THE ROLE OF SITUATIONS AND THEMATIC REORGANIZATION IN THE CONCEPTUAL PROCESSING OF ABSTRACT CONCEPTS

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To my father, for having believed in me.
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Abstract

The human conceptual system is known to contain two main types of concepts: concrete and abstract. Abstract concepts such as opinion or determination express the sequences of relations between different entities. They also manifest the internal and introspective states of existence that characterize the human consciousness. The semantic representation and organization of abstract concepts has received very little attention in the cognitive psychology literature over the past decades, whereas the vast majority of studies have been dedicated to concrete concepts. Previous research on abstract concepts has explained how they are conceptually represented by focusing on their differences from concrete concepts i.e., the concreteness effect. Current theories of grounded cognition such as the Perceptual Symbol Systems theory propose that situational knowledge and experiences could play a key role in how people simulate, understand and use abstract concepts.

The aim of the present work was to assess the principles that underlie the conceptual structure, organization and representation of abstract concepts within the cognitive system. Four series of behavioural experiments using categorization and similarity judgment tasks were designed to investigate the role of situational information and thematic organization in the processing of abstract concepts. The overall results indicated that the co-occurrences and the experiencing of unrelated abstract concepts in relevant situations significantly influenced the emergence of novel thematic reorganizations between the concepts compared to baseline. Thus, suggesting the central role that thematic reorganization and situational information play in the conceptual representation of abstract concepts.

Keywords: Abstract concepts, Situational information, thematic organization, taxonomic organizations, similarity, categorization, co-occurrence.
Résumé

Le système conceptuel humain est connu pour contenir deux types de concepts principaux: concrets et abstraits. Les concepts abstraits tels que l'opinion ou la détermination expriment les relations séquentielles entre les entités, ainsi que les états mentaux et introspectifs qui caractérisent la conscience humaine. Les recherches antérieures ont été consacrées essentiellement à l’organisation des concepts concrets. Elles se sont très peu intéressées à la manière dont les concepts abstraits sont représentés tant sur le plan cognitif que conceptuel. Dans la littérature, la représentation, récupération et traitement des concepts abstraits dans le système conceptuel sont principalement attribués au phénomène connu sous le nom de l’effet de concrétude (avantage pour les mots concrets relativement aux mots abstraits par rapport aux processus cognitifs). Les théories actuelles de la cognition incarnée telles que la théorie des Symboles Perceptifs proposent que les expériences réelles et les informations situationnelles pourraient jouer un rôle clé dans la façon dont les gens simulent, comprennent et utilisent les concepts abstraits. Le but principal de la présente thèse était d’explorer la structure conceptuelle, l'organisation et la représentation des concepts abstraits dans le système cognitif. Pour ce faire, quatre séries d'études expérimentales utilisant des tâches de catégorisation et de jugement de similarité ont été réalisées. Le premier objectif était de déterminer l’effet des informations situationnelles sur la réorganisation des concepts abstraits. Le deuxième objectif était de déterminer si une organisation taxonomique ou thématique pourrait être à la base de la représentation conceptuelle des concepts abstraits. Les résultats globaux ont indiqué que les cooccurrences et le traitement des concepts abstraits dans des informations situationnelles influencent significativement l'émergence de nouvelles réorganisations thématiques en comparaison à une ligne de base. Ainsi, ces résultats suggèrent que la réorganisation thématique et les informations situationnelles jouent un rôle central dans le traitement et la réorganisation conceptuels des concepts abstraits.

Mots-clés : concepts abstraits, information situationnelle, organisation thématique, organisation taxonomique, catégorisation, similarité, cooccurrence.
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Introduction

Abstract concepts such as liberty or opinion still remain a challenge for theories of conceptual knowledge representation. Despite recent research on such concepts, their processing, representation and organization within the cognitive system are still not very well understood. Due to their lack of physical referential entities in our experiences and their complex nature, they have been relatively neglected in theories of semantic representation in comparison to concrete concepts. This is partly due to the fact that these concepts unlike concrete ones capture and describe the complex nature of human thought, introspection, decision-making, reasoning, problem-solving and other higher forms of human cognition. However, it is incontrovertible that our understanding of the nature of abstract concepts is important to the entire comprehension of human intelligence. It is certain that a limited knowledge on the conceptualization of abstract concepts would incur a partial insight into the human cognitive system as a whole.

The fundamental aim of the current thesis was therefore to investigate the role that situational information and thematic organization play in the semantic processing and representation of abstract concepts. The experimental studies presented in this studies were based on the hypothetical argument that situational information facilitates the conceptual processing and representation of abstract concepts, and that thematic organization rather than taxonomic organization could be the principal representational framework within which abstract concepts are structured.

The current thesis is therefore divided into 5 main chapters. The first three chapters set the theoretical background upon which our hypothetical views and fundamental research questions are based. Thus, chapter I reviews the traditional models on the semantic organization of concepts in general and discusses why most of these classical models are not adapted to the representation and organization of abstract concepts.

Chapter II presents the effects of priming on semantic knowledge organization. It discusses the differences between standard semantic priming and the emergence of new thematic relations between unrelated abstract concepts as a function of their co-occurrences in recently experienced situations.
Chapter III discusses language comprehension and discourse processes by comparing embodied theories with traditional views on language representations. It explains how the comprehension of texts involving abstract concepts could be achieved through the mental simulation of the textual information in modality-specific systems.

Chapter IV presents a series of four behavioural studies that aim at providing empirical support for the view that situational information and thematic organization are central to the conceptual representation of abstract concepts.

The overall results, their interpretations and implications are dissertated in the General Discussion presented in chapter V.
Chapter I

The semantic organization of concepts in the conceptual system

Abstract concepts are typically defined as not being concrete, that is “concepts that are neither purely physical nor spatially constrained,” (Barsalou & Wiemer-Hasting, 2005, p. 129). The traditional approaches used to study the semantic representation and processing of abstract concepts have consisted of assessing their structure, content and characteristics through comparisons made between abstract and concrete concepts. Such traditional approaches have focused on “revealing” their differences from concrete concepts in terms of concreteness, imageability, processing, memorization, features and representational networks. Most of such approaches involved methods where abstract and concrete concepts are evaluated together, mostly using what we will term here as “comparative assessment methods,” thereby informing us on what abstract concepts are NOT rather than on what they are. Traditionally, the two types of concepts, selected from established norms are evaluated and compared on several cognitive tasks.

For example, Schwanenflugel, Shoben and their colleagues compared abstract to concrete concepts and showed that concrete concepts have a general advantage over abstract ones on a variety of tasks such as memory being better for concrete words (e.g., Wattenmaker & Shoben, 1987), comprehension being faster (e.g., Schwanenflugel & Shoben, 1983) and lexical access being quicker (e.g., Schwanenflugel, Harnishfeger & Stowe, 1988). Other studies using such comparative assessment methods have also shown that concrete concepts compared to abstract ones are read faster in naming studies (e.g., de Groot, 1989), have a higher recognition speed in lexical decision tasks (e.g., Bleasdale, 1987), are remembered better in serial recall (e.g., Romani, McAlpine & Martin, 2007; Paivio, Yuille, & Smythe, 1966), have better prototypical internal structure (e.g., Hampton, 1981; Rosch & Mervis, 1975) and are categorized more quickly (e.g., Hampton, 1979; Smith, Shoben & Ribs, 1974).

In summary, the comparative methods assess abstract concepts together with concrete ones, hence, subjecting abstract concepts to methods that are usually applied and adapted to concrete concepts. That is, methods that are traditionally used to study only the features of concrete concepts have been “extended” to abstract ones, without specifically taking into account beforehand or a priori, the particularities of the nature and properties of abstract concepts. For example, Hampton (1981) investigated the nature of abstract concepts by applying his original featural approach used to study the polymorphous nature of concrete concepts and extended it to evaluate abstract concepts.
A polymorphous concept is defined as a concept “in which an instance belongs to a certain category if and only if it possesses a sufficient number of a set of features, none of which need be common to all category members,” (Hampton, 1981, p. 149). The method used to test the polymorphous model involved the examination of the relationship between the featural definition of concepts and the rated typicality of their exemplars. Hampton (1981) applied this method to study the polymorphous nature of abstract concepts. He concluded that abstract concepts are less polymorphous in nature, have unlimited combination of instances that could be generated within a given category from the environment and have weaker prototypical internal structures. More importantly, he observed that features used to define abstract concepts are less constrained and more complex compared to concrete entities.

Wiemer-Hastings, Barnard and Faenar (2004), investigated the structural differences in abstract and concrete item categories. In a series of three experiments using exemplar listing, they asked participants to generate exemplars for concrete and abstract categories. They observed that abstract concepts’ categories have a weaker graded structure with very few exemplars and the typicality ratings for abstract concepts exemplars were much lower than for concrete concepts. In one of their studies, they asked participants to compare the similarity of items from the same versus different categories for abstract and concrete concept pairs. They observed that compared to concrete concepts, the difference between similarity ratings for same versus different categories was significantly smaller for abstract concepts. More importantly, they also observed that abstract concepts that are typical for a specific situation were rated as similar to each other to the same extent as abstract concepts belonging to the same abstract taxonomic category. That is, the level of similarity for two abstract concepts belonging to an abstract taxonomic category (e.g., “thought – belief” from mental states category) was reliably equal to the level of similarity between two abstract concepts belonging to the same situation-based category (e.g., “love – commitment” from wedding situation category). Whereas such an observation was not made for concrete concepts. They concluded that the processing of abstract concepts is semantically constrained by situations, almost in the same manner as taxonomic categories place semantic constraints on the processing of concrete concepts.

