Navigating Crisis: Assessing Cognitive Interference Theory's Role in Individual and Business Crisis Learning and Possibilities for Enhancement

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Abstract

In today's intricate organizational environment, crises are no longer uncommon, unforeseeable occurrences but are turning into regular obstacles that organizations need to manage. For this reason, organisational learning has gained significant attention in the crisis management literature as a key capability for companies to adapt, survive and maintain competitive advantage. Nevertheless, a question that remains unresolved in the literature is whether crises truly present a chance for learning, particularly given the cognitive constraints they pose on individuals.

This thesis, therefore, investigates the role of cognitive load in affecting both individual and organizational learning during crises, an important yet overlooked topic in crisis management research. Based on Cognitive Load Theory (CLT), the study explores if cognitive load in crisis scenarios influences learning of individuals and whether to a positive or negative extent, questioning possible ways to optimise the effects of the construct on learning.

Through online experimental research, the study exposed participants to a crisis scenario assigning them to different conditions, one of which experienced cognitive load, to evaluate whether a) being subjected to cognitive load affected their learning performance and b) optimising cognitive load sources by presenting different instructional information could shape the level of cognitive load, influencing learning positively. The results indicate that although cognitive load has been vastly studied to impair individual performance, it can yield positive learning outcomes if managed effectively, specifically if instructions for learning are simplified and individual mental processes for memorisation are stimulated.

Keywords: *Crisis management, organisational learning, cognitive load*

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Navegando na crise: avaliando o papel da teoria da interferência cognitiva na aprendizagem de crises individuais e empresariais e nas possibilidades de melhoria

Resumo

No intrincado ambiente organizacional de hoje, crises não são mais ocorrências incomuns e imprevisíveis, mas estão se tornando obstáculos regulares que as organizações precisam gerenciar. Por essa razão, a aprendizagem organizacional ganhou destaque na literatura de gestão de crises como uma capacidade essencial para as empresas se adaptarem, sobreviverem e manterem vantagem competitiva. No entanto, uma questão que permanece sem resposta é se as crises realmente oferecem uma oportunidade de aprendizagem considerando as limitações cognitivas que impõem.

Esta tese investiga o papel da carga cognitiva na influência sobre a aprendizagem individual e organizacional durante crises, um tema importante, mas negligenciado na pesquisa de gestão de crises. Com base na Teoria da Carga Cognitiva (TCC), o estudo explora se a carga cognitiva em cenários de crise afeta a aprendizagem dos indivíduos, seja de forma positiva ou negativa, e questiona maneiras de otimizar os efeitos desse constructo.

Por meio de uma pesquisa experimental online, os participantes foram expostos a um cenário de crise, sendo distribuídos em diferentes condições, uma das quais experimentou carga cognitiva, para avaliar se a) estar sujeito à carga cognitiva afetou o desempenho de aprendizagem e b) otimizar as fontes de carga cognitiva, ao apresentar informações instrucionais distintas, moldaria o nível de carga e influenciaria a aprendizagem positivamente. Os resultados indicam que, embora a carga cognitiva seja amplamente estudada por prejudicar o desempenho, ela pode gerar resultados de aprendizagem positivos se for gerenciada de forma eficaz, especialmente quando as instruções são simplificadas e os processos mentais de memorização estimulados.

Palavras-chave: Gestão de crises, aprendizagem organizacional, carga cognitiva

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Chapter 1: Introduction

1.1. Research Background

As today's organisational landscape grows in complexity, the concept of crises as purely extraordinary and exceptional circumstances has started to fade away. The new ordinary of every company involves the navigation of a business scenario characterised not only by elevated uncertainty and turbulences, but also by occurrences such as natural disasters, corporate scandals, terrorist attacks, product defections, and more. Such exogenous factors continuously put at stake the viability of businesses, challenging the resilience of organisational strategies, and frequently impacting their corporate performance (Bundy et al., 2016).

While in the past crises were treated as statistical outliers (Lampel et al., 2009) and were often viewed as the phase leading to the end of the organisational lifecycle (Veil, 2008), in the last decades literature has begun shifting away from a fatalistic point of view to a more proactive approach. Although it is undeniable that crises inevitably hit businesses of all shapes and sizes without distinction, due to their increasing occurrence academics have started stressing the importance to prepare for the "impossible", highlighting how the inevitable is neither unthinkable, nor unpredictable (Coombs, 1999). This acknowledgement led to a fresh perspective of crises as new competitive opportunities from which firms can and ought to learn (James et al., 2011), giving birth to the field of organisational learning. Thus, organisational learning, particularly in the post-crisis, has become a determinant factor in a firm's ability to survive, adapt, compete, and ensure long-term viability with several scholars affirming that if embracing such events organisations "(...) can emerge from crises with renewed vitality" (Seeger et al., 2003, p. 266).

Nonetheless, learning from crises poses difficulties in many terms. Streams of literature argue indeed that learning does not necessarily occur from crises and further criticise the quality of organisation learning, claiming that reflection and analysis following a crisis scenario often result in none or superficial learning, leading to the implementation of minor changes in the company - such as technical or procedural issues-, and not to a comprehensive understanding of crisis dynamics (Elliott & Smith, 1993; Fortune & Peters, 1995; Toft & Reynolds, 1997; Smith & Elliott, 2007; Boin, McConnell, & 't Hart, 2008). Likewise, crises were found to affect the ability to reconstruct scenarios and to clearly identify the antecedents of the occurrence, eventually making individuals inferring the wrong things (Veil, 2010).

Here lies the challenge in this debate: as unexpected events, there is no doubt that crises are tortuous to learn from. However, what if the common denominator preventing adequate, applicable organisational learning is the limitation of the human cognition to memorise and objectively recall information during impactful events? This dissertation argues that organisational learning from crisis may be substantially impacted by what is known in the academia as *cognitive load* theory (Sweller et al., 1988). Cognitive Load Theory, often referred to as CLT, has long been studied to be crucial when it comes to learning and posits that individuals have a limited processing capacity beyond which they experience cognitive overload (Sweller et al., 1998). Literature demonstrates how in situations of high cognitive demand, such as crises, cognitive load is significantly raised causing disruptions in individuals' capability to acquire and subsequently memorise new information.

The present research, therefore, aims to test whether cognitive load may have an impact on individual (and thus, organisational) learning under crisis situations and if so, whether such cognitive limitation of individuals can be optimised through cognitive load theory and instructional design format. The knowledge obtained will eventually contribute to enriching the crisis management field and organisational learning while giving insights to companies on how to optimise the individual learning process during crisis.

1.2. Justification of the Study

While numerous studies have been devoted to examining the paramount role of learning within organisations, until now relatively few scholars have in-depth researched the role of organisational learning within crisis management (Lalonde, 2007). Most of those have, indeed, focused on the possible beneficial effects organisational learning can generate for companies facing future crises. For instance, Weick & Sutclifee (2007) posit organisational learning as a key tool for companies in building resilience after crisis have occurred. Similarly, Mitroff, Pauchant, & Shrivastava (2006) highlight how learning can play a crucial role in preventing crises by anticipating their insurgence and implementing adequate prevention measures. Other scholars, recently, have started arguing the importance of considering and promoting organisational learning in every phase of the crisis management cycle to develop day-to-day strategies for systematic and continuous development of crises management capabilities (Metallinou, 2018; Boin et al., 2016; Anderson and Eriksson et al., 2017).

While these studies offer valuable insights, their contribution to advancing the field of organisational learning in crisis management remains somewhat limited (Coombs, 1999). Indeed, although stressing the relevance of integrating learning processes within the crisis management cycle, they leave several key aspects unaddressed. First, they do not explore nor consider the potential cognitive limitations that crises may impose on the learning process of individuals and organisations – indeed, although some barriers of OL have been investigated throughout the years (Senge, 1990; Marsick & Watkins, 1990; Quinn, 1985; Shaw & Perkins, 1992; McGill & Slocum, 1994; Leonard & Barton, 1995), none of them was found to specifically concern crisis situations; second, they offer little clarity on the degree to which individual (and organisational) learning can genuinely arise from such situations, with scholars having different opinions on the matter. Finally, if learning can actually arise, these studies fall short in providing guidance on how to develop and implement learning strategies under the unique and high-pressure conditions that crises present.

In order to start addressing these gaps, this research will investigate one major learning limitation associated with crisis, cognitive load, which although has been studied throughout years by educational psychology to be strongly intertwined with the learning performance of individuals (Sweller & Chandler, 1994; Sweller et al., 1998; Paas & van Merriënboer, 1993; Kirschner, 2002), has never been specifically considered in relation to crisis organisational learning. Understanding the impact of Cognitive Load Theory (CLT) during crisis situation may not only provide a great foundational theoretical analysis of how crisis conditions can affect learning, independently of the type of crisis individuals are exposed to but also, based on such premise, it would allow for a possible investigation on the degree and the direction of the relationship between crisis and learning to eventually understand if individuals are able to analyse and learn from crisis situations. Indeed, although up to date most research has demonstrated that cognitive overload generally leads to a decline in performance across various domains – such as poor creative thinking (Redifer et al., 2021), deteriorated problem solving ability (Sweller, 1988), increased irrational behaviour (Deck & Jahedi, 2015) –, recent studies have started questioning whether it could have instead a beneficial effect and how to promote such. For instance, in their study, Sankaranarayanan et al. (2020) proved how training under cognitive load benefitted the performance of surgical tasks.

Therefore, the present study investigates how being subjected to cognitive load may affect individual learning, answering the following research question:
"Based on the assumption that crises generate high levels of cognitive load in individuals, does this have an impact on the individual (and subsequential, organisational) learning capacity and if so, can this be optimised for improving learning?"

Addressing this ambiguity will serve as the first crucial step for advancing the academic field of both crisis management and organisational learning and eventually provide concrete guidance in developing practical interventions aimed at improving the efficiency of individual and organisational learning during crisis.

Chapter 2: Literature Review

To situate the importance of organisational learning and its implications in the crisis management context, this chapter will briefly review the published literature in the field by first delving into crisis management, deepening subsequently into organisational learning and finally, investigating cognitive load theory as a possible cognitive limitation that may affect learning absorption of individuals.

2.1. Understanding Organisational Crisis

2.1.1. Defining Organisational Crisis

According to its etymology, the term crisis derives from the Greek word "krisis", which means judgement, choice, or decision. Throughout history, crises have traditionally been viewed as events characterised by unexpected turning points that force the involved actors to incur critical decisions, leading to either positive or negative outcomes (Fink, 1986; Gottschalk, 1993; Lerbinger, 1997; Mitroff, 1988). As such, crises have been typically associated with feelings of apprehension, being primarily defined as events capable of disrupting ongoing and future organisational goals and potentially compromising a firm's survival (Perrow, 1984; Seeger, Sellnow, & Ulmer, 1998).

Over time the academia has tried to refine their definition, leading the term to evolve to better suit the context and the respective disciplines (Preble, 1997). However, scholars continue to lament the uncompletedness of the definition. Due to the amorphous nature of crises, achieving a universal terminology has remained extremely challenging to this day, causing the organisational field to be populated by a plethora of definitions. For instance, Holsti (1978, p. 41) affirms that crisis is "a much-overused term which has become burdened with a wide range of meanings, some of them quite imprecise," while Smith (2005, p. 319) declares that "the definition of crisis has generated considerable debate within the academic literature and there is no real collective acceptance about the precise meaning of the term."

Despite differing interpretations, the academia seems to agree on the abnormality of crises, claiming that if it can be stated that systems are not normally in crisis, then crises are themselves abnormal events (Almond, 1973). Several characteristics appear to be recurrently associated with crises in the organisational field. Crises are often described as a) ambiguous, unpredictable (Dutton, 1986; Quarantelli, 1988) and unexpected events (Hermann, 1963), b) with low probability of happening (Pearson & Claire, 1998), c) that generate high impact on the organisations and its stakeholders, threatening the company's survival (Hermann, 1963;

Jackson & Dutton, 1987), d) leaving limited time to respond (Pearson & Claire, 1998) and e) presenting a challenge to decision-makers within the company, which will lead to better or worse results (Aguilera, 1990).

Hence, as Clark (1988) states, what unites all the proposed definitions is the inclusion of three main elements: threat to organisation goals, urgency in terms of perceived time pressure, and uncertainty of outcomes. Pearson and Claire's definition (1998, p. 66), which integrates all agreed-upon factors, has been deemed the most comprehensive up to date, defining crisis as:

> *"A low-probability, high-impact event that threatens the viability of the organization and is characterized by ambiguity of cause, effect, and means of resolution, as well as by a belief that decisions must be made swiftly."*

The debate over the establishment of a common ground for definition has further intensified in recent years, particularly with the development of new perspectives deemed essential to assimilate into the current, albeit still incomplete, crisis definition. Some academics have challenged the definition of crises as uniquely characterised by a single event, suggesting instead that they are part of a larger process (Jaques, 2009; Pearson & Clair, 1998; Roux-Dufort, 2007). In this regard, Roux-Dufort (2007) criticises current definitions for revolving primarely around the nature of implications and consequences of crisis events, overlooking the intermediate states between normality and crisis. This formulation results problematic as it promotes an uncomprehensive view of crises as sudden and extraordinary occurrences, and not as an accumulation of organisation deficiencies and shortcomings. This conceptualisation is further aggravated by the tendency of organisational literature to use the terms "urgency" and "crisis" interchangeably, though they differ in terms of duration and clarity of solutions (Roux-Dufort, 2007). Indeed, in situations of urgency, although time is limited, the actors involved are usually aware of the solutions to implement (consider climate change, for instance); contrarily, in situations of crisis, not only time is scarce but solutions are also unknown, adding further uncertainty for stakeholders.

Another important integration suggested by the academia posits crises as behavioural phenomena (Pearson & Clair, 1998; Coombs, 2010), detaching from the conventional vision of crises as pure results of external factors. This perspective explores crises from a psychological point of view[1], highlighting how humans play a fundamental role in the way in

[1] Pearson & Claire's (1998) reframe crisis using a multidimensional approach including cognitive theories to explain how psychological forces contribute to the creation of organisational crises as they are found to generate "trauma" in individuals, prompting coping behaviors to intensify the crisis.

which crises are shaped. Being highly uncertain, emotional, and complex events, crises often spiral out as a consequence of decision-making errors or biases of organisational leaders (Stubbart, 1987). Additionally, they are socially constructed by the actors involved within it, which engage in collective sense-making and communication to interpret the circumstances, with Estes (1983) concluding that "crises are socially constructed as a consequence of social perception and definition; that is, a crisis may be said to exist if it is perceived to exist." (p. 445). Therefore, literature should not only better emphasise the role of individuals as decision-makers within the organisational definition of crises, but also better clarify how crisis outcomes depend on the ability of the top management team to make sense of change when it is encountered (Gioia & Chittipeddi, 1991).

