Deci, E. L. (2000b). Intrinsic and Extrinsic Motivations: Classic Definitions and New Directions. *Contemporary Educational Psychology*, *25*(1), 54–67. https://doi.org/10.1006/ceps.1999.1020

Sacher, M., Taconnat, L., Souchay, C., & Isingrini, M. (2009). Divided attention at encoding: Effect on feeling-of-knowing. *Consciousness and Cognition*, *18*(3), 754–761. https://doi.org/10.1016/j.concog.2009.04.001

Salthouse, T. A. (2010). Selective review of cognitive aging. *Journal of the International Neuropsychological Society*, *16*(5), 754–760. https://doi.org/10.1017/S1355617710000706

Saraiva, M., Albuquerque, P. B., & Garrido, M. V. (2023). Collaborative inhibition effect: The role of memory task and retrieval method. *Psychological Research*, *87*(8), 2548–2558. https://doi.org/10.1007/s00426-023-01821-z

Schultz, W., Dayan, P., & Montague, P. R. (1997). A Neural Substrate of Prediction and Reward. *Science*, *275*(5306), 1593–1599. https://doi.org/10.1126/science.275.5306.1593

Sheldon, K. M., Jose, P. E., Kashdan, T. B., & Jarden, A. (2015). Personality, effective goal-striving, and enhanced well-being: Comparing 10 candidate personality strengths. *Personality & Social Psychology Bulletin*, *41*(4), 575–585. https://doi.org/10.1177/0146167215573211

Siddiqui, A. P., & Unsworth, N. (2011). Investigating the role of emotion during the search process in free recall. *Memory & Cognition*, *39*(8), 1387–1400. https://doi.org/10.3758/s13421-011-0125-9

Silvia, P. J. (2006). *Exploring the psychology of interest*. Oxford University Press.

Sivashankar, Y., Fernandes, M., Oudeyer, P.-Y., & Sauzéon, H. (2024). The beneficial role of curiosity on route memory in children. *Frontiers in Cognition*, *3*, 1346280. https://doi.org/10.3389/fcogn.2024.1346280

Silvia, P. J., Winterstein, B. P., Willse, J. T., Barona, C. M., Cram, J. T., Hess, K. I., Martinez, J. L., & Richard, C. A. (2008). Assessing creativity with divergent thinking tasks: Exploring the reliability and validity of new subjective scoring methods. *Psychology of Aesthetics, Creativity, and the Arts*, *2*(2), 68–85. https://doi.org/10.1037/1931-3896.2.2.68

Silvia, P. J. (2012). Curiosity and motivation. In *The Oxford Handbook of Human Motivation* (2nd ed., pp. 157–166). Oxford University Press.

Spreen, O., & Strauss, E. (1991). *A compendium of neuropsychological tests: Administration, norms, and commentary*. Oxford University Press.

Stare, C. J., Gruber, M. J., Nadel, L., Ranganath, C., & Gómez, R. L. (2018). Curiosity-driven memory enhancement persists over time but does not benefit from post-learning

sleep. *Cognitive Neuroscience*, *9*(3–4), 100–115. https://doi.org/10.1080/17588928.2018.1513399

Talmi, D., Ziegler, M., Hawksworth, J., Lalani, S., Herman, C. P., & Moscovitch, M. (2013). Emotional stimuli exert parallel effects on attention and memory. *Cognition & Emotion*, *27*(3), 530–538. https://doi.org/10.1080/02699931.2012.722527

Taylor, P. J., & Marsh, J. E. (2017). E -Prime (Software). In J. Matthes, C. S. Davis, & R. F. Potter (A c. Di), *The International Encyclopedia of Communication Research Methods* (1ª ed., pp. 1–3). Wiley. https://doi.org/10.1002/9781118901731.iecrm0085

Tyng, C. M., Amin, H. U., Saad, M. N. M., & Malik, A. S. (2017). The Influences of Emotion on Learning and Memory. *Frontiers in Psychology*, *8*, 1454. https://doi.org/10.3389/fpsyg.2017.01454

Von Stumm, S., Hell, B., & Chamorro-Premuzic, T. (2011). The Hungry Mind: Intellectual Curiosity Is the Third Pillar of Academic Performance. *Perspectives on psychological science: a journal of the Association for Psychological Science*, *6*(6), 574–588. https://doi.org/10.1177/1745691611421204

Vredeveldt, A., Hildebrandt, A., & Van Koppen, P. J. (2016). Acknowledge, repeat, rephrase, elaborate: Witnesses can help each other remember more. *Memory*, *24*(5), 669–682. https://doi.org/10.1080/09658211.2015.1042884

Wade, S., & Kidd, C. (2019). The role of prior knowledge and curiosity in learning. *Psychonomic Bulletin & Review*, *26*(4), 1377–1387. https://doi.org/10.3758/s13423-019-01598-6

Watson, D., Clark, L. A., & Tellegen, A. (1988). Development and validation of brief measures of positive and negative affect: The PANAS scales. *Journal of Personality and Social Psychology*, *54*(6), 1063–1070. https://doi.org/10.1037/0022-3514.54.6.1063

Wechsler David. (1987). *Wechsler Memory Scale-Revised (WMS-R) Manual* (The Psychological Corporation).