Wiemer-Hastings and Xu (2005) assessed the content of abstract and concrete concepts using a feature generation task. They noted that compared to concrete concepts, abstract concepts possess qualitatively different types of properties. Specifically, abstract concepts contained fewer intrinsic features but had more relational properties. However, compared to concrete ones, most of the properties of abstract concepts designated subjective experiences.
Similar conclusions were drawn by Barsalou and Wiemer-Hastings (2005) from comparisons of abstract and concrete concepts. Barsalou and Wiemer-Hastings examined differences in conceptual content between three types of concepts using property generation tasks. Participants were asked to give properties of three abstract concepts (e.g., true), three concrete concepts (e.g., car), and three concepts intermediate in abstractness (e.g., to farm). Their results showed that, abstract concepts compared to concrete concepts contained social entities linked strongly to situations. In other words, the core content of abstract concepts consisted of introspective dimensions such as eventualities, doctrines, beliefs, principles and dogmas. Hence, the content of abstract concepts appeared to be more elaborated, heterogeneous and complex than concrete concepts.

Schwanenflugel and Shoben (1983) investigated the effect of sentence contexts on lexical decision for the processing of abstract and concrete concepts. On each trial in their study, participants were presented with either a concrete sentence context (e.g., The germ was a virus) or an abstract sentence context (e.g., the evidence proves his innocence). The nouns at the end of each type of sentence (virus and innocence) were presented in isolation as target words, upon which participants performed a lexical decision task, following the processing of the first part of the sentences. They observed that in comparison to concrete words, lexical decisions for abstract concepts were significantly longer when there was no sentence context. However, in the presence of contextual information there was no difference in processing latencies between the two. They concluded that the differences observed in the lexical decision latencies between concrete and abstract concepts were due to the fact that it was more difficult to fetch back contextual information for abstract concepts from memory, as proposed by the context availability model (e.g., Schwanenflugel and Shoben, 1983), which will be presented later.

Essentially, methods that are more adaptable to and “biased” in our view towards concrete concepts have been extrapolated to study abstract concepts, and we believe that such approaches do not fundamentally do much justice to abstract concepts. We believe that traditional models used to explain the semantic representation of concepts such as the Spreading Activation models (e.g., Collins & Loftus, 1975; Collins & Quillian, 1969), the Exemplar model (e.g., Medin & Schaffer, 1978), the Property Comparison model (e.g., McCloskey & Glucksberg, 1979), the Prototypical models (e.g., Rosch & Mervis, 1975), the Context Availability model (e.g., Schwanenflugel & Shoben, 1983) and the Dual-Coding model (e.g., Paivio, 1986) are biased towards concrete concepts, due to the fact that abstract concepts were not accounted for, a priori in these models.

Most of what we know today about abstract concepts comes from traditional
approaches that have effectively evoked aspects that separate abstract from concrete concepts. They have been very effective in revealing the similarities and differences between the two types of concepts and have shown the “deficiencies” of abstract concepts with respect to several cognitive processes. However, one important drawback is that it has not been very informative on the fundamental organizational principles that structure abstract concepts. They have also shed very little light on how abstract concepts support high level cognitive processes such as comprehension, reasoning, learning and inference generation. We believe that such traditional approaches lack the necessary theoretical components to accommodate and explain the semantic organization and representation of abstract concepts due to their amorphous nature.

Empirically, it would be a fundamental misconception to assume that abstract concepts have a representational structure similar to that of concrete concepts. Indeed, most theoretical models in psychology, developed to represent semantic knowledge organization, were initially conceptualized around the nature of concrete concepts. Concrete concepts have almost always been studied in their own right, without being compared to any other type of concept. We believe that certain fundamental questions have not been taken into account by traditional models and hence, still remain unexplored as far as abstract concepts are concerned. Some of these questions include: what is the semantic organizational network of abstract concepts? What factors influence the organization of abstract concepts? How does the nature of abstract concept facilitate important cognitive processes such as comprehension, memory or learning? What types of situational information facilitate or inhibit the processing of abstract concepts?

As noted by Breedin, Saffran and Coslett, 1994, p. 649): “The present results also point to a gap in the psychological literature on semantic representation, which has little to say about the manner in which abstract concepts are represented.” The current thesis aims to address some of these questions by studying abstract concepts in their own right. Without attempting to answer all the theoretical questions that encompass the complex nature of abstract concepts, we hope however to shed some light and to contribute to the few studies that have attempted to unravel the mystery behind the intricate nature of the very concepts which contribute to the enrichment of the human conceptual knowledge.

I begin by first addressing the construct of concepts. What are “concepts” and how are they organized and represented in the mind? Before attempting to answer this question, it is necessary to outline the different theoretical frameworks within which the organization of words corresponding to concepts may be represented. Most theoretical accounts on the organization of concepts are strongly linked with semantic categorisation. In particular, they
focus upon how different exemplars of a concept can be included in or excluded from a specific semantic category.

The next theoretical section will focus on abridging some of the main traditional models on the representation of concepts in the semantic system. It will explain why such traditional models have been proposed mainly for the organization of concrete concepts and hence might be less adaptable to the representation of abstract concepts. We will then briefly present two theories (Perceptual Symbol Systems Theory and Contextual Constraints Theory) that have focused on explaining the nature of abstract concepts and also that propose some promising insights into the conceptual representation of abstract concepts.

1.1. Traditional views on the semantic organization of concepts

Murphy (2002) defined concepts as: “the glue that holds our mental world together. They tie our past experiences to our present interactions with the world.” Traditionally, most models on semantic organization such as the Network, Feature-comparison, Binary and Prototypical models are based on the assumption that it is the properties, attributes and the features of concepts that establish their identities and definition. Since the beginning of time, philosophers have assumed that definitions are the most reasonable way to characterize the meaning of words and their category memberships. Words that represent entities or ideas have been given definitions that could tell us what they are and also what they are not. Thus, early psychological approaches to concepts took a definitional approach. These approaches led to psychological models referred to as the “classical view” on concepts. The classical views essentially dated back to the era of Aristotle (e.g. Aristotle's Categories, 350 BCE/1941; for review see: Apostle, 1980; Murphy, 2002) and the main assumption was that a concept could be defined in terms of two essential aspects: necessity and sufficiency. Based on these two aspects, it was assumed that concepts must have all the properties of the definition to be included in a category. In other words, the main claims of the classical views were that concepts are mentally represented as definitions and the latter provide features that are necessary and jointly sufficient for membership into a category (see Smith & Medin, 1981 for detailed review). So, every concept is either in the category because it has all the features described by the definitions or it is out of the category because it does not possess all the defining features. The classical view did not make any distinction between members of the same category. Therefore, all members of the category were considered to be “equal” and there was no room for ambiguity concerning category or concept membership.

The biggest theoretical and empirical drawback with this view was that most categories are not well defined in this way. Wittgenstein (1953) argued that though some
features may be necessary for a concept, not all of them are always sufficient for category
ingclusion. Wittgenstein (1953) showed that it was impossible to generate adequate features to
encompass all the meanings of a word using the much cited example of the concept « games ». For example, Wittgenstein argued that according to traditional theories, games like
board games, card games, ball games, Olympic games and so on, have something in common
or they would not be called games. The commonalities between them are based on similarities
and relationships by virtue of which they are all termed games. However, if one looks
carefully at board games or card games one finds many correspondences but also many
differences. There is a great deal of ingenuity and luck in games like chess but there is a
difference between ingenuity in chess and that in football. Thus, it is difficult to define
“games” without considering certain sports that are also games but that do not have all the
features included in the definition of games.

Indeed, there are many concepts that do not fit perfectly into a category. For example,
a duck according to the classical view will not have sufficient features to be included into the
bird’s category. Hampton (1979) noted that many items are not attributed into clear-cut
categories, instead there were items that lingered along the borderlines of categories. For
example, participants could not decide with certainty whether a tomato was a fruit or a
vegetable. The problem with the classical view was mainly its inability to provide definitions
for natural kind concepts like birds, fruits etc. Work by Rosch and colleagues provided further
arguments against the classical views. They argued that category boundaries are not
distinctively demarcated (Rosch, 1973). This led to what became known as the typicality
effect on categorization, which is the phenomenon whereby the exemplars that are considered
to be the most typical for a category receive preferential processing relative to other
exemplars (Hampton, 1979; Rosch, 1973). Indeed, Rips, Shoben, and Smith (1973) observed
that participants were faster in deciding that a robin was a bird but were much slower in
deciding that a turkey (a less typical item of the category) was a bird.