Current literature is still far from achieving consensus on a definition. In light of this, contemporary academia must seek not only a universal and updated terminology to replace Pearson & Claire's nearly 40 years old definition, but also for a more precise and careful formulation of the term, aiming at delineating crises not as events rarely originating from a single cause but rather from a series of critical factors, the perceived danger of which is ultimately perceived, constructed and interpreted by humans.

2.1.2. Categorising Organisational Crisis

Typological studies have sought exploring the underlying similarities of crises to offer evaluative criteria for companies to better assess the propensity of encountering crises and the potential harm or opportunity obtainable (Thierry et al., 1992; Mitroff, 1994; Parson, 1996, Hwang, 2000; Faulkner, 2001; Mitroff, 2004). According to Bundy and Pfaffer (2015: 351), classification of crisis allows individuals to engage into a "heuristic simplification process in which evaluators intuitively combine past experiences and expectations to reduce the complex nature of a crisis into easier-to-understand cognitive schemas" (p.351).

The first and foremost aspect that appears to define crises is the *temporal insurgence* of disrupting factors. Parsons (1996), for instance, classifies crises by temporal urgency, distinguishing them into immediate, emerging, and sustained. *Immediate* crisis refers to a state occurring without warnings, and which gives the company no opportunity to prepare. *Emerging* crisis also refers to unpredictable situations which, however, develop more slowly signalling clues of organisational distress before erupting. Finally, *sustained* crisis is considered a disruptive event lasting for weeks, months or even years, generally characterised by stakeholders' speculation and rumour. A similar approach was developed by Hwang (2000), which organises crises by the way in which they develop through time: on one hand, crisis can be *abrupt*, i.e., prompted by the sudden impact of either internal or external perturbations within the company's operating environment. Abrupt crises are, indeed, events originating from specific forces that create a rapid build-up in speed - leading to almost immediate consequences -, can happen at any time, and are time independent, meaning that the probability of a crisis arising the next day is independent of the probability of the previous day. On the other hand, crises can be *cumulative*, thus originating from a series of factors that become self-enforced once specific threshold is reached. In this case, the probability of occurrence is time-increasing, meaning that the longer the arising factors remain unnoticed or neglected, the higher the likeliness of the crisis to erupt. Moreover, their cumulative nature makes it difficult for companies to accurately trace them to specific events and/or causes. Cumulative crises are often observed within organisations as managers tend to rationally delay structural adaptations, maintaining business-as-usual configurations, as long as "the costs of the former outweigh the financial consequences of the latter" (Hwang, 2000: 133).

Another crisis classification scheme that has become particularly renowned is the one of Mitroff (1988). Compared to Parson and Hwang's temporal approach, Mitroff provides a complementary and useful categorisation of crises emphasising the *origin*, i.e., as either arising due to natural disasters, e.g., hurricanes, fires, or earthquake, or due to human action, e.g., corruption, product defection, scandal, terrorist attacks. Building on this work, a more comprehensive approach was developed by Thierry et al. (1992), revised by Mitroff (2004) later on, which sorts crises into seven categories: *economic* (e.g., stock market falls, labour problems), *informational* (e.g., data breaches, loss of records), *physical* (e.g., product failures, plant explosions), *human resources* (e.g. corruption), *reputational* (e.g., rumors, loss of reputation), *psychopathic acts* (e.g., terrorism), and *natural disasters* (e.g., floods, fires, earthquakes) – see Figure 1. He adds, however, that these categories are not to be consider mutually exclusive as they can also arise one as a consequence of the other and that, although some of them can be subject to a measure of control, the majority of them are entirely uncontrollable by organisations.

Finally, Faulkner (2001) analysed crises by classifying them by *degree of externality*, i.e., depending on whether the event was triggered by internal factors (e.g., organisational misconduct, insufficient safety standards, bribery) or by external factors (e.g., natural disasters, poor supplier's operations). The usefulness of this model is two-fold: first, it separates external causes from those caused by the personal, organisational, and social factors; second, it provides with an opportunity to subsequentially consider the relationship between external and internal factors in order to aid firms to better position for preparation and correction of crises.

As Hwang (2000) states, the several classifications portrayed by the literature act as a crucial step when dealing with the crisis concept. Indeed, although until today no research has demonstrated whether some crises are more likely to occur within certain types of organisational context (Spillan et al., 2003), categorisation provides the academia with a deeper understanding on how to recognise organisational crises, contributing to improve the effectiveness of the crisis management field.

Figure 1: Crisis Types Portfolio (adapted by Mitroff, 2004)

Major Crisis Types			
Economic	**Informational**	**Physical**	**Human Resources**
Labour strikes Labour unrest Labour shortage Major decline in stock and price fluctuations Market crash Decline in major earnings	Loss of proprietary and confidential information False information Tampering with computer records Loss of key information with regard to the customers/suppliers, etc.	Loss of key equipment, plants, and material supplies Breakdowns of key equipment, plants, etc. Loss of key facilities Major plant disruption or accidents	Loss of key executives Loss of key personnel Rise in absenteeism Rise in vandalism and accidents Workplace violence
Reputational	**Psychopathic Acts**	**Natural Disasters**	
Gossip Slander Rumours Damage to reputation Tampering with corporate logos	Product tampering Kidnapping Hostage taking Terrorism Workplace violence	Earthquake Fire Floods Explosions Typhoons Hurricanes	

2.2. The Role of Crisis Management

In an environment characterised by volatile and disrupting forces, it is easy to understand the fatalistic outlook found among macro theorists arguing that, although common, environmental pressures are beyond the control of organisations, leaving almost no opportunity for prevention. As a result of this, the study of crises has been redirected towards focusing on the role of individuals, both on how they singularly and collectively contribute to crisis emergence and on how they can prevent and learn from these events.

Therefore, the need for human-planned and permanent processes to mitigate crises has become a paramount concern for organisations. Fink (1986), one of the founding fathers of the crisis management discipline, defines planning for crisis as "(...) the art of removing much of the risk and uncertainty to allow you to achieve more control over your own destiny". This definition unifies two different, yet important, perspectives: it goes beyond the idea of crisis management as the skill of properly responding to and manage an already unfolded event and further highlights the necessity of preparing oneself for possible disrupting events. Crisis management can be defined, indeed, as the field focusing on crisis prevention and containment through the implementation of plans, procedures and mechanisms for prevention, detection, containment, recovery and learning from crisis (Mitroff et al., 2001).

2.2.1. Models of Crisis Management

Two primary concepts have shaped the evolution of crisis management models over time. First, crisis management models have unanimously recognised and advocated the paramount necessity of integrating crisis management into the daily operations of a firm as a guiding model capable of measuring a firm and its individuals' current management practices (Mitroff and Anagnos, 2001). Second, their academic focus of crisis copying frameworks has slowly shifted beyond the mere crisis occurrence, focusing more on the before-and-after crisis management opportunities. Indeed, while some emerging models have further stressed the necessity to look at early warning signals of crisis[2] (Paraskevas, 2006; Jacques, 2009), some others have delimited the post-crisis phase as essential in better handling crises (Bundy et al. 2017; Madsen, 2009). The crisis experts, Pauchant & Mitroff, highlight this concept by explaining the difference between crash and crisis management.

> "*Crisis management is not the same as crash management – what to do when everything falls apart. Obviously, this is important, but it is only one part of total crisis management effort. Here we focus not only on crash management – what to do in the heat of a crisis – but also on why crises happen in the first place and what can be done to prevent them*" (Pauchant & Mitroff, 1992, p. 11)

Although sharing similar ideological foundations, different schools of thought have developed in terms of crisis management approaches. On one side, some scholars have

[2] Particularly, Paraskevas (2006) adds practice have proven how, once the firm goes through the initial crisis stage, recovering the lost ground becomes extremely unlikely for management.

proposed management approaches that followed the crisis lifecycle, inspiring themselves to biological and evolutionary models (e.g., Fink, 1986; Mitroff 1994, Coombs, 2007). On the other, scholars have claimed that academia would better benefit from a dynamic, flexible, yet rigorous, model capable of separating the phases of crisis while allowing for non-linearity, this way better highlighting the independence of the stages (e.g., Pearson & Claire, 1998; Burnett, 1998; Jacques, 2007).

A best-practice model for crisis lifecycle models was provided by Mitroff (1994) who focuses on developing a typological-chronological framework that includes five main stages of the crisis management cycle (CMC): a) *signal detection*, where warnings can be identified and still acted upon, b) *probing and prevention*, during which organisations should look for factors and work on mitigating the hazard, c) *damage containment*, the onset crisis phase where the firm strive to limit damages, d) *recovery*, focus on returning to ordinary business operations swiftly, e) *learning*, which sees the firm involved into reviewing and critique the crisis management process actuated. Compared to older frameworks, this one places a greater emphasis on the actions that a firm can take, rather than the characteristics of the crisis (e.g., acuteness), this way further providing opportunities to disrupt the crisis lifecycle. Additionally, the model was later revisited by Mitroff himself to incorporate further details, adding a sixth step, f) *redesign*, which refers to the organisation's effort to analyse and restructure the internal structures that may have influenced the insurgence of the crisis (Mitroff, 2005) – further information on the framework can be found in Appendix A. Throughout the years, the academia has directed towards more reductionist approaches, such as the PPRR model, developed by Coombs (2007), with a *prevention* (including signal detection), a *preparation* (including probing and prevention), a *response* (including damage containment and recovery), and a *revision* (including learning and redesign) stages, allowing for further clarification and better categorisation of crisis stages.

These crisis management models, while comprehensive in scope, have faced criticism for being deeply embedded in a classic engineering mandate (Kahn et al., 2013). Moreover, step-by-step models may result difficult to implement as they are based on the strong assumption of linearity (Jacques, 2007), however as Lamertz, Martens, and Heugens (2003, p. 83) assert "(...) issues often fail to progress along predictable lines, and deviate frequently from the linear, sequential path suggested by evolutionary frameworks".

As a result of this, another stream of crisis management models has emerged which, by examining chaos theory, highlights multi-directional causality and lack of predictability. The model theorised by Jacques (2007) indeed challenges the restrictive assumption of linearity by seeking to organise crisis phases into clusters of activities that can occur simultaneously without necessarily having to adhere to a temporal sequence. In line with this perspective Penrose (2002:166) further stresses the need for a more comprehensive structure, adding that "in the past, pre- and post-crisis actions have not been consolidated as one integrated unit... These activities do cluster together and should be considered in aggregate rather than as separate sets of activities". Jacques' relational crisis model (2007), illustrated in Figure 2, comprises 4 major elements – *crisis preparedness, crisis prevention, crisis incident management, and post-crisis management* – with each component structured around a cluster of activities.

Figure 2: Relational Crisis Management Model (Jacques, 2007).

Compared to previous theoretical frameworks, the model's non-linear structure argues for a more holistic view of crisis management, revolving around two distinct phases: pre-crisis and crisis management. The author stresses the importance of the pre-crisis management steps, arguing that despite companies often fixate themselves on this aspect only, crises do not usually arise from inadequately developed protocols for crisis management. Instead, they are generated by factors such as poor maintenance, human error, bad planning, organisational culture, or leadership failure among the others[3]. Thus, prioritising the learning and identification of

[3] It is worth to note that none of these activities are usually included in the context of "crisis prevention". Crandall (1999) comments how, for example, the auditing department is not usually seen as contributing to financial risk. Nonetheless, several corporate crises have in fact traced back to poor auditing practices.

triggers and underlying causes must be a paramount concern for any crisis management "best practice" model.

Therefore, despite having different approaches, this widespread consensus of crisis management models on the value of learning stresses the significant potential they offer for organisational improvement. Nonetheless, although most models agree on the opportunity for a firm to learn from crisis, the crisis management literature exhibits two shortcomings in that regard. First, the role of learning lacks of prioritization in the currently available frameworks; indeed, learning is always relegated as the very last step of the process and not as an ongoing, necessary aspect of the crisis management process (Veil, 2011). Second, and most importantly, while the literature on the matter mostly focus on the importance of organisational learning for crisis management – e.g., Mitroff, Pauchant, & Shrivastava (2006) consider the importance of learning as part of crisis preparedness; Weick & Sutclifee (2007) examines learning as a tool for building resilience within organisations –, there is a lack on exploration into how to guide organisational learning in crisis circumstances. Specifically, the literature revolving around crisis management has not yet delved into analysing the human dynamics of organisational learning, including how individual learning should be promoted, how it may be affected by crisis situations and which factors might act as facilitators and deterrents of such. Therefore, Wang (2008) confirms that, while academia knows much about learning theories, what appears to be missing in the academic sphere is a revisitation of learning within the current crisis management frameworks, simultaneously accompanied by a deeper investigation on individual learning dynamics during abnormal circumstances.

2.3. Organisational Learning & Crisis

2.3.1. Conceptualising Organisational Learning

Teece et al. (1997) define learning as the permanent changes in individual behaviour as a result of repetition and/or experiences. In the business scenario, the concept of organizational learning (OL) has been defined as the process through which firms acquire knowledge to inform the decision-making process and to shape the organization's internal dynamics (Miller, 1996). Proposing a more updated definition, Chiva, Ghauri, & Alegre (2014: 689) formulate OL as "the process through which organizations change or modify their mental models, rules, processes or knowledge, maintaining or improving their performance". Although the literature that has been developed around OL offers diverse theoretical perspectives, Easterby-Smith et al. (2000) posit that early debates have had a long-lasting contribution to fostering still ongoing dialogues and creating a fertile ground for advancement, with each theory having its raison d'être and validity (Basten & Haamann, 2018).

A prominent discussion in the literature concerns whether organizational learning is simply the sum of individual learning as part of the organization or whether it originates from the specific organisational learning processes a firm adopts, which in turn serve as a catalyst for individual learning – a summary of the most influential papers addressing the topic is provided in Table 1. Theorists supporting the former perspective reflect either a more "purist" point of view - by condemning anthropomorphism[4] due to company being the exemplified aggregation of individual actions and decisions (Herbert, 1991; March & Olsen, 1995) - or express a more pragmatic approach stating that, since organisations are led by a limited number of people, the mapping of individual cognitive and learning process provides a good approximation of how the firm resonates and behaves (Garratt, 1987). Conversely, those who posit that organizational learning is more than the learning of its individual members, affirm that systems, structures and procedures within firms facilitate individual learning and it is within those that learning is ultimately stored (Hedberg, 1991; Shrivastava, 1983).