Weiß, C. (2007). StatSoft, Inc., Tulsa, OK.: STATISTICA, version 8. *AStA Advances in Statistical Analysis*, *91*, 339–341. https://doi.org/10.1007/s10182-007-0038-x

Weldon, M. S., & Bellinger, K. D. (1997). Collective memory: Collaborative and individual processes in remembering. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *23*(5), 1160–1175. https://doi.org/10.1037/0278-7393.23.5.1160

Weldon, M. S., Blair, C., & Huebsch, P. D. (2000). Group remembering: Does social loafing underlie collaborative inhibition? *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *26*(6), 1568–1577. https://doi.org/10.1037/0278-7393.26.6.1568

Wessel, I., Zandstra, A. R. E., Hengeveld, H. M. E., & Moulds, M. L. (2015). Collaborative recall of details of an emotional film. *Memory*, *23*(3), 437–444. https://doi.org/10.1080/09658211.2014.895384

Wilson, R. C., Guilford, J. P., & Christensen, P. R. (1953). The measurement of individual differences in originality. *Psychological Bulletin*, *50*(5), 362–370. https://doi.org/10.1037/h0060857

Wiseman, R., & Watt, C. (2018). Achieving the impossible: A review of magic-based interventions and their effects on wellbeing. *PeerJ*, *6*, e6081. https://doi.org/10.7717/peerj.6081

World Medical Association Declaration of Helsinki: Ethical Principles for Medical Research Involving Human Subjects. (2013). *JAMA*, *310*(20), 2191. https://doi.org/10.1001/jama.2013.281053

Wyer, Jr., & Srull, T. K. (2014). *Memory and Cognition in Its Social Context* (0 ed.). Psychology Press. https://doi.org/10.4324/9781315807591

Yaron-Antar, A., & Nachson, I. (2006). Collaborative remembering of emotional events: The case of Rabin's assassination. *Memory*, *14*(1), 46–56. https://doi.org/10.1080/09658210444000502

Yonelinas, A. P. (2002). The Nature of Recollection and Familiarity: A Review of 30 Years of Research. *Journal of Memory and Language*, *46*(3), 441–517. https://doi.org/10.1006/jmla.2002.2864

Yui, L., Ng, R., & Perera-W.A., H. (2017). *Concrete vs abstract words – what do you recall better? A study on dual coding theory*. https://doi.org/10.7287/peerj.preprints.2719v1

Zimmerman, C. A., & Kelley, C. M. (2010). "I'll remember this!" Effects of emotionality on memory predictions versus memory performance. *Journal of Memory and Language*, *62*(3), 240–253. https://doi.org/10.1016/j.jml.2009.11.004

ACKNOWLEDGMENTS

Giunta al termine di questo percorso accademico, desidero esprimere la mia sincera gratitudine a tutte le persone che, in modi diversi, hanno accompagnato e sostenuto la realizzazione di questo traguardo.

Un ringraziamento particolare va al mio tutor, il Prof. Alberto Di Domenico, pilastro di saggezza e dedizione nel campo della Psicologia Generale, per la disponibilità e la fiducia che ha dimostrato nei miei confronti sin dall'inizio. La sua competenza e il suo supporto, sia sul piano scientifico che umano, hanno rappresentato un punto di riferimento importante durante il mio percorso di formazione.

Desidero inoltre ringraziare i Professori Nicola Mammarella, Rocco Palumbo e le Professoresse Giulia Prete e Irene Ceccato, per la fiducia che hanno riposto in me in questi anni e per avermi coinvolta attivamente in progetti di ricerca e attività accademiche stimolanti. Collaborare con loro mi ha permesso di crescere sia sul piano scientifico che metodologico, offrendomi strumenti concreti per affrontare con maggiore consapevolezza il lavoro di ricerca. Il confronto con ciascuno di loro ha rappresentato un'occasione preziosa di apprendimento.

Un sentito ringraziamento va anche ad Adolfo, Lino, Eleonora, Matteo, Emanuela, Michele, Carla e Dalila per il clima di collaborazione e condivisione costruito giorno dopo giorno. Il lavoro di gruppo è stato arricchito dalla loro disponibilità, dallo scambio di idee e dall'impegno comune, che hanno reso ogni fase di questo percorso più efficace e stimolante.

Ringrazio la mia famiglia, per credere in me più di chiunque altro, anche quando non era semplice comprendere fino in fondo cosa comportasse il mio percorso.
Il dottorato di ricerca è un'esperienza poliedrica e non facilmente riconducibile ai ruoli standard: sei uno studente, ma al tempo stesso lavori, insegni, scrivi, fai ricerca... e spesso tutto questo non ha orari né confini netti. Nonostante ciò, hanno sempre accolto con entusiasmo ogni mia scelta, felici di vedermi felice, e questo per me ha un profondo valore.

Ringrazio i miei amici, per esserci sempre e per avermi regalato momenti di leggerezza, gioia e divertimento, che hanno reso più equilibrato e sereno anche il periodo più intenso di questo percorso.

Infine, il ringraziamento più profondo e sentito va a Stefano, la cui presenza costante e il cui amore incondizionato hanno reso ogni ostacolo meno arduo e ogni traguardo più luminoso. Grazie per avermi supportata nei momenti di difficoltà e per avermi regalato serenità, forza e fiducia.
Sei stato, e continui a essere, la mia più grande certezza.

Questa tesi non rappresenta solo un contributo allo studio della memoria e della psicologia generale, ma segna anche una tappa significativa del mio percorso di crescita, sia accademica che personale. Raccoglie non soltanto risultati scientifici, ma anche esperienze, confronti, errori e scoperte che hanno arricchito il mio modo di pensare e di vivere. Mi auguro che il lavoro svolto possa offrire spunti di riflessione e stimolare ulteriori ricerche, contribuendo in modo concreto all'avanzamento delle conoscenze in questo ambito.

Erika