Many theoretical arguments and considerable evidence against the classical views led
to the development of alternative models that took into account the typicality effect (e.g.,
Hampton, 1979; Rosch, 1978; Schaeffer & Wallace, 1970; Smith, Shoben & Rips, 1974). The
main assumption in the revised models is that two types of semantic features represent
concepts: defining features and characteristic features. Defining features are those that an
instance must possess to be part of a category. Whereas characteristic features are those that
are commonly associated with a concept but that do not need to be necessarily present for a
concept to be defined as a member of its category. For example ‘feathers’ is a defining feature
for birds but ‘flying’ is a characteristic feature since all birds do not fly. Hence, the definition
of an eagle will be based on a comparison between the features of an eagle and that of birds, in order to determine whether an eagle possesses all or most of the features of birds. The semantic features of concepts are hence used to determine their meaning based on predefined categories (Smith, Shoben & Rips, 1974; Rosch & Mervis, 1975).

1.2. The Prototype view

The Prototype view (e.g. Smith & Medin, 1981; Rosch & Mervis, 1975) assumes that concepts are organized around a best example or prototype that stands for most of the category. In other words, concepts are represented in the mind by “prototypes” which are summary representations of the average or ideal members of a class. Membership in the conceptual category is determined by similarity to the prototype.

Since the prototype is perceived as a summary representation or the average member of the category, it possesses the most frequent and basic attributes of the category members. Categories are therefore represented by a set of features that may carry more or less weight in the definition of the prototype. The entire category is represented by a unified representation, namely the prototype, rather than a separate representation for each member of the category. Thus, categorization is a comparative decision-making process based on whether an item possesses enough of these features. The prototype is an abstraction of the individual members of the category because there may be no real item in the world that represents it. According to this view, people supposedly use the prototype rather than the category definition in selecting and identifying members of the category. This view accounted for the typicality problem, and explained why there were no clear-cut boundaries between the members of a particular category. An entity that bore a very close resemblance to the prototype was recognized faster than items that do not resemble the prototype (e.g., Mervis & Rosch, 1981). The power of the prototype model enables it to explain the variances in typicality judgements for natural concepts (Hampton, 1979; Rosch & Mervis, 1975). Concepts according to this view can exist at various levels of a hierarchy. For example, a robin is a specific instance of the broad category birds.

1.3. The Exemplar view

The Exemplar view (e.g., Medin & Schaffer, 1978; Nosofsky, 1984) however proposes that concepts are represented by their individual exemplars rather than by an abstract summary. In this view, a category is represented by particular instances that have previously been encountered. If the exemplar is a subset of the category, then its representation consists of other exemplars or descriptions of the relevant features. However, if the exemplar is an instance, then it is represented by a description of its properties. Thus, the representation is
considered to be “disjunctive” and the features of an item are the accumulation of the exemplar’s features (see Figure 1 below).

A new item is assumed to be judged an instance of a category to the extent that it is sufficiently similar to one or more of the exemplar representations stored in memory. Therefore, the exemplars of a category play a fundamental role in categorization because they appear to be more readily available during category decision than summary information. People retrieve exemplars and use them to make category membership decisions, and the representation of a concept consists of separate descriptions of some of its exemplars (Holyoak & Glass, 1975).

1.4. The Network models

The Network models (e.g., Collins & Quillian, 1969; Rumelhart, Lindsay & Norman, 1972; Collins & Loftus, 1975) propose that concepts exist as independent units in semantic memory and that designated relations interconnect them within a network. The main assumption is that the semantic network has an organization based on property similarity. The more properties concepts have in common the more links they share through these properties and hence, the more related or similar they are. For example, the sentence ‘an eagle is a bird’ is represented in the network as two nodes corresponding to “eagle” and “bird” and the two nodes are connected by an “IS A” relation. Thus, concepts according to this model are represented as nodes in a network with properties of the concepts represented as “labelled relational links from the node to other concepts” (Collins & Loftus, 1975). In this model, concepts are represented by a set of shared properties or attributes and they are organized in inclusive networks structured by “IS A” relations. Therefore, their meanings are retrieved
from the systematic activation between nodes within the whole network structure (e.g., Collins & Quillian, 1969). The search in memory for concepts involves the spread of activation in parallel along the relational links from the node of each concept specified by the target input. Generally speaking, all the network models posit the view that concepts are processed by a top-down “spreading activation” through the network (e.g., Anderson, 1976; Collins & Loftus, 1975; McClelland & Rumelhart, 1981).

The parallel activations in the hierarchical organization of relations connect concepts together and these connections enable inferences of shared properties to be generated in order to make the cognitive network coherent.

One very important assumption made by network theories is the notion that similarities between properties of concepts play a major role in their organization in the semantic network. That is, the more similar two concepts are, the higher the relations between their properties and hence the closer they are in the semantic network. The implication is that though several objects might share a similar property, they are not necessarily closer together in the network. For example the concept “red” will prime more of other colours but less of associated concepts such as “roses, fire engines, strawberries etc.,” even though it is a common denominator among all these concepts (Collins & Quillian, 1969).

2.0. Recently proposed views on the semantic organization and representations of concepts

Before we continue, it is important to note here that most theories on semantic knowledge like those cited above do not give any explicit account for abstract concepts in their explanations for the organization of concepts.

2.1. Perceptual Symbol Systems and Situated Simulations

One of the few theories that proposed a plausible account of how abstract concepts could be accounted for in the conceptual system and how they are mentally represented is the Perceptual Symbol Systems theory (Barsalou, 1999). A central debate in cognitive science and in psychology concerns the representation of conceptual knowledge. This debate has led to the development of two schools of thought that attempt to explain the structure, content and processing of conceptual knowledge. On one hand are the “amodal” symbolic theories of cognition (see Figure 2).
The main claims of amodal theories (e.g., Newell & Simon, 1972; Pylyshyn, 1984; Fodor, 1975) are based on the separation assumption between cognitive and perceptual systems of representation. According to this view, conceptual knowledge is made up of amodal and arbitrary symbols that bear no resemblances to the perceptual states from which they were created. In that, concepts in general are represented by symbolic systems separated from the sensory-motor neural systems underlying perception and action. Several symbolic models, like the Network models explained above have over the years been proposed to describe how the conceptual knowledge stored in the human memory is organized semantically (e.g., Collins & Quillain, 1975; Smith, Shoben & Rips, 1974); or how language processing is assumed to be based on linguistic computational systems (e.g., Lund & Burgess, 1996; Landauer & Dumais, 1997). Amodal theories have had difficulties in determining how abstract concepts could be represented in the conceptual system because traditionally these theories have considered the conceptual system as modular that operates on symbolic principles, which differ significantly from modality-specific systems. Furthermore, these theories view concepts in semantic memory as decontextualized from background situations from which they were perceived and experienced. Thus, many classic semantic memory models used to explain the conceptual system such as the feature set models described above (e.g., Rosch & Mervis, 1975) or the Network models (e.g., Collins & Loftus, 1975) have not provided explicit accounts of abstract concepts.

An alternative approach that explains the representation of conceptual knowledge has been provided by theories of grounded cognition. One such theory that provides some insights into how abstract concepts could be processed, represented and understood is the

![Figure 2. The fundamental assumption behind 'amodal' representation of concepts (courtesy to Barsalou, 1999).](image-url)

Figure 3. The fundamental assumption behind the perceptual symbol system for the representation of concepts as explained by the Perceptual Symbol Systems Theory (Barsalou, 1999).

According to PSS, perceptual representations rather than amodal symbols constitute the building blocks of cognition. Thus, the mental representations of conceptual knowledge are perceptual symbols grounded in embodied experiences and hence, sensorimotor systems are actively involved in cognitive processes such as language comprehension, categorization and memory retrieval (see Figure 3 above).

Perceptual symbols are considered to be the neural traces of a perceptual experience, captured and stored as patterns of activations in the brain. They conserve an analogical relationship with their referents in the environment. A set of related perceptual symbols can be organized together in a “simulator” to represent a particular concept. A simulator uses a subset of components captured during different experiences from different modalities to represent specific instances of a category. Therefore, the conceptual simulation of a concept is based on a dynamic combination of several perceptual components analogous to the actual perception and action that was experienced. According to the theory, conceptual processing emanates from partial re-enactments or simulations of actual experiences. Due to limited attention, mental simulations are not the complete activations of all accumulated knowledge, but rather, they are selected in such a way that they capture the most relevant information needed to represent a specific concept. PSS advances the assumption that perceptual symbols and sensory-motor simulation play a central role in the representation of both concrete and abstract concepts (Barsalou, 1999). There is a wide body of empirical evidence in the literature that supports the assumption that conceptual processes rely on perceptual
simulations using modality-specific systems. PSS has been used to explain how text comprehension can be embodied and situated, thus implicating sensory-motor areas in the brain. For example, Zwaan, Stanfield and Yaxley (2002) found support for this phenomenon in the domain of language by showing that comprehenders implied the shape of objects during sentence comprehension. In their study, they presented participants with sentences such as “the ranger saw the eagle in the sky” followed by a picture of the eagle with its wings folded implying a mismatch condition as opposed to a match condition where the sentence “the ranger saw the eagle in its nest” was followed by a picture of an eagle with folded wings. The participants made speeded recognition responses as to whether the item in the picture was mentioned in the previous sentences. Their findings supported the perceptual symbol theory, in that responses were faster when there was a match between the implied shapes of the object in the sentences.