Table 1: Summary of Relevant Literature Covering the Organisational Learning Debate

Author(s)	Approach	Research Focus
Garvin (1993)	Learning as individual	Suggests that organizations engage in learning but specifies five main activities of learning organizations which are primarily individual.
Huber (1991)	Learning as both individual and organisational	OL is an information processing perspective that can be applied at individual, group, organizational, industry, or society levels of analysis. The author focuses on individual interpretation but relates it to an organisational level.
Senge (1990)	Learning as individual	Focus is heavily individual (leaders and people). "Leaders in learning organizations are responsible for building organizations where people are continually expanding their capabilities to shape their future." The leader is designer, teacher, and steward.
Stata (1989)	Learning as organisational	Organizational learning differs from individual learning in that it "occurs through shared insights, knowledge, and mental models". It depends on institutional mechanisms to provide memory as well as individual memories.
Shrivastava (1983)	Learning as organisational	"Organizational learning is an organizational process rather than an individual process." Although it is stated that learning takes place at various levels and that individuals are the agents of learning, the emphasis is on organizational level learning systems.

[4] By definition, the attribution of human characteristics to non-human entities. This stream of thought asserts that human characteristics such as "thought" and "learning" cannot be attributed to inanimate objects like organisations as this would underestimate the contribution of individuals in shaping a firm and its culture.

Argyris (1976;1977)	Learning as individual	Organizations learn through individuals acting as agents for them." However, groups/teams and organizations are facilitators or inhibitors of learning.
Cangelosi Dill (1965)	Learning as both individual and organisational	"Organizational learning must be viewed as a series of interactions between adaptation at the individual or subgroup level and adaptation at the organizational level."

(Adapted from: Crossan et al., 1995)

In that sense, individual learning does not presuppose organizational learning (Ikehara, 1999), as Hedberg confirms:

> "*Although organizational learning occurs through individuals, it would be a mistake to conclude that organizational learning is nothing but the cumulative result of their members' learning. (...) Members come and go, and leadership changes, but organisations' memories preserve certain behaviours, mental maps, norms, and values over time*" (1981, p.6)

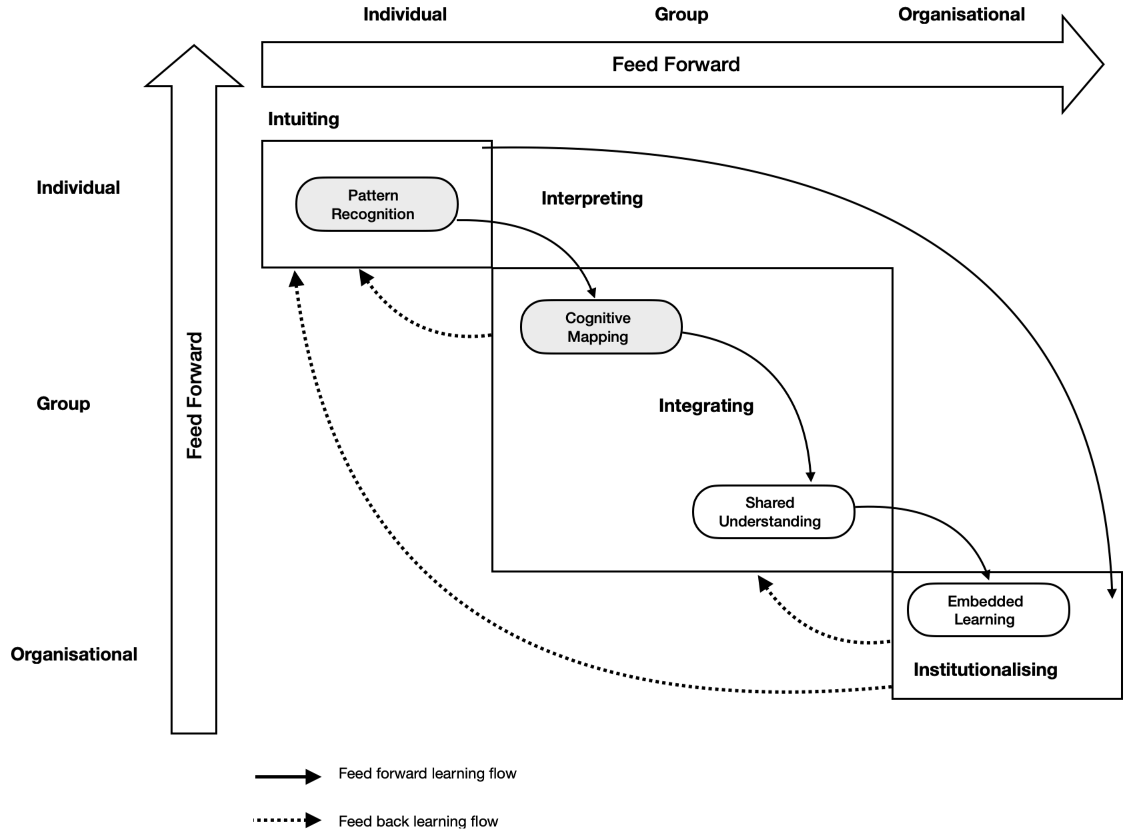
Notwithstanding this, most authors agree that in a sense, organisations do not learn (Senge, 1990), the humans in them do (e.g., Argyris & Schon, 1978; Honey and Mumford, 1992; Wang & Ahmed, 2003), therefore concluding that it is first necessary to grasp the learning processes of individuals as OL starts exactly with them, marking the very first step in the knowledge creation process. Consequently, streams of theories seeking to illustrate the OL process have developed a more moderate perspective, portraying organisations as vessels facilitating the integration of individual learning into organizational learning. Under this viewpoint, OL is indeed expressed as "the collectivity of the individual learning within the organization" (Wang & Ahmed, 2003:9), meaning that collective learning occurs in addition to individual learning, which is independently carried out, to a different extent, by each single individual. Hence, if the organisation does not have in place adequate organizational learning systems, collective learning cannot simply take place (Kim, 1993; Romme and Dillen, 1997). For this reason, Kim (1993) underlines the necessity of distinguishing individual and organizational learning as, without such, OL models might neglect the significance of individuals. This could lead to OL being erroneously reduced to a simplistic extension of individual learning when, in reality, it is crucial to treat and analyse the two constructs both distinctively and in relation to each other.

2.3.2. How Organisations and Individuals Learn

Within organisational learning, Crossan's model (1999) has gained prominence for offering a coherent and fluid approach to explaining the individual and group dynamics involved within organizational learning. This model is posed on four key premises: (1) OL is seen as a multi-tiered construct encompassing three layers of learning, namely individual, group and organizational; (2) OL encompasses four categories of learning processes - *intuiting, interpreting, integrating, and institutionalizing* (known as the 4Is), (3) learning layers are connected between each other through psychological and social processes; (4) learning occurs as a flow (forward and backward) between levels as knowledge is re-elaborated among individuals, groups and organisations and becomes internalised in the minds of individuals. Thus, although being the first step of the process, individual learning by itself does not guarantee organisational learning; rather, to reach institutionalizing of knowledge within a company, a transference process is necessary (Senge, 1990; Easterby and Araujo, 1998; Wang and Ahmed, 2003).

Crossan's model delineates learning into four fundamental processes. The first phase, *intuiting* occurs at an individual level and is defined as the subconscious recognition of patterns and information as a result of personal experience. Secondly, *interpreting* takes place - both at individual and collective level – where individuals explain concepts to themselves and others through words and actions. Thirdly, *integrating* involves the development of a mutual, collective understanding among individuals and groups via adjustment, and finally *institutionalising* involves processing acquired knowledge to eventually improve "systems, structures, procedures and strategy" (Crossan et al., 1999: 525) to guide organisational actions - see Figure 3. Therefore, while the three levels of learning (individual, group and organisational) delineate the structure where the learning takes place, the four sub-processes (intuiting, interpreting, integrating and institutionalising) are the mechanisms that unite this structure, serving as a glue and facilitating organisational learning.

Figure 3: Crossan's 4I Model of Organisational Learning (Crossan et al., 1999)



Albeit this model is renowned to be the most exhaustive in explaining the organisational learning process, it is not exempted from limitations. For instance, Jenkin (2013) recognises a gap regarding to "understanding the mechanisms that (...) restrict the stocks and flows of learning" (Crossan et al., 1999: 535; see also Crossan et al., 2012), arguing the necessity of re-elaborating micro-level aspects to resolve existing gaps in the OL literature.

Particularly, Balarezo et al. (2023) affirms the model does not recognise any potential cognitive barriers arising from learning, neither it explores situations where individuals are exposed to difficult, uncertain, or unfamiliar situations – that is, where learning is most difficult to take place. Indeed, given the under-theorisation of individual learning due to the subconscious nature of the field (Balarezo et al., 2023), academia should seek to comprehend the causes influencing such individual learning processes as understanding possible deterrents and facilitators to learning could create a potential for organisational learning improvement, especially in situations where learning is influenced by external factors and put at stake.

2.3.3. The Relationship Between Crisis and Learning

As explored in Section 2.2., organizational learning plays a crucial role in crisis management, serving as a vital mechanism in assisting companies to develop the necessary capabilities to prevent crises and limit their implications (Carley and Harrald, 1997). Nonetheless, the relationship between crisis and learning still remains ambiguous. On one side, the relationship between crisis and learning is thought to have a positive influence. In that regard, two main streams of work connect crisis management to positive organisational learning outcomes: the first concerns the idea of organisational learning as a tool to build resilience after crisis occurrence (Weick & Sutclifee, 2007). The second stream sees learning as part of crisis preparedness (Mitroff, Pauchant, & Shrivastava, 2006). A third more recent stream of work, which is gaining prominence, argues that because of the positive effects generated, learning should start to be incorporated as an on-going process, that is within every single stage of the crisis management process (Wang, 2008).

On the other side, much debate has however revolved around the validity of this relationship, with scholars questioning the feasibility of generating organisational learning from crises and claiming that although learning offers excellent opportunities for future business improvement, it is not always achievable in practice. Thus, academics argue that it remains still uncertain the extent to which organizations and their members can analyse their experiences of a crisis event and using the results as a basis for change (Stern & Sundelius, 2002). While some schools of thought, such as Stern (1997), affirm there is indeed good reason to believe that crises in fact generate more rigorous thinking and promote a speed up in learning due to psychological accountability effects - such as increased political attention or broadened attentive public -, other scholars contend that crises are inherently challenging events from which to learn. For instance, crises are thought to often prevent learning by evoking strong emotional responses in the involved actors (Kovoor-Misra et al, 2000), by generating rigidity of core beliefs (Argyris and Schön, 1978; Kets de Vries and Miller, 1984), or by causing communication difficulties (Argyris, 1999; Barton, 1993; Bood, 1998; Smart and Vertinsky, 1977; Smith, 1990; Toft and Reynolds, 1992).

Regardless of how crises are categorized or their potential for fostering learning, what is agreed upon the relationship between crisis and learning is that, by causing sudden, unexpected changes in the business environment of a company, crises modify the ordinary learning environment of individuals by creating environmental complexity, time pressures, information overload as well as uncertainty and ambiguity. As will be discussed in the following section, such conditions have been studied to exert considerable cognitive load pressures on individuals which, in turn, have a role in influencing the learning process.

2.4. Cognitive Load in the Learning Process

Cognitive load theory (CLT) is based on the theoretical foundation that the working memory of humans is subjected to limitations (Sweller and Chandler, 1994), that is every time a learning task requires more capacity than what an individual can accommodate in working memory, he experiences what is known as "cognitive overload".

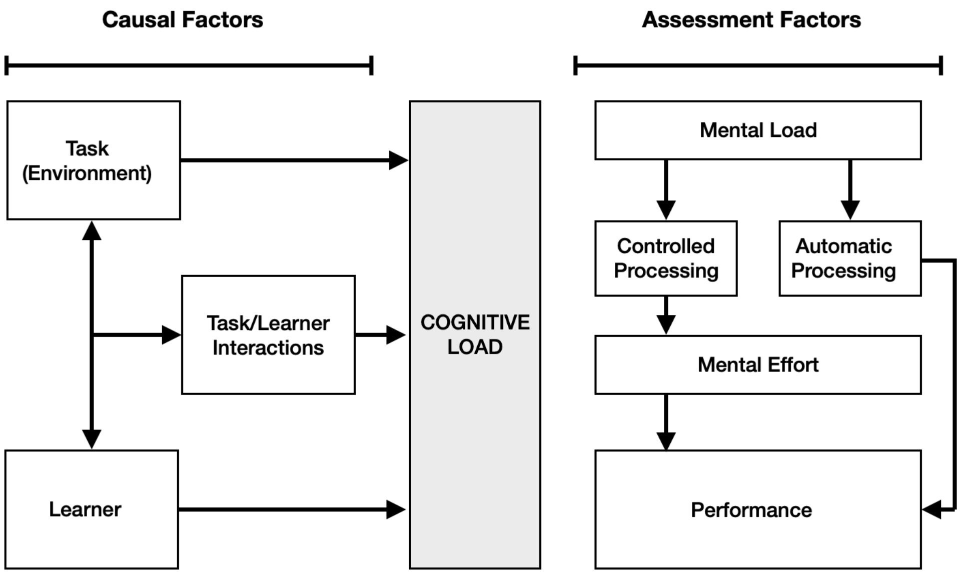
According to Cognitive load theory (CLT), the process of learning is carried out through two distinct memory systems: working memory, also known as short-term (working) memory (WM) and long-term memory (LTM) (Sweller, 1988). WM is a short-term, limited-capacity system wherein mental resource is shared between process and storage (Baddeley and Hitch (1974), whereas LTM is a part of memory that acts as a (semi)- permanent depository for information, skills and knowledge which individuals use to make sense of the environment (Bower, 1975). Thus, every very time an individual has to deal with tasks requiring excessive mental capacity, the WM gives rise to an important trade-off: the cuncurrent cognitive load increases and individuals' performance of WM to process information decreases, resulting in a loss of information from short-term memory, which fail to be processed, organised and eventually retained in LTM (Anderson, Reder, & Lebiere, 1996; Case, Kurland, & Goldberg, 1982; Conway & Engle, 1994; Daneman & Carpenter, 1980; Just & Carpenter, 1992). Therefore, learning acquisition differ by the amount of cognitive load it places in the working memory of individuals, i.e., the amount of mental resource individuals need to carry this task out, meaning that a depleted WM will influence the capacity of individuals for complex reasoning and learning and, therefore, for knowledge retention (Baddeley, 2006).