Other studies have shown that during language comprehension, people activate perceptual symbols that make references to perceptual dimensions such as orientation (e.g., Stanfield & Zwaan, 2001), colour (e.g., Connel, 2007) and location (e.g., Bergen, Lindsay, Matlock & Narayanan, 2007). All these studies indicate that the representation of the semantics of language is a dynamic process involving malleable perceptual representations instead of mechanical combinations of amodal symbols. For example, Glenberg and Kaschak (2002) showed that when participants read the sentence “John gave you the pen” and at the same time effectuated a congruent action (pressing a button away from their body), reaction times were shorter than when the action was incongruent (pressing a button closer to their body). Other studies have shown that there is a conceptual processing cost associated with switching from one sensory modality to another during property verification tasks (e.g., Vermeulen, Comeille & Niedenthal, 2008; Pecher, Zeelenberg & Barsalou, 2003). For example, Pecher et al. (2003) found that participants were faster in verifying the target sentence “a banana is yellow” (visual property) if previously they had verified the prime sentence “a diamond is sparkling” from the same modality (visual) compared to if the prime sentence was from a different modality such as “the blender is loud” (auditory).

A common denominator amongst all these studies is the fact that they mostly used concrete concepts to show how sensorimotor systems are implicated in cognition. Thus, even though Barsalou (1999) described extensively how PSS could be used to equally represent and mentally simulate abstract concepts, very few studies have actually attempted to empirically show how this could be possible. Barsalou (1999) argued that perceptual symbols for introspective states play a significant role in the mental representation and simulation of abstract concepts. An abstract concept according to PSS is not represented out of context.
Rather, it is represented within the context of a wider situational background. Therefore, introspective states and situational contexts are some of the core contents used to simulate abstract concepts according to PSS (Barsalou, 1999; Barsalou & Wiemer-Hastings, 2005).

Since most abstract concepts do not have explicit physical referents in the environments, the type of research that has managed to show empirically that they contain situational information and rely on brain regions that process introspective states come from neuroimaging studies. Most of these studies have shown that the retrosplenial cingulate cortex is heavily implicated in the processing of abstract words and sentences. The retrosplenial cingulate cortex is a brain region that stores and processes abstract contextual information and internal states (Greicius & Menon, 2004; Bar & Aminoff, 2003). A first line of evidence comes from an fMRI study, which was carried out, by Ghio and Tettamanti, (2010) using dynamic causal modelling. Participants were acoustically presented with either action-related sentences (e.g., “I pushed the button”) or sentences with an abstract content (“I appreciate sincerity”) while being scanned. After the scanning session, participants were submitted to an informal interview on the sentences so as to ensure that they did process the sentences conceptually. Their results showed that concerning the action-related stimuli, there was a higher functional coupling brain activities between the auditory language processing areas (LSTG)\(^1\) and the left-hemispheric action representation system, which is implicated in the processing of action. In contrast, for the abstract sentences, they observed a functional coupling between auditory language processing areas and the retrosplenial cingulate cortex. Ghio and Tettamanti (2010) interpreted their observations within the theoretical framework of perpetual simulations in modality-specific systems. They argued that to process and mentally represent action-related sentences, sensory regions in the brain that represent actions are activated. Whereas, to process and mentally represent abstract sentences which involve abstract words such as sincerity or appreciation, modality-specific regions that process situational information and introspective states are activated. In other words, in the same way as the visual cortex processes information that involves colour, the retrosplenial cingulate cortex is heavily implicated in processing information that represents abstract words such as sincere, appreciation, kindness etc.

A second line of evidence comes from the study by Wilson-Mendenhall, Simmons, Martin, and Barsalou (2013). They investigated whether the meanings and representations of abstract concepts included relevant non-linguistic information. In a neuro-imaging paradigm that used a concept-scene matching task, Wilson-Mendenhall et al. (2013) examined neural activations for two abstract words (convince, arithmetic) and two concrete words (rolling,}

\(^1\) Left superior temporal gyrus
Participants were presented with one of the four words followed by a picture scene that was either a match or a mismatch to the word. They observed that the processing of the abstract concept *convince* mainly recruited regions such as the medial prefrontal cortex, posterior cingulate, orthofrontal cortex and superior temporal sulcus. These neural regions are usually associated with mental states, social interactions and affective processing. On the other hand, *arithmetic* activated regions associated with numerical and mathematical processing such as the right superior parietal cortex and right middle frontal gyrus. Thus, the neural activity observed for the processing of these abstract concepts was distributed across the brain, which is contrary to previous assumptions according to which abstract concepts elicit a rather specified or localized linguistic brain pattern activation. From their study, Wilson-Mendenhall et al., (2013) concluded that abstract concepts possess rich semantic content that is both complex and grounded in relevant situations.

These lines of evidence cited above are very crucial to our work as we intend to show the pertinent role that situational information plays in the processing and representations of abstract concepts. We anchor our experimental predictions in the theoretical framework of Perceptual Symbol Systems. We assume that perceptual simulations of situations within which specific abstract concepts are experienced contribute to their conceptual processing, representations and organization. We propose in the current thesis that if introspection were considered to be a specific sensory modality with the same merits as vision or gustatory, and if sensory-specific brain regions such as the retrosplenial cingulate cortex are implicated in the processing of introspective states and contextual or situational information, then we can logically suppose that abstract concepts which represent introspective states perceived from situations could be processed using modality-specific systems, most specifically the retrosplenial cingulate cortex as explained by Ghio and Tettamanti (2010). Thus abstract concepts anchored or experienced in situations could, in principle be “sensorially” simulated. Logically again, situations could be used to “ground” abstract concepts in modality-specific systems. This argument goes to show how central situational information is to the representation of abstract concepts (Barsalou & Wiemer-Hastings, 2005; King & McRae, 2012). Barsalou (1999) argued that representations of abstract concepts do not involve the simulation of an entire event, “An abstract concept is not the entire event simulation that frames it but is a focal part of it” (Barsalou, 1999, p. 600). In other words, simulating a situation or an event sequence within which the core content of an abstract concept is framed, enables the concept to be mentally represented. The questions that merit being reflected upon at this point are: What constitutes the focal core contents of an abstract concept? How does an abstract concept become the focal part of an on-going situation? Since situations or settings
usually contain other entities that could be either abstract or concrete, how does a specific abstract concept integrate or combine with the other “peripheral” entities in order for it to be simulated within the situational frame? Stated differently, how does a specific abstract concept rely on or interact with the peripheral entities also present in situations for its mental simulation and representation to be achieved? Plausible theoretical answers to some of these questions are elaborated in later sections.

2.2. The Contextual Constraints Theory of Abstractness – A model for abstract concepts

Nearly all of the theoretical frameworks and models on the organization of concepts which are based on feature comparisons presented above (sections 1.2 – 1.4), have focused upon the physical features and characteristics constituting the definitions of concrete concepts. The exclusion or inclusion of concepts into categories is mainly based on the similarities between their physical and/or functional properties. Intuition tells us that abstract concepts do not always adhere or correspond with physical or featural definitions since these concepts are known to have very few if any, perceptual or physical referents in the environment. This implies logically that, the feature-based models on the organization of concepts technically cannot be used to explain the conceptual representation of abstract concepts. It becomes therefore problematic to use the feature-based criteria to categorize abstract concepts. Indeed, this could be one of the reasons why the feature-based comparison models make very little references to the organization of abstract concepts.

One of the few theories formulated around the core properties of abstract concepts is the Contextual Constraints Theory of Abstractness (Wiener-Hastings, Krug & Xu, 2001). This theory was based on observations from one of the few behavioural experimental studies that used ONLY abstract concept as stimuli. Wiener-Hasting et al. (2001) examined the abstractness nature of abstract concepts by assessing ratings for context availability, imagery and abstractness of abstract nouns. They reported that the elements that determined the concreteness of concrete concepts could be completely different from those that determine the abstractness of abstract concepts. As noted by Wiener-Hasting et al., “… abstractness and concreteness are determined by two different kinds of information. For concrete entities, both contextual availability and imageability were good predictors … For abstract concepts, the most critical type of information was the type of contextual constraints involved,” (Wiener-Hasting et al., 2001).

According to the Contextual Constraints Theory, the determinants for abstractness are based not only on their “perceptual observability” but also on the “characteristics of the
contextual constraints” of abstract concepts. Thus, contexts/situations provide different types of constraints that function like the “abstract building blocks of contexts” within which abstract concepts are represented. The role of constraints in context/situations is to guide the construction of a mental model for the processing of abstract concepts. The theory groups contextual constraints into 4 categories: concrete entities, temporal constraints, relational constraints and introspective-related constraints and proposes that these different types of contextual constraints could vary in levels of abstractness. Abstract constraints such as introspection, relations and temporality play a significant role for the perceived abstractness of abstract concepts. The theory assumes that the abstractness of an abstract concept is heavily dependent on the level of abstractness of the constraints subjected to it in a context. In their study, they derived a list of contextual/situational constraints that were relevant to abstract concepts such as locations, introspective elements, relations, temporal events etc. 121 abstract nouns were assessed to determine whether some of the contextual constraints listed could predict their perception of abstractness. They observed a strong correlation between introspection-related constraints and abstractness.

In other words, for abstract concepts, the elements that reliably determined and predicted their abstractness nature as well as the variations in abstractness between different abstract concepts and NOT their “non-concreteness” nature, were the introspective-based contextual constraints (e.g., beliefs, feelings, attitudes etc.) and relational constraints (e.g., relation between two entities, agent-thematic etc.). Logically, if the contextual constraints are very abstract, then it is difficult to construct a mental representation of the abstract concept occurring in it. Conversely, if the contextual constraints are less abstract, and therefore containing more physical elements (agents, objects, physical events etc.), then the construction or the simulation of a “situationally-based” mental representation of the abstract concept becomes easier and quicker. Since one of our objective is to study how situations influence the organization of abstract concepts, the Contextual Constraints Theory becomes an important theoretical background for this thesis. Further details on this theory and its implications to our work will be provided later.

3.0. Systems of conceptual organization

3.1. Taxonomic organization system

In everyday life, people encounter other people, animals, plants, objects, etc., and they interact continuously with such entities. In order to make sense of all the multiple instances and interactions that could possibly exist among a variety of entities, people generally and continually organize and categorize nature, events, people, and objects into groups. However,
not all entities can be classified into the same category, thus people are forced to make decisions when categorizing. This section will address a particular kind of category organization: the taxonomic hierarchical system of categories, illustrated in Figure 4.

![Classical hierarchical taxonomy](image)

**Figure 4.** An illustration of the hierarchical taxonomic organization of categories and instances.

According to the Oxford English dictionary (7th edition, 2012), a hierarchy is “an arrangement or classification of things according to their relative importance or inclusiveness.” Hierarchical organization has been suggested as a very important manner in which people organize concepts (e.g., Markman & Callanan, 1983). But, a taxonomic organization of semantic knowledge in psychology is a special hierarchical organization of concepts that uses “nodes” to represent categories connected by “set inclusion” relations between the categories and their exemplars (Murphy, 2002). It is an array of progressively wider categories within which each higher-level category includes all the preceding lower ones. In taxonomic organizations, the relations between the concepts are based on the properties of the items themselves, and hence taxonomically related concepts resemble one another in terms of their features and functions. In a taxonomy, concepts are defined by shared properties and are organized in inclusive nests, linked by “IS A” relations. That is to say for example, “a canary IS A bird, and a bird IS An animal.” Taxonomic organization has been suggested as a particularly predominant way of representing concepts (e.g., Murphy & Lassaline, 1997). For example, the category of “animals” includes the set of reptiles, which includes the set of lizards, as shown in Figure 4 above. The nature of the IS A relation is first and foremost asymmetric in a descending order, i.e., all lizards are reptiles, but all reptiles are
not lizards. Features of superordinate categories are a subset of the features of its subordinates.

Additionally an “IS A” relation is transitive and hence enables deduction and inferences to be generated for novel concepts. This is what is known as property inheritance. Specifically, every property that is true for the superordinate members of a category is also true for the category’s subordinates. For example, all roses are flowers and all flowers are plants, therefore all roses are plants. This deduction is made from the property inheritance on plants based on the hierarchical organization of entities (Murphy, 2002). So, if we learn that a new concept called “pimpap” is a flower, we can easily deduce and conclude that it is most likely to also be a plant.

One unresolved issue in psychology is whether taxonomic hierarchies for the representations of concepts are pre-stored in memory or are constructed/computed during concept processing (Smith, 1978). The view that concepts are probably pre-stored in memory with interconnected hierarchical networks, and that “IS A” relations are used to make inductive inferences and categorization judgements, is consistent with the Network models of memory which posit that concepts are linked in large taxonomic networks (e.g., Collins & Loftus, 1975; Collins & Quillian, 1969; McClelland & Rumelhart, 1986; Anderson & Bower, 1973). Empirical evidence supporting this hierarchical network for the organization of concepts came from extensive research on the activation of semantic knowledge. According to this assumption, when semantic information about a concept is activated, other concepts that are taxonomically related are also activated (Collins & Quillian, 1969; Collins & Loftus, 1975). As shown in Figure 5, semantic memory is supposedly characterized by a highly interconnected network structure and includes mechanisms by which taxonomically related concepts activate each other. The taxonomic organizational structure has been shown to facilitate cognitive processes such as semantic priming, whereby the processing of a prime word (e.g., summer) facilitates the subsequent activation of a taxonomically related word (e.g., winter). This facilitated processing is inferred from faster response latencies to targets compared to unrelated and neutral primes.
The alternative view of how hierarchical taxonomic structures are represented by the conceptual system is that hierarchies of concepts are not pre-stored, rather they are computed from logical reasoning on knowledge about concepts and their properties (e.g., Rips, Shoben & Smith, 1973). According to this view, people use their knowledge about category inclusion to make inferences and draw conclusions about concepts and their exemplars without necessarily having to store them in any specific memory network. This view is consistent with feature and prototype theories of categorization. That is, hierarchical relations are “calculated” by comparing the defining and characteristic features between superordinate, subordinates and a novel exemplar entity, and then making a decision as to whether the novel entity is a true member of the category. For example, to categorize a shark, one will compare all the features that are generally true of fishes to those of sharks. A higher level of overlap between the two would lead to an affirmative response that a shark is a fish. Cross-cultural studies have shown that typically, hierarchical taxonomic organization appears to be a natural and a universal way in which humans use and represent concepts (e.g., Rosch, Mervis, Gray, Johnson & Boyes-Braem, 1976). More on how culture affects categorization styles will be discussed later.

### 3.2. Thematic organization system

Recent studies on the organization of concepts have shown that taxonomy is only one of the many different organizational systems used by people to group concepts. One of such systems is thematic organization. This section presents evidence along with explanations of what thematic organizations are and why they are important for conceptual processes.

The entities that people interact with in the environment (people, objects, events) do
not belong to a single category, and hence can be placed into different groups. The question is how do people decide which entity goes into which category and why? The taxonomic hierarchical structure for the categorization of concepts based on their common features and properties has been suggested to be only one of the many possible ways in which an object or event can be categorized. It has been documented that the conceptual system has other forms of concept organizations, one of these being thematic (Murphy, 2002). Previous research has shown that participants spontaneously organize concepts both taxonomically and thematically during several cognitive tasks such as categorization and inference generation (e.g., Lin & Murphy, 2001).

Thematic organization is defined as “an external or complementary relation among objects, events and other entities that co-occur or interact together in space and time” (Lin & Murphy, 2001). That is, entities or events that co-exist and relate to each other within the same context, space and time are structured by a common theme that links them together (e.g., Barsalou, 2003, 2008). Examples of common thematic relations are: spatial (a driver sits in a car), temporal (cigarettes are usually lighted before smoking), functional (a knife is used to cut bread) and causal (a sail helps a boat to move over water). However, in computational modelling and simulations of human cognitive processes, thematic relations are given very little attention compared to taxonomic relations. This is because first, taxonomic relations have inductive power, in that they support inference generation and the extrapolation of knowledge across domains (e.g., Rosch, 1973; Murphy, 2002). Second, taxonomic acquisition was considered to be a sign of cognitive maturity and high intelligence in conceptual development (e.g., Inhelder & Piaget, 1964; Vygosky, 1962). Developmental psychologists supposed that there was a “shift” from thematic to taxonomic relations in the conceptual development of young children from the age of about eight. However, much of the research on the “thematic-to-taxonomic” shift has been criticized on methodological grounds.

What do we really mean when we refer to thematic representations? Naturally, entities that possess the same features or attributes and hence belong to the same group or category, in the taxonomic sense, do not always exist in isolation. In other words, *birds*, as a category do not exit among themselves in isolation. Exemplars of birds, e.g., eagles, do not live by themselves. Eagles interact with trees, the sky and have a preying function. Thematic relations occur between concepts that do not need to resemble each other, and hence their features are mostly dissimilar. Thematic perception is a process of creating meaning for relations between different stimuli that co-occur and compliment each other in a common scenario. Thematic relations enable a meaningful assessment to be made between different stimuli via a common theme. For example, a robin, a tree and some twigs come together in a “nesting” theme; a
golden eagle, a prey and a hunter come together in a “hunting” theme; computers and desks are related in a “working” theme; papers and pens are related in a “writing” theme. Consequently, thematic relations directly influence essential cognitive processes such as comprehension and inference generation in language, categorization, similarity, naming and induction (Estes & Jones, 2009; Jones & Love, 2007; Lin & Murphy, 2001).