Particularly, this phenomenon has been found to occur when individuals are exposed to novel information. Literature has shown that working memory is limited to capacity of around 4±1 elements of information (Cowan 2001; Baddeley 1986; Miller 1956) and duration to about 30 s (Cowan 1988). Given these limitations, organisational crises provide the ideal conditions for cognitive load to occur, as they often involve the rapid introduction of environmental stressors as well as novel and complex information on which actors are required to act upon, likely overloading their working memory capacity.

2.4.1. Factors Influencing Cognitive Load Capacity

When engaging in learning, cognitive load is generated by both causal and assessment factors (Paas & van Merriënboer, 1993; Kirschner, 2002) – see Figure 4. On one side, causal factors influence the cognitive load of individuals based on three inputs: the characteristics of the subject (e.g., the intrinsic cognitive abilities), the task (e.g., task complexity), and the environment (e.g., the noise, uncertainty, confusion generated by an event), with the mutual relationships between these factors affects cognitive load proportionally. On the other, assessment factors include mental load (i.e., the portion of the task that is merely influenced by the task and the environmental demand), mental effort (i.e., the amount of attention a subject allocates to the task) and finally, performance, which will be the final reflection of the causal and assessment factors aforementioned.

Figure 4: Factors determining individual cognitive load (Paas & van Merriënboer, 1993)



As vastly found within crisis management literature, crises impact on the causal, and more specifically, on the environmental factors, exposing subjects to anomalous environmental conditions and increasing the complexity of the learning task. This, in turn, has both indirect (via learner) and direct influences on the extent of cognitive load experience by individuals.

Research in academia has recently categorised some environmental stressors that are positively correlated with increased on cognitive load (Phillips-Wren & Ayda, 2020). These are namely, information overload, time pressure, complexity, and uncertainty. In situations where such stressors could not be addressed, such in crisis situations, these factors were found to exacerbate individual cognitive load and eventually decrease learning performance quality.

a. **Information Overload**

Information overload arises when the decision maker receives more information than what he is able to process for effective reasoning. According to Klapp (1986), this overload can have effects similar to noise, causing distraction, stress and errors in judgement or even having paralysing effects in crisis situations, by limiting the functional ability of cognitive load and making it challenging to discern crucial information from irrelevant one, this way subsequentially increasing the execution times of tasks (Vugdelija & Aguirre, 2004). Besides, Glass and Singer (1972) found that unpredictable and uncontrollable noisy conditions were most deleterious to task performance after the cessation of the stressor, causing long-lasting effects on the individual learning performance.

b. Time Pressure

Under time pressures individuals significantly constrain their engagement in cognitive tasks (Ordonez & Benson, 1997), leading to misinterpretation of the data available within the environment explored. According to Galy et al., McLeod, P.L. (1996). New communication technologies for group decision making: Toward and integrative framework. In R. Y. Hirokawa & M. S. Poole (Eds.), *Communication and group decision making*(pp. 426–461). Sage Publications.2012), time pressure triggers emotional response by creating a conflict between the imposed time to complete the task and the one actually required to complete the task, leading to heightened emotional reactions. For instance, McLeod (1996) studied how individuals in situations of time pressure, fail to dedicate adequate mental resources to the task, focusing instead on task-irrelevant information as a natural response to the high cognitive load experienced.

c. Complexity and Task Difficulty

Another dimension is the complexity of the situation and/or task experienced. Events characterised by newness, variability, and interdependence between causing factors are generally difficult to read through and understand (Roux-Dufort, 2007). Increase in complexity is found to be associated with a decrease in performance (Carley & Zhiang, 1997), particularly when coupled with dynamism and constantly changing environments. More specifically, the level of intrinsic cognitive load depends primarily on the number of elements to be processed simultaneously and on their degree of interactivity. Backs and Seljos (1994) illustrated how task difficulty highly impacted cognitive load by executing memory tasks on individuals, resulting in a mean error rate increasing from 1.09% to 5% when subjects were tasked to recall three items instead of one.

d. Uncertainty

Defined as the inadequate level of knowledge of the situation at hand, uncertainty is considered to be a primary contributor to cognitive load due to its detrimental impact on individual's capacity to process data (Simon, 1990; Landsbergen et al., 1997; Nutt, 1990). Uncertainty, indeed, by creating feelings of fear, concern and undecisiveness, it interferes with rational deliberation process in such a way that only the most prominent information will be considered, neglecting other relevant secondary elements (Covey et al., 1994). To manage the high cognitive load generated by uncertainty, individuals will use simplifying heuristics (Mahan et al., 1999) such as for example *cognitive economising* through selective attention (availability bias). Balarezo et al. (2023) argue that by taking the most probable and causally important information, individuals may distort their own judgement of events and bias the data collection, in exchange for a "false sense of complacency".

Hence, based on the premise that the above-mentioned stressors significantly influence the magnitude of cognitive load, we posit that in crisis situations – where these stressors are particularly intense - individuals are more likely to experience diminished learning performance.

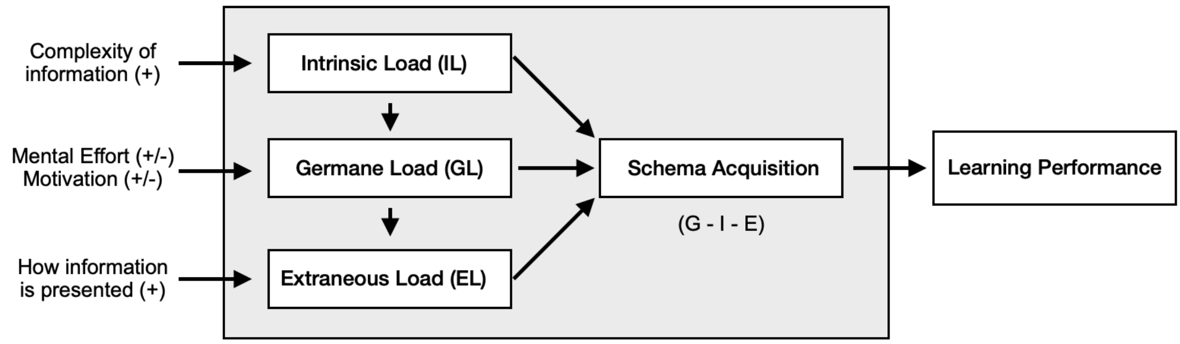
Proposition 1: Crisis situations amplify environmental stressors, resulting in an increase of cognitive load and working memory and negatively affecting individual capacity for learning.

2.4.2. Cognitive Load in Crisis Learning: Beneficial or Detrimental?

In addition to analysing the causes of cognitive overload, CLT has started to concern about the measures that can be taken to manage learners' cognitive load and, therefore, improve their learning performance. Sweller et al. (1988) posits that the limited capacity of the working memory is distributed among three types of cognitive load: intrinsic, extraneous and german cognitive load. *Intrinsic cognitive load* (IL) refers to the cognitive load given by intrinsic complexity of learning materials. *Extraneous cognitive load* (EL) is caused by the cognitive load originating from the instructional design of the learning materials, that is how the information is presented and what the learner is required to do by the instructional procedure (Sweller et al., 2019). Finally, *Germane cognitive load* (GL) is the mental load given by the active mental processes an individual engages into to interpret, classify, differentiate and organise information within mental schemas, which stimulate the learner to elaborate the learning materials at a deeper level. Germane load represents the remaining capacity of the working memory, which is directly related to learning effectiveness (Mayer, 2002). An illustration explaining the effects of the different cognitive load types on learning is provided in Figure 5.

Sweller et al. (1998) conceptualised germane cognitive load when they noticed that some instructional learning formats increased cognitive load whilst simultaneously leading to an improvement in learning performance, suggesting for the first time that cognitive load could have a beneficial effect on the learning process. In fact, the engagement in mental processes and schemas for knowledge retention poses a beneficial cognitive load on individuals, helping them to retain information in their long-term memory (Jordan et al., 2020). In line with this, they proposed that, although intrinsic load (IL) is fixed and intrinsically related to the learning material, learning is best supported, and even promoted, when cognitive processing irrelevant to learning is minimised (extraneous load) and cognitive processing germane to learning is optimised, all while staying the limits of cognitive laod capacity (Van Merriënboer et al. 2006). With this in mind, CLT can explain how an increased cognitive load might potentially result beneficial for the learning task at hand, rather than exclusively lead to a decline in learning performance.

Figure 5: Integrative Model of the Effect of Cognitive Load Components on Learning (adapted from Parte et al., 2018)



Albeit cognitive load theory has not, to the best of our knowledge, been studied specifically in relation to crises, this theoretisation provides excellent insights for understanding and improving the acquisition and retention of knowledge generated by crisis situations. Specifically, the theory suggests that the type of information and learning activity an individual is exposed can determine whether cognitive load has a detrimental or beneficial effect on the learning outcome, with this impact being determined by the level of both extraneous and germane load this information generates in the minds of individuals, which in turn affects their capacity to learn.

Therefore, the following proposition was developed:

Proposition 2: The impact of cognitive load on individual learning is influenced by the type of information presented. When extraneous load is minimised and germane load is optimised, cognitive load can potentially enhance individual learning.

Chapter 3: Research Methodology

The present study investigates whether cognitive load generated during crisis conditions may impact on working memory of individuals and eventually prevent long-term individual learning and if so, whether this load can be optimised. For this purpose, the proposed research will adopt an experimental methodology. This section will therefore provide a detailed discussion of the research hypotheses, design and procedure as well as the statistical methods used in this dissertation for analysing and assessing the results.

3.1. Research Hypothesis

Based on the literature explored in Chapter 2, the research predicts that during crisis participants under high cognitive load would demonstrate an observable decrease in working memory capacity, which in turn would deter individual learning performance. Furthermore, the study further aimed to investigate the direction of this relationship, and whether the type of information individuals is required to learn might have an impact on such. The following regression was therefore formulated, where cognitive load is set =1 when subjects are under cognitive load and =0 when they are not.

$$Learning\ Performance_i = \beta_0 + \beta_1 * cognitive\ load_i + \varepsilon_i$$

Therefore, two main hypotheses were formulated based on the studied literature:

H1: Individuals demonstrate a decreased tendency to learning when they operate under limited cognitive resources as compared to when they operate at full cognitive capacity.

H2: The cognitive load experienced by individuals (and the subsequential learning) can be optimised through the type of information presented.

Therefore, by providing a link of how cognitive load will affect memory and learning in simulated crisis conditions, this research aims to resolve the ambiguity of whether and how learning can actually occur under stressful situations. Toward this end, the research will experimentally manipulate the presence of cognitive load in participants as explained in the below sections.

3.2. Research Design

Considering the hypotheses tested, a deductive research philosophy was considered the most suitable for the research. Unlike inductive approach, which uses the collected data for formulation of new theories, deductive reasoning uses the existing theory to prove the hypothesis (Glaser and Strauss, 1967). Since the research builds up on organisational learning (Crossan et al., 1999; see also Crossan et al., 2011) and cognitive theory (Baddeley, 2006), this approach well complements the purpose of the study.

Furthermore, the proposed investigation decided to employ an experimental research design with a randomisation-based approach. The main goal of the proposed design aims indeed to assess a causal correlation between the independent and the dependent variable (Kirk, 2009), being in this case cognitive load and individual learning. For this sake, a between-subjects approach was adopted and each individual was exposed only to one of the two experimental conditions, contrarily to an within-subjects design where participants are exposed to more than one treatment (Pany & Reckers, 1987). Following standard practices in behavioural and cognitive research, the research strategy was carried out through controlled experiments. Particularly, given the difficulty of conducting observational studies through real-time crises, experiments result more practical in this context as they allow the researcher to measure the experimental effects, such as individuals' change in behaviour or cognitive performance (Posner, 1993).

3.3. Method

3.2.1. Participants

The participants involved were 60 individuals (39 females, 20 males, 1 unspecified). The sample size was calculated following Green's (1991) rule of thumb for the minimum number of observations in regression analysis of N = 50 + 8*p*, where *p* is the number of predictors. Subjects were recruited through *Prolific*, a web-based recruiting platform specifically designed for conducting academic experiments and received a completion fee for undergoing the experiment, which lasted approximately from 7 to 8 minutes.

The median age[5] was between 35 and 44 years old and approximately 88% of participants were native English speakers, while the remaining 12% identified as bilingual (2 subjects) or native speakers in another language (1 Turkish, 2 Russian, 1 German, 1 Polish).

[5] The estimation was based on the assumption of uniformity within age categories in a finite interval, therefore the median age corresponds to the age of the "middle person".

Given the majority of participants were of English mother tongue and/or bilingual, we reasonably assume a high comprehension of the text in question and be fairly confident that language barriers did not affect the ability of participants to understand and retain the information presented in the text.

Figure 6: Summary Statistics of Sample Population

Statistic	N	Mean	St. Dev.	Min	Median	Max
Gender	60	1.383	0.585	1	1	4
Age	60	4.317	1.359	2	4	7
Employment Status	60	2.433	1.651	1	2	7
Educational Level	60	3.000	1.042	1	3	6
Learning Disabilities	60	2.000	0.000	2	2	2

3.2.2. Cognitive Load Manipulation

Cognitive load manipulation was implemented to allow exerting control on the working memory load utilised by participants while completing the instructed tasks, being such highly correlated with cognitive ability (Colom et al., 2006; Gray et al., 2003). Previous studies have indeed shown that the use of a sequence memorisation increases task difficulty, causing to split-attention effects and leading individuals to think more automatically (Gilbert, 1991; Kahneman, 2011). Therefore, in line with cognitive experiments[6], the research replicated Conway and Gawronski (2013)'s study, where subjects in the treatment group were asked to memorise a password-like sequence of 7 digits (e.g., MS86#1), as a secondary task, which was shown at the beginning of the page. Subjects were asked to keep the sequence in memory and recall the information until the learning task was proposed to them.

3.2.3. Procedure & Materials

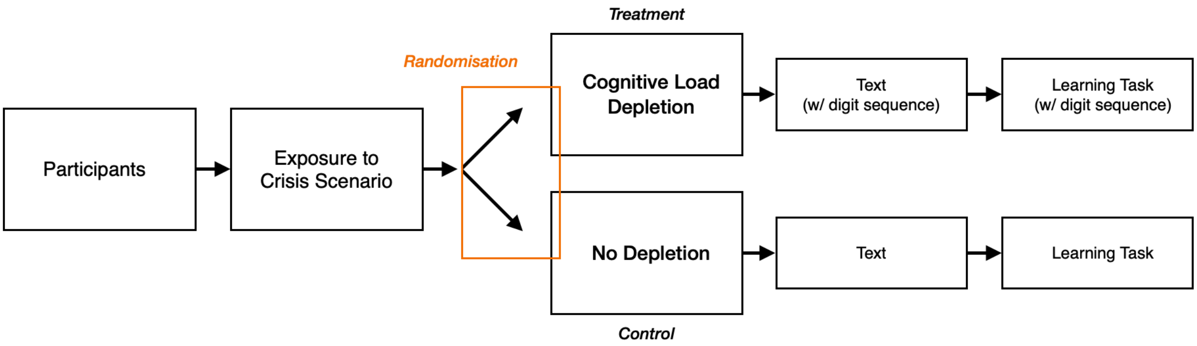
Participants were equally assigned to the treatment and control groups. Subjects in the treatment group underwent cognitive load manipulation while those in the control group performed the same task without being subjected to manipulation. Figure 7 provides a sketch of the experimental setup.

The experimental procedure was set up in three stages. In the first stage, participants were exposed to a crisis simulation, in which they had to impersonate. In the second stage, they were asked to perform a primary task, which involved reading and memorising a product recall procedure. Participants in the treatment group simultaneously engaged in the secondary task

[6] Benjamin et al. (2013) noted that, asking participants to memorise strings of digits and/or numbers while involving them in other cognitive activities, is a widely used cognitive load manipulation method in the psychology literature.

(that is, the digit-sequence memorisation) aimed at increasing their cognitive load during the experiment. Finally, the third stage consisted of some specific questions elaborated from the text, where participants' learning acquisition was assessed.

Figure 7: Illustration of Experimental Procedure



Before launching the experimental procedure, a pre-testing pilot study was conducted to minimise the likelihood of respondents experiencing issues in responding questions and to check the validity and reliability of the data collected (Saunders et al., 2007). The collected insights were useful to better tailor the experiment to the requirements of the study.

3.2.2.1. Exposure to Crisis Scenario

In order to obtain valid experimental results, the simulation reproduced crisis conditions as close as possible to ensure participants perceived the exposed scenario as a genuine threat, evoking in them similar feelings and reactions as the ones experienced during crises (e.g., tension, anxiety, time pressure, inadequate information availability, frustration, etc.) (Borodzicz & Van Haperen, 2002). In order to do so, the research followed Gleder's study (1992) four essential components to build an effective crisis simulation: opening scene (crisis priming), assigned role(s), stimuli to which subjects must respond, and reactions to participants' actions[7]. For the activation of the crisis mental state in individuals, the following crisis scenario was proposed to participants – see Figure 8.

[7] Since this study investigates real-time crisis learning ability while the one of Gleder (1992) aims to build crisis simulation exercise for enhanced feedback on future crisis management, the latter element "reaction to participants' actions" was excluded as not applicable to the current research.

Figure 8: Excerpt of Crisis Scenario for Individual Priming

> Imagine you are working for Firm B, a company known for selling alimentary products.
>
> Recently, one of its sub-brands has launched a new version of its best-selling product, instant noodles. However, after investigation, regulatory authorities have declared the product as containing excessive levels of lead and the presence of monosodium glutamate (MSG), two highly poisonous elements that might lead to severe health problems, such as kidney diseases, seizures, and even to death in excessive doses.
>
> The company was therefore obliged to recall and temporarily ban the product. As the media spread the news, panic started raising among consumers which eventually boycotted Firm B and organized protests in several cities. Consequently, the stock price fell considerably reflecting investor concerns about the potential damage to Firm B's reputation and financial outlook.
>
> During the entire process, Firm B did not make public appearances and denied all the accusations received, facing significant decreases in sales and market share. This event further led to expanded investigations to the other product categories as a consequence.

3.2.2.2. Exposure to Academic Text

As a call to action to the crisis response (Figure 9**)**, subjects were subsequently asked to read and memorise a product recall procedure to eventually test their learning retention. An expository text of 427 words summarising the standard FDA procedure in case of product defection was chosen and adjusted in order that all participants would be able to comprehend the text easily, without prior experience. The full procedure is provided in Appendix B.

Based on Miller (1956)'s notable paper "the magical number of seven plus or minus two", which showed that adults can recall a list of maximum seven randomly order elements or chunks of words, the text included seven steps with the relative explanation. Other researchers have found the average number of recalled items to be lower, between 3 and 5 items in adults (Cowan, 2001; Halford et al., 2007). For this reason, the research may expect below optimal scoring. However, the recall limit is important as it gives an average indication in terms of working memory capacity of individuals.

To transpose the crisis and the stressors that subjects are generally exposed to, environmental factors were included to add further complexity to the scene as highlighted in Chapter 2. Text readability was purposedly not optimised to simulate informational overload, with Flesch Kincaid's Reading Score indeed indicating a score of 41 – which is associated to the text being relatively difficult to read. Besides, response times were set to create a sense of time urgency. Although until nowadays response times have not been collected and analysed in cognitive tasks (see Benjamin et al., 2013; Deck and Jahedi, 2015), in this context they prove of particular importance as an additional factor that stimulates the crisis scenario and depletes participants' cognitive load. Subjects had a maximum time of 2 minutes, with a count-down timer, to execute both the reading and memorisation task. Similarly, minimum times of 30 seconds were set to ensure participants thoroughly engaged with the text in question.

Figure 9: Stimuli to Promote Crisis Response

> Your company, firm B, did not have a contingency plan to follow in case of product recall, being it relatively new on the market. Therefore, during the crisis, your firm distributed the FDA recall curriculum, a document provided by the institution to follow in case of food hazards.

3.2.2.3. Learning Assessment

Following the text, participants were instructed to answer to a set of questions aimed at measuring the information retained after exposure to the text – see Appendix C for an overview of the learning assessment. The test focused on factual knowledge and required participants to recall the procedure and/or information illustrated in the text.

Three types of comprehension and learning questions were presented to subjects: one with high extraneous load (that is, with a more difficult instructional design), one with low extraneous load and thirdly, one with low extraneous load but requiring participants to stimulate high germane load by making their own inferences about the information given. The inclusion of questions posing different type of information and learning activities, indeed, was thought to potentially give an insight of whether the level cognitive load had a different effect on learning. For instance, the question exhibiting high extraneous load is: "Could you please rank in order the steps of the FDA procedure?". Such question, for example, exhibited a more difficult instructional design while, contrarily, the remaining two were, respectively, aimed at diminishing that load with the latter one focusing, instead, on promoting the development of mental processes by asking individuals to recall implicit information within the text. In addition, the treatment group, who underwent cognitive manipulation, was asked during this phase to recall the 7-digit sequence previously shown.

3.4. Statistical Tools

First, the collected data was exported from *Prolific* and converted into Excel format. Using R Studio, the dataset was cleaned from noise and reorganised properly to ensure data quality. Although some significant outliers were found within the dataset, they were not removed from the sample as it can be assumed they will not influence reliability of data given the adequate sample size.

The study employed the use of different statistical tools to compare the learning performance between the two conditions. After executing data manipulations and normality checks, descriptive statistics were employed to generate valuable insights into the relative importance of each predictor variables, such as demographics and execution times, on the dependent variable. Subsequently, different statistical means were employed to investigate a possible learning difference between the two conditions: first, a one-way ANOVA was run to analyse question one and test whether, when exposed to high extraneous load, the procedure ranking was significantly different between the two groups; subsequently, LOGIT regressions were used for question two and three, aimed to test low extraneous load and high germane load, because of the discrete nature of the variables. The mentioned tools are briefly discussed below.

3.4.1. One-way ANOVA

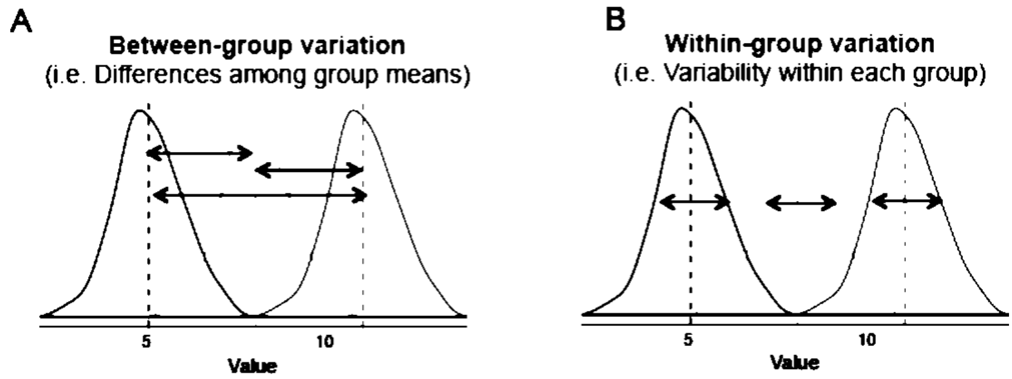
To evaluate the main effect of the conceptual model proposed, the research employed a one-way analysis of variance (ANOVA) as statistical procedure. One-way ANOVA is particularly used in behavioural experiments to test significant differences between the mean scores of two populations. By stating the null hypothesis (H_0) that the population means are equal, the ANOVA tests the following hypotheses using an F statistic:

$H_0: \mu_1 = \mu_2 = \mu_3 = \ldots = \mu_i$ The means of the population are equal

$H_0: \mu_1 \neq \mu_2 \neq \mu_3 \neq \ldots \neq \mu_i$ The means of the population are not equal

In this research, the ANOVA analysis was employed to assess whether there existed any variation in the mean scores between subjects experiencing cognitive load manipulation and those not experiencing cognitive load manipulation. Given the focus on understanding the variation between the average performance of the two conditions, the research adopted a between-subjects approach – see Figure 10. A significance level of $p \leq 0.1$ was used.

Figure 10: Illustration of Between-group and Within-group Differences



3.4.3. Regression Models

The research employed both linear and logistic regression models. On one side, linear regression was utilised to investigate the effects of the predictor variables (such as demographics and execution times) on the learning outcome. On the other, in order to fit the binary outcome of question two and three and calculate the difference in learning outcome between the conditions – where ANOVA was not suitable–, a binary model was implemented using one quantitative explanatory variable, as follows:

$$logit(p) = \beta_0 + \beta_1 x \,,$$

where p is the expected probability of correct response when the value of the explanatory variable is x, which represents the group condition (0 = no cognitive load, 1 = cognitive load).

3.5. Conclusion

In summary, this chapter documented the research methodology designed to answer the research question of a) whether cognitive load impacts individual learning in crisis situations and b) whether it can be optimised for learning. Using a deductive philosophy and an experimental research design conducted via Prolific, the study recreated crisis conditions while exposing participants to a learning task in order to compare their learning outcome with and without being exposed to cognitive load. Statistical analysis to evaluate their performance included descriptive statistics, ANOVA and regressions models; these were instrumental, respectively, in providing insights on the sample population, comparing the mean learning scores between the two conditions and assessing the probability of correctly answering questions. Thus, this chapter has set the methodological foundations for answering the research question, whose results will be analysed and discussed in the following chapters.

Chapter 4: Data Analysis & Results

In this chapter, the main results of the thesis will be presented following the outlined research methodology. First, the results of descriptive analysis of the population sample will be presented in the form of tables to provide insights on the possible learning differences between the two conditions. Secondly, the analysis of ANOVA and the main regressions conducted will be presented to assess the impact of cognitive load on both execution times and learning outcomes of participants, this by further considering the effect of predictors variables. Such results will be accompanied by a selection of figures and tables to best illustrate the relevance of findings.

4.2. Results Overview

4.2.1. Data Analysis

Before testing the hypothesis, initial data checks were performed to ensure the assumptions of linear regressions were met. First, a multicollinearity check was performed on the obtained dataset. This served to identify possible variables causing interferences with the individual effects of each predictor and further inflating the standard errors of the coefficients. The analysis accentuated a significant negative correlation between employment status and educational level ($r = -0.385^{**}$, $p < 0.05$), suggesting that in the presented dataset higher level of education was associated with lower employment status, or vice versa – see Table 2.

Table 2: Correlation Matrix and Reliability Scores

	Gender	*Age*	*Employment Status*	*Educational Level*	*Mother Tongue*
Gender		0.101 *(.445)*	0.001 *(.996)*	0.083 *(.526)*	-0.095 *(.472)*
Age	0.101 *(.445)*		0.036 *(.785)*	-0.036 *(.785)*	-0.192 *(.141)*
Employment Status	0.001 *(.996)*	0.036 *(.785)*		-0.385 *(.002)*	0.072 *(.586)*
Educational Level	0.083 *(.526)*	-0.036 *(.785)*	-0.385 *(.002)*		0.000 *(1.00)*
Mother Tongue	-0.095 *(.472)*	-0.192 *(.141)*	0.072 *(.586)*	0.000 *(1.00)*	

Computed correlation used pearson-method with listwise-deletion.

Such effect may be originating from the chosen platform, Prolific, known mainly by academic researchers, which requires participants to be active on daily basis. Consequently, this effect may be attributed to the platform's user base, which includes researchers who do not have a full-time occupation – indeed, an average of around 48% of our sample was working less than a full-time (40 hours a week) – see Appendix D for the frequency table of sample demographics. For the above reason, employment status was excluded from the regression after being identified as the least impactful variable in the model. The homoskedasticity criteria was also met. Normality tests run on demographic data showed some not entirely normal distributions, however neither ANOVA nor linear and logit regression assume normality for either predictors (IV) or outcome (DV). Therefore, because all the other assumptions were met and the sample was sufficient in terms of size, the analysis was carried out accordingly.

4.2.2. Descriptive Statistics

After ensuring the balancing of the sample (see Table 3 and 4), the two conditions were compared by using descriptive statistics. This was done to evaluate any potential differences in terms of execution times between the experimental group and the control group.

Table 3: Summary Statistics of Sample Demographics (Control Group)

Statistic	N	Mean	St. Dev.	Min	Median	Max
Age	31	4.226	1.334	2	4	7
Gender	31	1.226	0.425	1	1	2
Educational Level	31	2.839	1.098	1	3	6
Mother Tongue	31	1.129	0.428	1	1	3
Learning Disabilities	31	2.000	0.000	2	2	2

Table 4: Summary Statistics of Sample Demographics (Experimental Group)

Statistic	N	Mean	St. Dev.	Min	Median	Max
Age	29	4.414	1.402	2	5	7
Gender	29	1.552	0.686	1	1	4
Educational Level	29	3.172	0.966	2	3	6
Mother Tongue	29	1.172	0.468	1	1	3
Learning Disabilities	29	2.000	0.000	2	2	2

As predicted, the results underscored a noticeable difference in the time taken to complete the learning task as a consequence of the cognitive load imposed - see Table 5 and 6. The mean duration of the experiment was significantly longer for the experimental group (*mean* = 446.414, SD = 123.919) compared to the control group (*mean* = 400.581, SD = 134.454), suggesting that the imposed cognitive load may have slowed down the ability to controlling attention and efficiently processing information. Similarly, in order to read the crisis scenario, the experimental group took 11 seconds longer (*mean* = 131.288, SD = 72.057) than the control group (*mean* = 120.346, SD = 64.464). However, it also exhibited a shorter timing for reading the call to action: in fact, the experimental group took, on average, a time of 13.902 (SD = 7.004) whereas the control group of 17.742 seconds (SD = 21.182), indicating that, overall, the cognitive load condition had a quicker reaction time, which may have been a consequential reaction generated by a better activation of mental capabilities.