Thematic relations are very different from general associations between concepts. Conceptual associations are based on the assumption that the thought of a specific item elicits almost immediately another item through “association cues”. For example, given the cue word ‘birthday”, the probability of a “cake” being evoked in a free association task is about 0.192 (Nelson, McEvoy & Schreiber, 1998). Associations are more elaborate than thematic relations because they could be constructed from several relations such as synonyms (e.g., fat – heavy), antonyms (e.g., low – high), taxonomic relations (e.g., cat – lion) or conventional derivatives (e.g., face – book). Thematic relations are fundamentally based on the interaction between items that play meaningful complementary roles in a common scenario, and hence are very different from mere associations. Many thematically related items are unassociated, (Estes & Jones, 2009; Simmons & Estes, 2008; Estes, Golonka & Jones, 2011). For example “car” and “driver” are thematically related but completely unassociated and many associated concepts are thematically unrelated. For example, “cat” is strongly associated to “dog” (0.52) (The Edinburgh Associative Thesaurus, Kiss, Armstrong, Milroy & Piper, 1973) but they are thematically unrelated.

Thematic relations also differ from ad hoc categories (Barsalou, 1983). An ad hoc category is goal orientated. It is a category purposely constructed to achieve a specific objective. It is defined as “sets that violate correlational structure and are usually not thought of by most people,” for example, “WAYS TO ESCAPE BEING KILLED BY THE MAFIA” or “WAYS TO MAKE FRIENDS” (see Barsalou, 1983, pp. 214 – 225; also see Barsalou, 1999, 2003). So the exemplars of ad hoc categories share a common goal-based property that translates as a shared function. For example, “joining a card playing club” or “having a garage sale” are members of the ad hoc category “WAYS TO MAKE FRIENDS.” This category of “WAYS TO MAKE FRIENDS” provides an “internal” relation that structures the members together. But the members do not perform any complementary role in the relationship they share. Whereas if we compare the thematic relation between a “car” and a “driver,” they perform external functions that complement each other within the “driving” theme. Stated differently, thematic relations provide conceptual coherence and meaning among a variety of different entities that share spatio-temporal dimensions and engage in reciprocal roles within that dimension. One important feature of thematic relations is that they are extrinsic and
complementary, that is, they occur between and across different entities and events (Lin & Murphy, 2001; Estes, Golonka & Jones, 2011). These features of thematic relations (i.e. external and complementary) contrast fundamentally with “internal” and similar relations described for taxonomic organizations.

In a series of elegant experiments, Lin and Murphy (2001) showed that when given the option for taxonomic and thematic relations, participants often prefer to categorize according to thematic relations, (e.g., the thematic pair cat and litter box was often preferred over the taxonomic pair cat and lion). They also demonstrated that thematic categorization supported induction of relevant properties, such as “having the same bacteria” for cat and litter box. One other important characteristic of thematic relations is that they play a significant role in conceptual processes such as similarity judgements.

Several studies have shown that thematic relations affect perceived similarity between different concepts. For example, Wisniewski and Bassok (1999) argued that the similarity between different items from different categories increases when they occur in the same thematic relation, relative to when they do not. They proposed that the type of cognitive processing that underlies and supports thematic reasoning could be fundamentally different from those that support taxonomic reasoning. They distinguished relations between concepts as “alignable.” In that, they can be compared through their intrinsic physical features or properties and “non-alignable,” i.e., concepts which cannot be compared because they possess very different features but could be “integrated” into a common role or theme. According to their view, thematic relations are compatible with the process of integration. As most thematically organized items possess external relations and play complementary roles, they usually have very different physical features that are incomparable.

Another line of work by Jones and Love (2007) also found that concepts were judged as more similar when they were presented in the same thematic sentence as opposed to when presented in thematically unrelated sentences. These studies provide empirical evidence on the strong effect of thematic relations on conceptual processes. Thus, in contrast to the vertical hierarchical structure of taxonomic organization, thematic organization seems to have a “horizontal” structure within which items have relations with a wide variety of concepts coming from different categories, therefore making the thematic structure more complex and intricate than what has been proposed for taxonomic organization.

4.0. Understanding the nature of abstract concepts

Most of what we know today about the nature of abstract concepts, their features, processing and representations come from studies and theories that have generally concluded
that abstract concepts are more difficult to process compared to concrete concepts. As presented in the beginning of this chapter, concrete words are known to have a processing advantage; they are recognized quickly (e.g., Kroll & Merves, 1986), remembered better (e.g., Paivio, 1971) and more resilient to brain damage (e.g., Coltheart, Patterson, & Marshall, 1980; Goodglass, Hyde, & Blumstein, 1969) compared to abstract words. This is referred to as the concreteness effect. Basically, the concreteness effect has been used as the basis to explain how abstract concepts differ from concrete ones, across various cognitive tasks such as learning, lexical decision, comprehension, recognition, memory etc. This section will begin with a summary of some of the traditional theories on the processing of abstract concepts founded on the concreteness effect, (e.g., Dual-Coding Theory, Context-Availability Theory and Conceptual Metaphor Theory), and highlight some of the shortcomings of these theories concerning the nature of abstract concepts. Then, it will give an overview of studies that have assessed some fundamental characteristics of abstract concepts outside the domain of the concreteness effect theories. Finally, it will conclude with a detailed account of the Contextual Constraints Theory and what it proposes as the principal nature of abstract concepts.

4.1. The Dual-Coding Theory

The Dual-Coding Theory, DCT, Paivio (1986) proposed the concreteness effect as an explanation for the differences between abstract and concrete concepts, and thus described the nature of abstract concepts through their lack of concreteness. The theory assumes that the fundamental difference between abstract and concrete concepts is that only concrete concepts are associated with imagery. That is, the concreteness effect results from representational differences in two cerebral systems, the imagery systems and the verbal (linguistic) system. Concrete concepts mainly contain imagery from modality-specific information (auditory, visual, tactile etc.) and are therefore processed in both the imagery system and the linguistic system. Contrary to this, abstract concepts are only processed by the linguistic system, because they contain limited perceptual information. The activation of either of these systems is based on the type of information conveyed by the concepts. According to DCT, since abstract concepts by nature have very limited physical perceptual referents, they are less likely to be processed in the imagery system. What this theory tells us about the nature of abstract concepts is that they are principally taken over by the linguistic system by virtue of the fact that they are heavily dependent on language. Hence, they are difficult to represent because of the singular mode of semantic representation. Note that the main line of argument here is that concrete concepts have a higher concreteness effect compared to abstract concepts
and therefore have a representational and processing advantage over abstract ones in many cognitive tasks such as comprehension, word recognition and recall. DCT does not give us any convincing and conclusive details on how the conceptual system processes and represents abstract concepts. Moreover, it is quite “simplistic” in our view to suppose that the complexity and the richness in meanings expressed by abstract concepts could be represented only by the verbal system.

Interestingly however, recent studies on abstract concepts have recognized that linguistic information alone does not account for all the representations of abstract concepts (e.g., Wilson-Mendenhall, Simmons, Martin & Barsalou, 2013; Pecher, Boot & Van Danzig, 2011; Wiemer-Hastings & Xu, 2005; Wiemer-Hastings, Barnard & Faelnar, 2004; Wiemer-Hastings & Graesser, 2000). DCT inherently still leaves us with the notion that abstract concepts are simply not “concrete” enough to benefit from facilitated cognitive processing.

4.2. The Context-Availability Theory

The Context-Availability Theory, CAT, (e.g., Schwanenflugel, 1991; Schwanenflugel & Stowe, 1989; Schwanenflugel & Shoben, 1983) uses the concreteness effect to explain the differences between abstract and concrete concepts by focusing on the differences in the amount of contextual information available in memory. In contrast to DCT, CAT postulates a single (amodal) system for representing the meaning of both abstract and concrete concepts. In other words, both types of words are represented by associating the word with relevant prior knowledge referred to as “context,” and the differences between processing abstract and concrete words are attributable to differences in the amount of available contextual information. The main idea to grasp here is that it is not about whether a context is produced or not, but rather how long it takes for a context to be constructed based on information from memory.

In trying to understand the nature of abstract concepts based on CAT, what it advocates is that abstract concepts are difficult to represent because their nature is such that they have less or limited context readily available in memory. Indeed, studies have shown that the availability of contextual information is highly correlated with concreteness. Thus, when a context is provided, the concreteness effect is annulled and abstract concepts are processed just as quickly as concrete concepts. Over a series of elegant experiments, Schwanenflugel and collaborators used the concreteness effect to explain why lexical access is faster for concrete items than for abstract items, why comprehension is quicker for concrete words compared to abstract words and why recall is better for concrete items than for abstract items (e.g., Schwanenflugel, Harnishfeger & Stowe, 1988).
The shortcoming of CAT for abstract concepts is that it does not readily explain the fundamental principles that govern the representation of abstract concepts. Though this theory provides us with an important characteristic about the nature of abstract concepts, (i.e., they require contextual information for their processing), it also leaves us with some more questions about the content and the organizational framework that structures abstract concepts.