Table 5: Summary Statistics of Sample Timing (Control Group)

Statistic	N	Mean	St. Dev.	Min	Median	Max
Duration (in seconds)	29	446.414	123.919	247	454	704
Crisis Scenario_Timing	29	131.288	72.057	25.044	120.756	339.500
Call to Action_Timing	29	13.902	7.004	0.822	13.094	31.491
Instructions_Timing	29	8.518	3.983	0.865	7.313	18.308
FDA Procedure_Timing	29	115.471	11.007	81.644	120.024	120.144
Learning Test_Timing	29	113.846	53.712	37.077	107.656	263.055

Table 6: Summary Statistics of Sample Timing (Experimental Group)

Statistic	N	Mean	St. Dev.	Min	Median	Max
Duration (in seconds)	31	400.581	134.454	202	388	772
Crisis Scenario_Timing	31	120.346	64.464	34.054	116.284	337.326
Call to Action_Timing	31	17.742	21.182	5.995	11.941	125.260
Instructions_Timing	31	8.616	4.627	2.271	7.853	28.557
FDA Procedure_Timing	31	101.975	26.221	46.135	120.014	120.152
Learning Test_Timing	31	81.766	39.253	32.194	70.393	176.896

As regards the learning of the FDA procedure, the experimental group and the control group showed similar timing even though this phase was more mentally demanding for the experimental group, which was also tasked to memorise the digit-sequence. The FDA learning phase took on average only 15 seconds longer for the cognitive load condition compared to the control one. Moreover, the control group experienced a higher standard deviation (SD = 26.221) compared to the experimental group (SD = 11.007), highlighting considerably lower variation from the mean. Lastly, an expected result concerned the learning test timing, which took on average around 32 seconds longer for the experimental group and had a greater standard deviation (*mean* = 113.846, SD = 53.712) compared to the control group (*mean* = 81.766, SD = 39.253). In particular, cognitive load appears to have affected the difference between the minimum and maximum time of the experimental group (*min* = 37.077, *max* = 263.055) compared to the experimental group (*min* = 32.194, *max* = 176.896), also known as the individual's differences in working memory capacity. Indeed, if without imposing cognitive load, the difference between the minimum and maximum time was 144.702, then the cognitive load was found responsible for an increase up to 81.276 seconds in the learning test ($Time_{max} – Time_{min =}$ to 225.978).

These findings demonstrate that, while the amount of cognitive load imposed on individuals increases the time needed to complete a task, it may also appear to have an impact on promoting individuals' attention and reactiveness to the issue encountered. Such hypothesis will be explored more in-depth in the below section.

4.2.3. Testing Differences in Execution Times

Following such finding, the analysis tested whether execution times changed accordingly to the cognitive load exposure, i.e., if increased cognitive load deteriorated learning performance by affecting the speed at which individuals completed the task. After visualising the two conditions using boxplots, the one-way ANOVA indicated that the cognitive load significantly affected two main dependent variables related to execution times, i.e., *FDA_scenario_times* and *learning_response_times* (Figure 11 a & b). As seen in Table 7 & 8, the experienced cognitive load both influenced the time taken to learn the text, with an increase of about 13.46 seconds, and the time taken to eventually execute the learning task, with an increase of 32 seconds at a significance level of $p < 0.05$. In particular, as it can be observed from Figure 11a**,** almost all the participants under the cognitive load condition exceeded the maximum time given to memorise the FDA procedure, suggesting that the time differences might have been even greater in that regard. These results are consistent with the expectations that cognitive load affects the memorisation, execution as well as reasoning speed of individuals as highlighted in the previous section.

The other variables tested (such as *total_duration, crisis_scenario_timing, call_to_action_timing* and *instructions_timing*) did not show significant mean variance between groups, contrarily to what previously highlighted by the descriptive statistics. Hence, the research cannot conclude a statistically significant difference in the mental activation of individuals caused by the imposed cognitive load. However, particularly worthy of note are the results given by the *total_duration*, which although showed longer execution timing of about 45 seconds, did not substantiate a statistical difference in the overall time taken to complete the entire sequence of tasks. This confirms indeed that cognitive load influenced exclusively the phases highly reliant on cognitive resources and does not impact uniformly all the aspects of the learning task execution.

Figure 11 (a & b): Boxplots of Learning Response Times and FDA Scenario Times

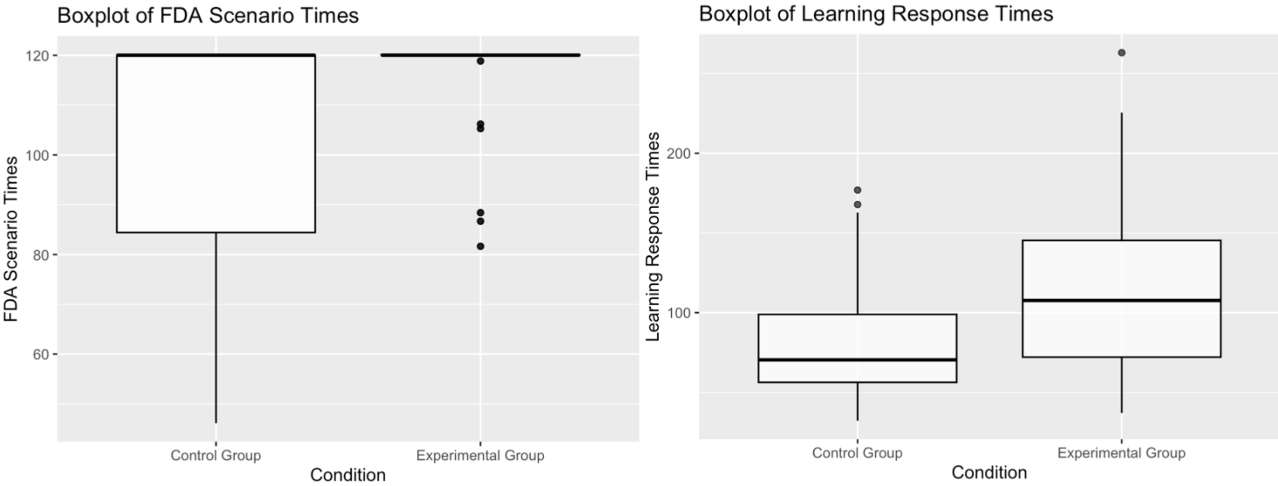


Table 7: Linear Regression Model for FDA Scenario Times (Reading & Memorising)

	Dependent variable:
	FDA_scenario_times
group_typeExperimental Group	13.496**
	(5.257)
Constant	101.975***
	(3.655)
Observations	60
R^2	0.102
Adjusted R^2	0.087
Residual Std. Error	20.350 (df = 58)
F Statistic	6.590** (df = 1; 58)
Note:	*p<0.1; **p<0.05; ***p<0.01

Table 8: Linear Regression Model for Learning Response Times (Executing Task)

	Dependent variable:
	learning_response_times
group_typeExperimental Group	32.080**
	(12.089)
Constant	81.766***
	(8.404)
Observations	60
R^2	0.108
Adjusted R^2	0.093
Residual Std. Error	46.794 (df = 58)
F Statistic	7.042** (df = 1; 58)
Note:	*p<0.1; **p<0.05; ***p<0.01

The following result is therefore formulated:

Result 1: Increased cognitive load significantly extends both the time required by individuals for reading and memorising information as well as the time to complete the learning task.

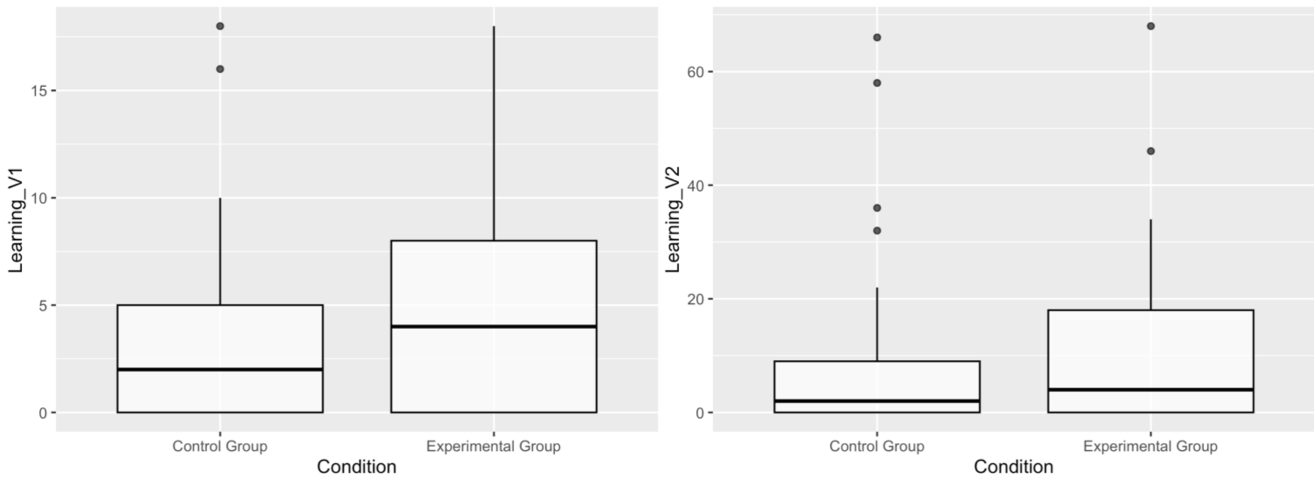
4.2.4. Testing Differences in Learning Retainment

Following these findings, the research delved into answering its main interrogative: does cognitive load have a statistically significant impact on the learning outcomes of individuals and to what extent? And are there particular types of information exposure capable to promote or hinder the effects of cognitive load on learning? As mentioned previously, in order to test whether and how information was better retained, learning was evaluated for three different types of information and employed two different statistical techniques, namely simple linear regression and logit regression models, in order to fit the obtained data.

4.2.4.1. High Extraneous Load: ANOVA Analysis

When testing the means of the groups' performance on high extraneous load information, two different methods of calculations were employed to investigate the effect on the dependent variable, being learning tested with a procedure ranking. The first method calculated the absolute value of the sum of differences between the right (r_i) and answered (a_i) items, i.e., Sum_{for all i} (r_i - a_i), whereas the second method involved the squared sum of differences obtained in precedence, i.e., Square root (Sum_{for all i} (r_i - a_i)^2). Hence, the lower the score, the lower the difference between what was correct and was answered by the individual and, in turn, the higher the number of correct answers. This data manipulation served to amplify the effect and the predicted power of the model. An initial data visualisation was conducted through a boxplot chart (Figure 12 a & b).

Figure 12 (a & b): Boxplots of Learning Scores on High Extraneous Load of V1 and V2



The boxplots highlight that cognitive load introduces greater variability in individual learning performance when the extraneous load is high, confirming that individuals are affected by cognitive load to a different extent depending on their individual differences but also that, overall, they tend to have a poorer learning performance compared to individuals who are not exposed to cognitive load. In fact, the higher median of the experimental group (in both V1 and V2) showed that when facing high extraneous load information, subjects may experience cognitive overload, hindering the learning performance of individuals and having a negative impact on their learning.

To confirm a possible statistical significance in the differences observed, a one-way ANOVA was employed. In both cases, the results showed no statistical significance with p-values of accordingly 0.527 and 0.704 – see Table 9 (a & b).

Table 9 (a & b): ANOVA Analysis for Testing High Extraneous Load of V1 and V2

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Group type	1	9.8	9.825	0.406	0.527
Residuals	58	1405.1	24.226		

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Group type	1	40	40.17	0.146	0.704
Residuals	58	15951	275.01		

Although a negative relationship was highlighted in accordance with the literature, the analysed data in this research did not have sufficient information to conclude that when individuals are subjected to high extraneous cognitive load, their learning ability is impacted negatively. Hence, the following result is formulated:

Result 2: While the data suggests, in accordance with literature, that high extraneous cognitive load may negatively affect learning performance, this impact is not statistically significant. Therefore, this research did not have sufficient evidence to conclude that cognitive load with high extraneous source substantially impairs the ability of individuals to learn and retain information.

4.2.4.2. Low Extraneous Information: PROBIT Regression

Subsequently, the research proceeded to test low extraneous information by simplifying the question instructional format and asking individuals to recall information that was explicitly stated within the text. The analysis of individual learning conducted through logistic regression did not reveal a statistically significant difference between the two groups, highlighting a p-value higher than 0.05 (p-value = 0.216). – see Table 10. The experimental group performed generally better at the memorisation task, achieving a lower number of incorrect answers. In fact, only one individual in the experimental group answered incorrectly (Figure 13), whereas in the control group four subjects did not catch and/or memorise the information provided in-text. While consistent with the hypothesis tested (H_1) that cognitive load influences individual learning, the direction of the effect was unexpected as the cognitive load condition despite being constrained succeeded better at retaining the information given. Thus, this result provides further evidence for H_2, i.e., that diminishing the extraneous load, by modifying the way the learning activity is presented to individuals, can impose a different cognitive load on them.