4.3. The Conceptual Metaphor Theory

The Conceptual Metaphor Theory, CMT (e.g., Gibbs, 1992, 1994; Lakoff, 1986; Lakoff & Johnson, 1980; Lakoff & Turner, 1989) proposes that abstract concepts are represented partially through the modality-specific systems with the help of concrete relations using metaphors. Thus, the concept “anger” for example, could be metaphorically likened to the explosion of a volcano (e.g., Lakoff & Johnson, 1980). According to CMT, people use metaphors to create imagery that enables them to represent the meanings of abstract concepts, such as representing “time” as a horizontal line from left to right; “life” as a journey etc. Lakoff and Johnson (1980) argued that the metaphorical mappings that are used to represent abstract concepts (e.g., love is a journey) are conceptual and not just linguistic. Furthermore, the CMT proposes that spatially oriented words known as image schemas (Johnson, 1987) are often used to describe abstract relations, such as “far away,” or “staying in the present.” Over the years, the theory has evolved to include sensorimotor relations. For example, Casasanto (2009) reported that abstract concepts, which signify emotional valence, are represented partly by mental metaphors. People generally associate “up” and “right” with goodness and “down” and “left” with badness. He demonstrated that handedness affects whether people see positive or negative on the left or right side of space. Meier, Hauser, Robinson, Friesen and Schjeldahl (2007) reported that pictures which depict “goodness” are recalled better when they are presented at the upper part of a computer screen, however, pictures that depict “badness or evil” are remembered better when shown at the lower section of a screen.

The shortcoming in this theory is that there are no empirically proven cognitive principles that explain why certain metaphorical imagery is chosen to represent certain abstract concepts. As argued by Murphy (1996), CMT does not provide clear explanations as to the internal structure of abstract concepts. Rather, it supposes that the conceptual structures of abstract concepts are derived from the concrete schema (e.g., journey and volcano) upon which they are metaphorically mapped onto (e.g., love and anger respectively). Most critically, if CMT does not specify the content and structure of an abstract concept, it is difficult to determine which concrete schema or image would most suitably serve as a metaphor. In order for an
abstract concept to be mapped metaphorically onto a concrete schema, its contents must be similar in some way to those of that concrete schema, otherwise the representation would be baseless. In other words, the abstract concept must already have clear conceptual structure, which CMT can’t explain, much less any other theory to this point.

On this basis, Murphy (1996) argued that conceptual metaphor mapping alone cannot account for the rich representations of abstract concepts. Also, not all abstract concepts can be represented through metaphorical phrases. Hence, the mapping between metaphors and abstract concepts remains questionable. Barsalou and Wiemer-Hastings (2005) suggested that metaphors play a complementary role in representing abstract concepts in addition to our direct experiences with them. Therefore, though certain metaphors have succeeded in representing specific abstract concepts it is very far from explaining their nature, content and structure.

**5.0. Theories and studies on abstract concepts not based on the concreteness effect**

In our view, theories that seek to explain the content, structure and conceptual representations of abstract concept must take into consideration their “abstractness” rather than their lack of “concreteness.” We believe that in order to understand their abstract nature (i.e., what makes them abstract and what organizational principles underlie their conceptual representation and processing), we need a theory on abstractness.

The Contextual Constraints Theory, CCT, (Wiemer-Hastings, Krug & Xu, 2001) presented in section 2.2 to our knowledge is one of the very few theories that has taken into account factors that could underlie the abstract content of abstract concepts. It also accounts for the variations in the abstractness between different abstract concepts. We believe that understanding the factors which define abstractness could have a fundamental impact on experimental paradigms aimed at researching the organizational structure and representations of abstract concepts. One of the most fundamental assumptions made in this theory is that it is not just the intrinsic features of an abstract concept (i.e., the lack of physical referents) that makes it abstract but also, the abstractness of the constraints on situations within which the item is instantiated (Wiemer-Hastings et al., 2001). This is a very powerful assumption as far as our thesis is concerned and it will be developed later in this section.

**5.1. The characteristics of abstract concepts.**

I next offer a brief account of studies on abstract concepts that were not directly founded on the concreteness effect assumption, but which have equally shed light on some important characteristics of abstract concepts.

First, Wiemer-Hasting and Xu (2005) proposed that the basic characteristic of abstract
concepts is relational. That is abstract concepts often instantiate and express the subjective and introspective relations that are experienced within an event sequence. They argued, “abstract concepts are anchored in situations and regularly involve subjective experiences, such as cognitive processes and emotion” (Wiemer-Hasting & Xu, 2005, p. 731).

Second, the characteristics and properties of most abstract concepts are also abstract themselves (e.g., liberty as a feature for emancipation). In other words, their indeterminate and unconstrained nature of many abstract concepts come from the fact that their contents are also abstract (Wiemer-Hasting and Xu, 2005).

Third, abstract concepts portray considerable flexibility in terms of their unconstrained nature in the real world. In other words, different and novel exemplars of abstract concepts are easily invented for a category. For example, the abstract concept ‘a rule’ can be given several definitions and new exemplars can be invented for the category ‘rules’ (for a review see Hampton, 1981).

Fourth and most importantly, the types of featural information used in defining abstract concepts is mainly made up of behaviours, goals, agents, social attributions, in general, social situations and contextual information (Barsalou & Wiemer-Hastings, 2005; Wilson-Mendenhall, Barret, Simmons & Barsalou, 2011; Wiemer-Hastings & Xu, 2005; Schwanenflugel & Shoben, 1983; Hampton, 1981). All these studies on abstract concepts have reported that participants generate features and properties that describe and refer to situations, events and introspection than do concrete concepts. In other words, people often use situations to define abstract concepts. This particular nature of abstract concepts begs for further enquiry since it seems to be the main component upon which most previous research on abstract concepts agree upon. One interesting question that comes to mind is: Why are situations an integral characteristic for abstract concept processing and understanding?

Indeed as noted by Barsalou and Wiemer-Hastings (2005), all concepts including abstract ones are not used in a vacuum. That is, concepts are always part of a contextual background (Barsalou, 2003). Planes are contextually related to the sky and airports, cookers are contextually related to kitchens and swings are contextually related to playgrounds. However, when people are asked to define planes, cookers or swings, they rarely mention, airports, kitchens or playgrounds. Therefore, unlike concrete concepts that are defined by their internal perceptual features, abstract concepts on the other hand seem to need elements that are extrinsic, but contextually related to them in order to be defined. These extrinsic elements do not need to be necessarily perceptual. An abstract concept can be likened to a rich “cocktail” made from a variety of other diverse concepts, including introspective features, all embedded in a situation. Just like any cocktail, it is very difficult to determine all the
ingredients that went into it from a single taste. Similarly, it is difficult to define abstract concepts from a single perspective. One cannot evaluate an abstract concept without carefully assessing the contents or the elements that constituted the situation within which it is instantiated.

Several sources of evidence support the idea that abstract concepts by nature heavily depend on situations for their representation. The first line of work that supports this claim was mentioned in section (4.2) on the Context-Availability model (Schwanenflugel & Shoben, 1983).

The second line of evidence comes from studies presented by Barsalou (1999), which suggested that to represent the meaning of a concept like “TRUTH,” one needs a situation in which a speaker first states a fact about some aspect of the world to a listener (e.g., the sky is cloudy). Next the listener builds a mental simulation of the speaker’s statement. And afterwards the listener must verify the fact stated by comparing the statement with the actual state of the sky. If the facts concord with each other, the listener might accept the statement of the speaker as the “TRUTH.” If the facts do not concord, he/she might interpret the statement as “FALSE”. This example shows the complex and intricate manner in which a single abstract concept like “TRUTH” could be represented by using a situational background involving a speaker, a listener, physical events, mental events and processes etc. It is clear that without a situation, it would be almost impossible to represent the meaning of “TRUTH.”

A third source of evidence further suggests that situations are an integral part of the nature of abstract concepts. Using an oral characteristic production task, Barsalou and Wiemer-Hastings (2005) found that when participants were asked to describe the features of abstract concepts, they mentioned situations that included settings, events and introspective elements. Barsalou and Wiemer-Hastings (2005) suggested an important characteristic of abstract concepts is their situational focus and content. Specifically, the central focus for processing abstract concepts is orientated towards various elements of situations including communication, introspections, emotions and social institutions. This focus most often involved other abstract concepts, hence creating a large and complex cluster of concepts that make it difficult for abstract concepts to be constrained into neat intrinsically-defined categories.

A fourth line of evidence comes from studies reported by Hampton (1981) that also implicates situations in the processing of abstract concepts. Hampton (1981) suggested that the features produced for abstract concepts mainly describe situations. Using a property generation task, Hampton asked participants to produce properties for abstract concepts such as “A RULE.” He observed that the properties generated described social and situational
meanings, statements and consequences that included (“is for protecting the safety of others.” “is something followed,” “made up by some group of people”). Hampton concluded that abstract concepts are flexible and mainly elicit features that involve some kind of social meaning of action, behaviour or motive.

Finally, Katja Wiemer-Hastings, (1998) used a computational neural network approach to investigate the role of context in the representation of the meaning of abstract concepts. The network was used to assess how contextual information could be used to determine the meanings of abstract nouns. This study assessed only six abstract nouns with 100 sentences per noun. The sentences were fed into an artificial neural network that could classify the majority of the target nouns correctly from the contextual information provided. The features taken from the contextual information were used to successfully differentiate and determine the meaning and the similarity between most of the abstract nouns, thereby implying that semantic contextual information is relevant in the processing of abstract words.