Figure 13: Distribution of Learning Outcomes by Condition – Low Extraneous Load

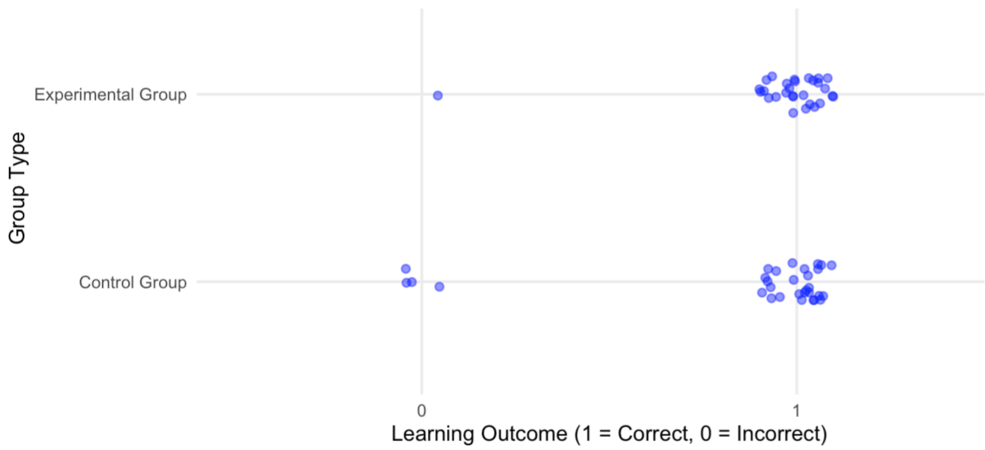


Table 10: LOGIT Regression Results for Testing Low Extraneous Information

Coefficients

	Estimate	Std. Error	z value	Pr(>|z|)
(Intercept)	1.9095	0.5358	3.564	0.000365 ***
group_typeExperimental Group	1.4227	1.1501	1.237	0.216094

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Despite no statistical relevance was found, this outcome may suggest in line with literature that when extraneous cognitive load is minimised, the overall cognitive load imposed on individuals may decrease and thus, not necessarily hinder the ability to learn and acquire information. Contrarily, it may improve learning by leaving more space for information processing, avoid in this way cognitive overload. Therefore, such findings enable the research to draw the following conclusion:

Result 3: While the data suggest, in accordance with literature, that low extraneous cognitive load may positively affect learning performance, this impact is not statistically significant.

Therefore, the research did not have enough evidence to conclude that cognitive load with low extraneous source substantially enhance the ability of individuals to learn and retain information.

4.2.4.3. Low Extraneous Information with High Germane Load: PROBIT Regression

Finally, using the same logistic regression model, the research further tested low extraneous information while simultaneously stimulating an increase in germane load through recall of implicit information - i.e., knowledge implicitly stated in the test and unconsciously acquired and stored by individuals without deliberate intention or awareness-, to assess whether any differences occur in comparison to the other two scenarios previously tested. The logistic regression highlighted an almost statistically significant result with p-value of 0.0551, indicating that the predictor variable (cognitive load) was positively affecting the response variable of the model when individuals were exposed to implicit information – see Table 11.

Figure 14: Distribution of Learning Outcomes by Condition – Low Extraneous and High Germane Load

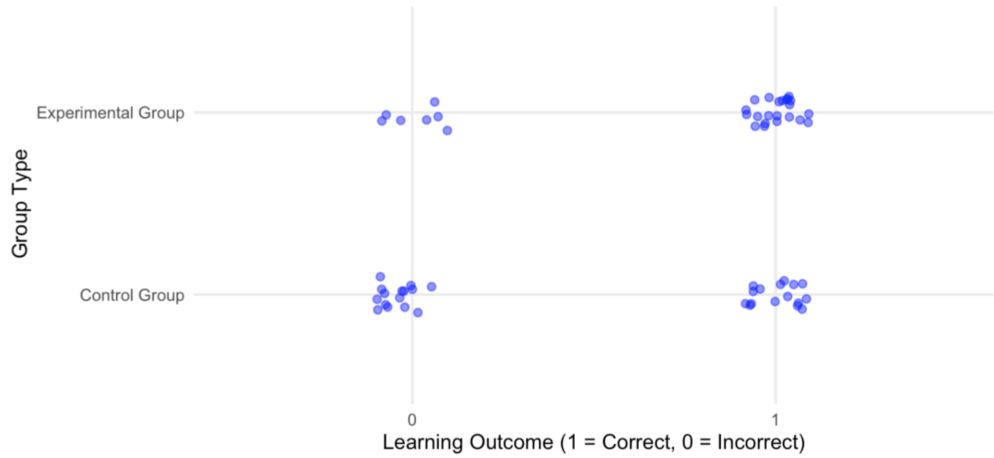


Table 11: LOGIT Regression Results for Testing Low Extraneous and High Germane Load

Coefficients

	Estimate	Std. Error	z value	Pr(>|z|)
(Intercept)	0.06454	0.35940	0.180	0.8575
group_typeExperimental Group	1.08059	0.56345	1.918	0.0551 .

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Specifically, the logistic regression outlined a positive statistical difference between the learning results of the experimental group and those of the control group at p-value < 0.1– see

Table 12. Hence, this result shows that individuals subjected to cognitive load displayed a significantly better performance when their germane load was stimulated.

Table 12: LOGIT Regression Model for Testing Low Extraneous and High Germane Load

	Dependent variable:
	learning_Q3
group_typeExperimental Group	1.081*
	(0.563)
Constant	0.065
	(0.359)
Observations	60
Log Likelihood	−37.499
Akaike Inf. Crit.	78.997
Note:	*p<0.1; **p<0.05; ***p<0.01

Given the Pearson coefficients were not suitable for interpretation in LOGIT models due the discrete nature of the response variable, an average partial effects method (APE) was conducted to determine the probability of one respondent to answer correctly (=1) or incorrectly (=0) – see Table 13. In contrast to low extraneous exposure, where the difference of learning performance between the two groups was not statistically significant, presenting a learning activity with low extraneous and high germane load revealed relevant results. The results highlight a 24.2% probability of the experimental group of answering correctly compared to the control group at a statistical significance of p-value < 0.05 and with a test statistic of 2.022841, which allows to confidently reject the null hypothesis of no significant difference between groups.

Table 13: Average Partial Effects on Logistic Regression

term	atmean	estimate	std.error	statistic	p.value
group_typeExperimental Group	FALSE	0.2424917	0.1198768	2.022841	0.0430895

The findings provided in the Table 13 support the hypothesis that cognitive load not only affects learning performance positively when the information to be recalled stimulate individuals' mental processes, but it does so in a way that increases the likelihood of participants of providing correct answers. This supposedly suggests, indeed, that it is the type of information itself, and whether it activates individuals' mental processes, that influence how cognitive load impacts individual learning. In fact, compared to the first two questions which tested different amounts of extraneous load on participants, what proved to be crucial in determining the impact of cognitive load on learning was the extent to which this imposed germane load on individuals and thus, activated individuals' mental processes useful for learning. Therefore, the findings indicate that cognitive load may improve learning performance in tasks where mental processes are required by fostering a more engaged approach, as further suggested by what found in the initial results. Therefore, the following result is formulated:

Result 4: The data suggest, in accordance with literature, that minimising extraneous cognitive load and maximising germane cognitive load has a statistically significant and positive impact on learning. Therefore, in this case, cognitive load may enhance the ability of individual to learn and retain information.

4.2.4.4. Moderation Analysis of Covariates on Learning Performance

Finally, after testing the effects of cognitive load onto learning from different types of information exposure, covariates moderation analysis was executed to explore whether cognitive load might impact learning *conditional* on certain demographics characteristics of the population (i.e., age, gender, education, employment, mother tongue) - consider Table 14, 15 & 16. The analysis was carried out distinctively, always keeping into consideration the type of information exposure to investigate any differences among different levels of cognitive load.

Table 14: Linear Regression Model Including Covariates Interaction – High Extraneous Load

	Dependent variable:
	learning_v1
group_typeExperimental Group	−16.923**
	(7.385)
age	−1.301**
	(0.641)
gender	−2.182
	(2.012)
educational_level	−0.212
	(0.756)
mothertongue	−2.332
	(1.989)
group_typeExperimental Group:age	0.681
	(0.900)
group_typeExperimental Group:gender	4.821**
	(2.374)
group_typeExperimental Group:educational_level	0.168
	(1.172)
group_typeExperimental Group:mothertongue	6.687**
	(2.742)
Constant	15.147***
	(4.979)
Observations	60
R^2	0.270
Adjusted R^2	0.138
Residual Std. Error	4.545 (df = 50)
F Statistic	2.054* (df = 9; 50)
Note:	*p<0.1; **p<0.05; ***p<0.01

Table 15 & 16: Linear Regression Model Including Covariates Interaction – Low Extraneous Load and Low Extraneous Load with High Germane Load

	Dependent variable:
	learning_Q2
group_typeExperimental Group	−0.710
	(0.441)
age	−0.014
	(0.038)
gender	−0.214*
	(0.120)
educational_level	−0.101**
	(0.045)
mothertongue	−0.137
	(0.119)
group_typeExperimental Group:age	0.041
	(0.054)
group_typeExperimental Group:gender	0.184
	(0.142)
group_typeExperimental Group:educational_level	0.075
	(0.070)
group_typeExperimental Group:mothertongue	0.180
	(0.164)
Constant	1.635***
	(0.297)
Observations	60
Log Likelihood	−2.416
Akaike Inf. Crit.	24.832
Note:	*p<0.1; **p<0.05; ***p<0.01

	Dependent variable:
	learning_Q3
group_typeExperimental Group	−0.743
	(0.793)
age	0.005
	(0.069)
gender	−0.153
	(0.216)
educational_level	0.070
	(0.081)
mothertongue	−0.212
	(0.213)
group_typeExperimental Group:age	0.063
	(0.097)
group_typeExperimental Group:gender	0.133
	(0.255)
group_typeExperimental Group:educational_level	0.064
	(0.126)
group_typeExperimental Group:mothertongue	0.285
	(0.294)
Constant	0.723
	(0.534)
Observations	60
Log Likelihood	−37.617
Akaike Inf. Crit.	95.233
Note:	*p<0.1; **p<0.05; ***p<0.01

As evinced from the linear and logit regressions, significant effects were found for the variables *gender* and *mothertongue* on high extraneous load (Table 14). However, no significant effects were found in the interactions for low extraneous load and low extraneous load with high germane load (Table 15 & 16). This finding may be explained by the fact that the first question exhibited a higher level of negative load (extraneous), while the others two questions aimed at minimising such effect. Therefore, the reduction of cognitive load level has possibly also minimised the impact of the covariates conditionally affecting the treatment condition.

When analysing the covariates interaction on cognitive load for the extraneous load question, both predictors *gender* and *mothertongue* highlighted a positive relationship with the learning dependent variable, both at a significance level of $p < 0.05$. The interaction effect between cognitive load condition and gender suggests that gender "male" performed better under cognitive load compared to gender "women", by 4.821 units higher. This means that although males performed higher in terms of learning, in the experimental condition they still exhibited a lower learning performance compared to the control group by 12.102 (in fact, the effect for males is -16.923 + 4.821 = 12.012) at a significant level of $p < 0.05$. Although the literature did not investigate possible demographics effects on cognitive load, some studies argued gender effects related to cognitive load, claiming how males have better capacity to react under cognitive load while females show more difficulty in facing stressful situations (Hwang et al., 2013).

Another conditional effect of covariates of cognitive load on learning was found for the variable *mother_tongue,* where the interaction highlighted a positive effect. Considering the mother tongue variable being 1 = English mother tongue (reference category), 2 = Other native language and 3 = bilingual, the outcome of the interaction suggests that when exposed to cognitive load, those whom on top of English proficiency were mother tongue in other languages and/or bilingual exhibited higher learning performance. Specifically, they performed 6.687 units higher, having a less negative effect on learning (in fact, the effect for other language and bilingual is -16.923 + 6.687 = 10.236). This shows that the effect of the experimental condition on learning varied depending on the participants' language background, with those being proficient in more than one language or being bilingual experiencing better learning. Numerous research has studied the benefits of bilingualism on individuals' mind, so this is an interesting effect that should be further investigated to see if it can actually minimise the effects of cognitive load on learning.

Therefore, as mentioned, moderation effects were only visible in the question posing higher extraneous cognitive load for the variables *gender* and *mother tongue*, which highlighted potential interesting mediation effects on cognitive load. In light of this, the following and last result of the research was below formulated:

Result 5: The findings show that demographic characteristics such as gender and mother tongue significantly moderate the effect cognitive load has on learning. Specifically, gender effects were highlighted with males performing better under high cognitive load conditions, compared to females. Similarly, participants with proficiency in more languages or bilingual background showed a better learning performance under cognitive load.

Chapter 5: Discussion

According to what emerged in the previous analysis, in this final chapter the results outcomes will be discussed alongside with some practical implications for the academia and the business field. Finally, the research will introduce the study's limitations and will close the chapter by presenting some indications for future research.

5.1. Conclusions & Findings

The study attempted to understand the impact of cognitive load on individuals' learning capability for academic and organisational purposes. Given the daily exposure of companies to volatile environments, a crucial question raised by current literature was whether a) crisis situations could be limiting the organisational capability of companies and of the individuals within it and b) whether cognitive load could be optimised for learning. Based on this purpose, the following hypotheses were formulated to conduct further investigation.

H1: Individuals demonstrate a decreased tendency to learning when they operate under limited cognitive resources as compared to when they operate at full cognitive capacity.

H2: The cognitive load experienced by individuals (and the subsequential learning) can be optimised through the type of information presented to them.

Through the exposed research methodology, the research highlighted interesting results, some of which in line with what studies previously within the academia. The first part of the research focused on testing H1, i.e., whether individuals under cognitive load showed decreased learning performance compared to the control group. The second hypothesis, H2, was formulated and tested to understand the possible implications of different information exposure on the learning outcome of individuals. The results are discussed below.

When observing the first hypothesis (H1), i.e., ***"individuals demonstrate a decreased tendency to learning when they operate under limited cognitive resources as compared to when they operate at full cognitive capacity"***, the results did not find statistical evidence to support this theorisation. In fact, when it comes to the overall learning performance, findings diverged from what previously argued in literature, which generally suggest that cognitive load inevitably deteriorates individual learning (Redifer et al., 2021; Sweller, 1988; Deck & Jahedi, 2015). Following this academic stream, the research should have shown evidence that learning performance was negatively and significantly affected across all the questions, which was not the case. Contrary to this, the results instead provided evidence of differences in learning performance from one question to another, challenging the notion that it is not necessarily true that individuals exhibit a decreased learning performance whenever they are subjected to cognitive load; rather, other factors may come into play and influence the effect and direction of cognitive load on learning.

Although the research could not conclude that cognitive load has a universal negative impact on learning performance, it collected evidence to conclude that it has instead a statistically significant negative effect with regards to the learning response times of individuals, confirming that an increased cognitive load always and necessarily leads to increased response times in individuals. This result is consistent with similar studies in research, such as the medical study of Sankaranarayanan et al. (2020), which concluded that cognitive load slowed down significantly the rate at which the surgery was achieved. Indeed, by overloading an individual's cognitive load and working memory, situations evoking cognitive load stressors (such as crises) were found to affect speed reaction negatively, making more difficult for individuals to read, understand, memorise and process relevant information. Thus, we cannot conclude that cognitive load will necessarily and inevitably worsen learning performance, but we can state with confidence that it will significantly impact the learning response times of individuals.

The second hypothesis of this thesis, which posits that "***the cognitive load experienced by individuals (and the subsequential learning) can be optimised through the type of information presented to them***", aimed at testing whether the information type and learning activity presented to individuals would influence the direction of their learning outcome. In line with the literature analysed in Chapter 2, the research procedure exposed participants to three different levels of cognitive load: one with high extraneous load (that is, with a higher level of information complexity), one with low extraneous load and thirdly, one with low extraneous load but simultaneously requiring participants to stimulate high germane load by making their own inferences about the information given. The results from this hypothesis illustrate that subjects performed differently depending on the whether the type of instructional information presented stimulated higher or, viceversa, lower extraneous cognitive load. In fact, although not at a significant level, information promoting high extraneous load showed a negative relationship with learning whereas information promoting low extraneous load showed a positive relationship with learning. In particularly, when the latter was associated with further promoting a high level of germane load, cognitive load was found to have a statistically significant impact on learning. In sum, when individuals were subjected to extraneous load, cognitive load hindered their learning performance by overburdening their working memory capacity; contrarily, when the learning task involved the engagement in deeper mental processes in order to acquire new knowledge, such as with low extraneous load and high germane load, the overall cognitive load positively influenced their learning performance, contributing to a better acquisition of new knowledge. Therefore, this research provides substantial evidence that the cognitive load experienced by individuals can be optimised, having a positive or negative influence on the learning performance depending on the type of instructional information presented to subjects and the relative levels of extraneous and germane cognitive load they stimulate in individuals.

Finally, when investigating possible mediating effects of the covariate variables, the research identified significant influence on cognitive load from the variable *gender* and *mother tongue*. However, this effect was only shown when extraneous load was increased, i.e., in question one, while the effect of the mediators was not sufficiently high to be detected when extraneous load was tried to be minimised, i.e., in question two and three. The linear regression conducted with the analysis highlighted a) a statistically significant moderation effect of the variable *gender* between cognitive load and learning, with male subjects showing a better performance than females, in line with literature (Hwang et al., 2013) and b) a statistically significant moderation effect of the variable *mother tongue* between cognitive load and learning, demonstrating that individuals proficient in multiple languages or from bilingual backgrounds learned generally better than those only proficient in a single language.

5.2. Theoretical & Managerial Implications

Being heavily grounded on theory, the results obtained are valuable in advancing the academic discourse revolving around learning under cognitive load conditions while still provide with some suggestions for businesses to better manage their employees during crisis situations and ensure learning is fully optimised.

First, to the best of our knowledge, this study is among the first to explore and identify one primary cause influencing organisational learning during crisis. Unlike previous research which primarily investigated the potential of learning for crisis (e.g., Weick & Sutclifee, 2007; Mitroff, Pauchant, & Shrivastava, 2006), this study goes one step further delving deeper into understanding how and in which way the learning environment may be altered for individuals during crises and better clarifying the environmental pressures they are subjected to. In fact, by introducing to the discourse the role of cognitive load, the study identifies a key factor that not only incorporates all the relevant stressors mentioned in the literature - e.g., time constraints, complexity and task difficulty, information overload, uncertainty (Phillips-Wren & Ayda, 2020), but that was also found to practically and significantly affect the development of individual and organisational learning for companies.

Second, as mentioned previously, this research enhances the understanding of learning under crisis situations, challenging the academic conventional view of cognitive load as generally detrimental to performance (Kovoor-Misra et al., 2000; Argyris and Schön, 1978; Kets de Vries and Miller, 1984; Argyris, 1999; Barton, 1993; Bood, 1998; Smart and Vertinsky, 1977; Smith, 1990; Toft and Reynolds, 1992). Although this research's findings diverge from most established research on the matter, the study offers theoretical validity and potential explanations for such result. Indeed, this result is not meant to challenge previously established theories, which found their theoretical assumptions on more than solid ground, but to instead advocate for a less defined and more flexible vision of the construct that takes into consideration the role of the three types of cognitive load components -i.e., intrinsic, extraneous and germane load, in affecting the learning performance of individuals.

Third, this research introduces a new theorisation of cognitive load, by applying educational psychology and instructional design's concepts to conceptualise the components of cognitive load (i.e., intrinsic, extraneous and germane loads) as fundamental in determining the direction of relationship onto learning performance. Indeed, the findings suggest that learning may be possible under cognitive load (and even facilitated by such) whenever extraneous load is minimised, leaving space for individuals to engage into mental process that ultimately facilitate the learning performance. This opens new avenues for theoretical exploration, prompting the academia to reconsider cognitive load as something not necessarily negative but, when properly managed, as something that can be leveraged to enhance organisational learning outcomes rather than hinder them.

5.2. Research Limitations

This thesis research exhibits various limitations that might contribute to the prevalence of less significant results and, thus, to claims not fully supporting the theories formulated in the literature review. The main research limitations are three and concern sample, methodological and applicability and generalisability limitations.

5.2.1. Sample Limitations

A primary limitation of the conducted research relates to the sample utilised for the data analysis, which although respected the minimum number useful for conducting valid research, can be considered fairly small consisting of a total of 60 participants. Studies conducting similar research usually employ larger sample sizes, however the small population sample used in the research can be attributed to the economic constraints associated with using Prolific for experimentation coupled with the extended duration of the experiment due to the exposure of individuals to the text and subsequent learning task. In fact, such factor considerably increased the economic funding required for conducting the experiment.

5.2.2. Methodological Limitations

This study also faced major methodological challenges and limitations. One primary limitation is due to the complex nature of the crisis management field and the intrinsic factors that characterise crises and relates to the *validity of research methodology*. Indeed, crises are very complex to replicate in controlled settings and, hence, to transpose into valid theories. This difficulty to simulate crisis conditions poses concerns regarding the overall validity of the results obtained, particularly as the researcher cannot be entirely unsure of whether the crisis scenario affected participants in the desired way. This, in turn, limits the efforts to develop theoretically applicable frameworks. The crisis management field has, indeed, long suffered from methodological monolithism (Roux-DuFort, 2007) with most relevant findings in the academia originate from case study analyses still kept nowadays as immovable references (Coombs, 2007; Sellnow & Seeger, 2013).

Additionally, another significant methodological limitation regards the abstractness of the topic and *the measurement and quantification of cognitive load's categories.* Indeed, cognitive load cannot be measured directly, so most studies rely on indirect methods such as post-tests to assess knowledge retention based on different levels of cognitive load (Stull & Mayer, 2007). Despite scholars have questioned the validity of the methodology used expressing the need for direct measurement of cognitive load (Mayer et al. 2002), until nowadays it remains the most accepted method to evaluate learning performance. Thus, in the context of this research, such methodological issue can limit the precision of findings in terms of how of intrinsic, extraneous, and germane cognitive loads influence the overall impact of cognitive load on performance.

5.2.2. Applicability & Generalisability Limitations

Finally, another limitation of this research concerns the *poor generalisation of results*. Crises are indeed, by definition, exceptional, and isolated situations that never replicate in the same exact manner (Pearson and Clair, 1998). This poses significant limitations in terms of legitimacy and applicability of results given that not all types of crises exhibit the same level or even the same types of environmental stressors on individuals. Hence, cognitive load conditions may vary and, as a result, have different impact on individual learning. Therefore, the findings may be highly context-specific, applying only to the particular simulated crisis used in the study. This is, however, a limitation that characterises the entire crisis management field and which has led to a fragmented and non-cumulative body of literature and leaves limited opportunity for improvement (Bundy et al., 2017; Roux-DuFort, 2007).

5.3. Future Research

As regards to future research indications, this research paves the way for interesting studies in the organisational learning field related to crisis management. For instance, given the importance of germane load for learning performance, a possible direction for research could explore whether training individuals to develop and utilise mental schemas (and thus, better organise and interpret information) would improve their ability to learn more efficiently under high-pressure situations, and possibly, further reduce the time execution of both reading and learning task. By teaching individuals to form and rely on cognitive structures, future studies may uncover ways of improving learning quality under crisis, while providing practical implications for companies seeking to prepare individuals for unpredictable and high-pressure contexts.

Another potential area of exploration may be the investigation of learning performance under crisis after the crisis has passed. In the current study, indeed, we focused on learning *during* crisis; however, it would be interesting for research to assess the effects of cognitive load on learning after the crisis to shed light on the potential long-term effects of cognitive load generated by stressful situations. For instance, Glass and Singer found that unpredictable and uncontrollable noisy conditions were most deleterious to task performance even after the cessation of the stressor, suggesting that the impact of cognitive load might extend beyond the crisis itself and potentially hinder organisational learning for a prolonged period. Understanding the post-crisis impact of cognitive load on learning could be essential for developing more effective crisis management strategies that account for both immediate and delayed cognitive challenges for organisational learning.

Furthermore, to address the limitations concerning the validity of research methodology, future studies could improve the experimental procedure by conducting the cognitive load manipulation in a laboratory rather than online settings, where participants would be more stimulated by the imposed crisis conditions resulting in higher engagement in the execution of the main learning task. Furthermore, in laboratory settings, more advanced forms of cognitive load manipulation treatment could be executed, thus giving the researcher the possibility to test different levels of cognitive load and ensure a proper execution of those, which were not opted for because of concerns regarding participants cheating and compromising the reliability of data.

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Appendix

Appendix A – Mitroff's Crisis Management (Further Explained)

Step	Description	Examples
1. Signal detection	Identifying small but significant indicators that suggest a crisis may occur.	Multiple engineer warnings about the booster rocket O-ring seal on NASA's Challenger space shuttle.
2. Crisis planning	Systematically preparing the organization to manage a crisis event by planning and implementing necessary measures.	Crisis training, developing business continuity plans, creating a crisis communication strategy, and forming a crisis team.
3. Crisis containment	Managing the crisis to mitigate further losses, often through communication and securing resources that may be vulnerable.	Communicating with stakeholders, securing fiscal, operational, and human resources, and addressing employee relations issues.
4. Crisis recovery	Taking steps to resume partial or full operations after a crisis, often by supporting human resources and continuing business operations.	Enacting the business continuity plan, supporting employee assistance programs.
5. No-fault learning	Supporting the learning process from a crisis without placing blame on individuals; reflecting on the crisis and its impacts.	Critical reflection on the crisis experience, considering direct and indirect impacts.
6. Redesign	Restructuring organizational elements that may have contributed to the crisis; includes evaluation of human factors and management psychology.	Evaluation of human factors, gathering new data for early indicator identification in future crisis detection.

Appendix B – Experiment Excerpt: FDA Procedure

The recall execution involves the following steps:

Step 1: Determining the incumbent of recall
When confronted with a potential recall scenario, it is imperative for your company to meticulously scrutinize whether the product aligns with established guidelines. The firm must undertake a thorough investigation to ascertain if the product is in violation of standard regulations and assess whether the FDA may initiate legal action.

Step 2: Informing FDA
Not reporting a recall can affect the firm's rapport with the agency, therefore it is crucial to actively involve them in your recall planning process. Make it a priority to promptly notify the FDA about the recall, with a particular emphasis on seeking their involvement in planning Class I recalls (i.e., where there is a reasonable possibility that the use of the product will lead to serious, adverse health consequences or death).

Step 3: Evaluating the health hazards
In contemplating a recall, it is incumbent upon your company to conduct a comprehensive evaluation of the health hazards associated with your product. Delve into potential risks to determine the urgency and severity of the recall.

Step 4: Developing and implementing recall strategy
Tailor a specific strategy for each recall, taking into consideration its depth, the necessity for public warnings, and the extent of effectiveness checks. Delineate whether a public warning is necessary and specify the channels through which it will be communicated.

Step 5: Recall communication
Assume full responsibility for explicitly notifying all affected stakeholders within and outside of your company about the recall. You must clearly convey:

1. That the product is subject to a recall;
2. That further distribution or use of the product should stop immediately;
3. When appropriate, the recipient should in turn notify the next party in the chain of distribution of the recall; and
4. What to do with the product.

Step 6: Narration to FDA
Your firm must provide periodic status reports to the FDA throughout the recall process. You must include details such as the number of recipients notified, responses received, products returned, effectiveness checks conducted, and the anticipated completion date for the recall.

Step 7: Terminating a recall
Termination of a Class II (remote possibility of hazard) or Class III (very unlikely to cause hazard) recall does not require any prior approval by the centre. In every case, written reportage that a recall is abolished will be issued by the appropriate District office to the recalling firm. FDA will not terminate a recall until the firm has brought the drug product into compliance or disposed of it in a conceded manner.

Appendix C – Experiment Excerpt: Questions for Learning Testing

What was the series of characters you had to remember?

What was the order of the steps of the FDA procedure?

- Determining the incumbent of recall
- Informing FDA
- Evaluating the health hazards
- Developing and implementing recall strategy
- Recall communication
- Narration to the FDA
- Terminating a recall

As a company, do you need to tailor a specific strategy for each recall (in case you need to make more than one)?

- Yes, you need to adapt each strategy: customize strategies based on the different depth of the recall, the necessity for public warnings and the extent of effectiveness checks.
- No, use one standard strategy: apply the same approach to all recalls as it is generally sufficient.

For which class is it important to raise the FDA procedure?

- Class I
- Class II
- Class III
- All of them
- None of them

Appendix D – Frequency Table of Sample Demographics

Characteristic	**Control Group**	**Experimental Group**	**p-value**
Age Group			0.9
Under 18	0 (0%)	0 (0%)	
18-24	3 (9.7%)	2 (6.9%)	
25-34	7 (23%)	8 (28%)	
35-44	8 (26%)	4 (14%)	
45-54	7 (23%)	7 (24%)	
54-64	5 (16%)	7 (24%)	
65+	1 (3.2%)	1 (3.4%)	
Gender			0.053
Male	24 (77%)	15 (54%)	
Female	7 (23%)	13 (46%)	
Unknown	0	1	
Employment Status			0.5
Employed Full Time (>40h)	8 (28%)	10 (36%)	
Employed full-time (<40h)	12 (41%)	15 (54%)	
Unemployed (looking)	1 (3.4%)	1 (3.6%)	
Unemployed (not looking)	3 (10%)	1 (3.6%)	
Student	4 (14%)	1 (3.6%)	
Retired	1 (3.4%)	0 (0%)	
Unknown	2	1	
Educational Level			0.6
Less than diploma	2 (6.7%)	0 (0%)	
High school diploma or equivalent	11 (37%)	7 (25%)	
Bachelor's degree	11 (37%)	13 (46%)	
Master's degree	5 (17%)	7 (25%)	
Doctorate	1 (3.3%)	1 (3.6%)	
Unknown	1	1	
Mother Tongue			0.8
English Native	28 (90%)	25 (86%)	
Non-Native	2 (6.5%)	3 (10%)	
Bilingual	1 (3.2%)	1 (3.4%)	