5.2. The Contextual Constraint Theory revisited

The Contextual Constraint Theory, CCT (Wiemer-Hastings et al., 2001) provides further theoretical support for the centrality of contextual information in the representation of abstract concepts. According to this theory, abstract concepts are contingent on certain elements that form part of a situation. These situational elements play the role of contingencies upon which abstract concepts depend for their representation. The contingencies could take the form of events, actions, mental states or circumstances expressed in situations. The theory refers to these contingences as part of the “contextual constraints.” Thus, the type of contextual constraints upon which an abstract entity depends determines whether it could be represented in many or few situations.

Our current study follows the line of reasoning proposed by the CCT and PSS, because they are the theories that principally place situations at the core of abstract concept processing. We have outlined several studies and theories that capture the characteristic nature of abstract concepts. To summarize, abstract concepts represent diverse relational structures across different components in situations, hence, causing them to have fewer typical and less distinct exemplars compared to concrete categories (Wiemer-Hastings et al., 2004). They are heavily dependent on language and contextual information. They are less polymorphous in structure, namely, instances and featural definitions for them are unlimited and show a greater liberty for numerous combinations across situations. Abstract concepts relate different parts of situations together, they are more flexible and form part of the situation within which they occur. It is therefore logical to suppose that the semantics of abstract concepts can be
modified substantially depending on the situation, and that they are therefore impoverished when studied in isolation.

The particularities of abstract concepts seem to suggest that it is important to assess them in their own right by relying on features that are relevant to them, instead of using comparative methods, relative to concrete concepts. That is, it is important to make situations a central focus in their assessment. This brings us to the main objectives of our present thesis, which are as follows. First, we focus on abstract concepts alone, rather than on the mere differences between them and concrete concepts. Second, we assess abstract concepts by taking into account one of the most important aspect relevant to them, namely, situational information. Simply stated, our aim is to assess the role of situational information and of thematic organization in the conceptual processing and representation of abstract concepts.

6.0. Semantic knowledge organization and abstract concepts

The objective of this section is to present and discuss the assumption that taxonomic principles of organization may be less adaptable to the representation of abstract concepts than to concrete concepts. Conversely, thematic organization may be more appropriate for their conceptual representation and organization.

6.1. Taxonomic organization and abstract concepts

We mentioned under the section on taxonomic organization that concepts that are taxonomically related resemble each other by virtue of their shared properties. Wisniewski and Bassok, (1999) suggested that the properties of stimuli affect the way in which they are processed and hence, the type of cognitive processes involved. In other words, different properties of concepts are compatible with different cognitive processes. They argued that the physical features of concrete concepts make them “alignable,” facilitating a comparative type of processing for classification into categories. For example, cars and trucks are alignable because they have a similar function and share common physical features that classify them to be modes of transport. However, car and mechanic are not necessarily alignable, and therefore are less likely to be classified using comparative processes.

The cognitive processes that are used to carry out taxonomic classification involve the comparison of features of the concepts themselves. Such classifications are based on the intrinsic features of the objects, enabling them to be classified into distinct groups. In other words, the cognitive processing underlying taxonomic classification involves comparing the features of exemplars to the features of the superordinate category and deciding whether there are similarities between them (Murphy, 2002).

As described under the section on the nature of abstract concepts, most of their
features are not physical and hence not as distinctly pronounced. Moreover, most of their properties are made up of situational elements. Hence, it would seem that comparative processes would be less suitable for the classification of abstract concepts, since their properties are less alignable along the lines of physical perceptual features. For example, the situational features that instantiate the concept “idea” are very different and diverse from those for “determination.” It would therefore be very difficult to directly compare them along taxonomic relations, even though we could consider both concepts as being a form of mental state. Wiemer-Hastings et al. (2004) suggested that taxonomic relations have very little representational effect on abstract concepts, because taxonomic classes for abstract concepts are neither salient nor distinct. Moreover, due to their less constrained nature, similarity judgements of abstract concept pairs are less influenced by taxonomic similarities and hence their processing may be less dependent on taxonomic abstract categorization principles.

In a series of studies, Wiemer-Hastings et al. (2004) assessed the effect of prototypicality on categories of abstract items using an exemplar generation task. They observed that, overall, the number of abstract exemplars which were rated as typical for abstract categories were reliably lower compared to concrete items. In a second experiment, they tested the similarity ratings for abstract and concrete items belonging to the same categories compared to items belonging to different categories. They observed that though the similarity ratings for both concrete and abstract items belonging to same categories were significantly higher than those belonging to different categories, this difference was significantly smaller for abstract items than for concrete items. That is, compared to concrete items, the category distinctness for abstract concepts is very low, indicating a high level of overlap between different abstract categories. Wiemer-Hastings et al. (2004) therefore concluded that since abstract concepts have fewer prototypical exemplars, coupled with lower distinctness between its members, taxonomic organizing principles do not define categories of abstract items in the same manner as they do for concrete categories.

Hampton (1983) argued that the Network models or Spreading Activation models, which have been proposed to support taxonomic relations hardly apply to the representation of abstract concepts, because they have a weak graded structure. Abstract concepts by their nature, do not always fit into set hierarchical networks proposed for concrete concepts. One can therefore understand why it may be difficult to structure abstract concepts within a classic taxonomic framework. It is important to note that the argument being conveyed here is not that taxonomic organization can never be used to organize or represent abstract concepts. Rather, what is being explained here is that overall, very few abstract taxonomic categories exit for abstract concepts. And within the few that exist, their exemplars have very loose
category membership (Hampton, 1983, Wiemer-Hastings et al., 2004). The fundamental question then is, what kind of organizational structure best suits the relations between abstract concepts?

6.2. Thematic organization and abstract concepts

Studies focusing on the nature of abstract concepts have shown that categories of abstract concepts overlap with each other on many dimensions (Hampton, 1981; Miller & Johnson-Laird, 1976). For example, Wiemer-Hastings, Barnard and Faelnar (2004) found that participants often rated abstract concepts pairs from different categories, (e.g., anger and thought from emotions and cognitive processes categories respectively) as being more similar compared to concrete concepts from different classes (e.g. dog and fence).

Indeed, Wiemer-Hastings et al. (2004) proposed that one of the main practical purposes of organizing items into taxonomic categories is to allow for inferences to be made between items for situated action. Thus, knowing that a cat and an unknown entity named “zizzao” are both pet animals could facilitate what to do with “zizzao,” even though one has never seen it before. In contrast for abstract concepts, they proposed that when a person is sad, knowing that sadness is an emotion and that it is taxonomically related to happy, fear or anger does not facilitate the practical understanding of the concept sad, neither does it facilitate any inferences on what to do about a new unknown emotion. However, understanding how sadness interacts thematically with other concepts from other categories, such as “finding solutions” could be more helpful in relating to it. They argued that abstract concepts generate their cohesion from the thematic relations that they share with other concepts within a temporal and/or causal sequence of events. For example, giving advice, or proposing an idea to solve a problem or simply giving comfort, might be more useful in situating the concept of sadness relative to a specific situation that caused it. Clearly this could explain why thematic relations between abstract concepts play a central role in their representation.

It is important to caution here that we are not saying that abstract concepts do not exist within taxonomic categories at all, nor benefit from such structure. What we intend to convey is that abstract taxonomic categories are less adapted to representing abstract concepts in view of their fundamental nature and characteristics. And, conversely, thematic organizational structures and categories might be more suitable for their semantic representation and conceptual processing.

Evidence supporting the assumption that thematic organization could be more adapted to the organization of abstract concepts comes from neuropsychology and fMRI studies.
Researchers from the neuropsychological domain have proposed the view according to which the differences in the organizational structure between abstract and concrete concepts is one of a qualitative nature rather than quantitative (e.g., Warrington & Crutch, 2007; Crutch, 2006; Beedin, Saffran & Coslett, 1994). This view supposes that the representation of abstract concepts relies principally on their semantic association with other concepts, whereas concrete concepts rely heavily on featural and semantic similarity principles.

In a series of interesting experiments, Crutch and Warrington (2005) found and suggested that the principles of organization underlying abstract concepts could be fundamentally different from those for concrete concepts. Crutch and Warrington observed that patients with semantic refractory disorder showed a significant interference for abstract words inserted in an array of other abstract words organized by association (e.g., joke in an array that included funny) as compared to an array organized by taxonomic relations (deceit in an array that included trick). Semantic refractory access disorder, is a neurological phenomenon whereby a patient’s ability to process a series of stimuli presented in rapid succession deteriorates over time. Using stimuli consisting of synonymous abstract words, they observed that the refractory deficit for thematically related abstract concepts was significantly higher compared to that of taxonomically related abstract concepts stimuli, implying a “semantic contextual association” interference for abstract concepts. The reverse pattern was observed for concrete words, that is, they showed greater interference in arrays organized by semantic similarity compared to arrays organized by association.

Crutch and Warrington argued that abstract concepts are more likely therefore to be represented in an associative neural network than are concrete concepts. In other words, the representational system for abstract concepts is based on their association with other concepts irrespective of their individual category membership, hence the presence of stronger thematic relations. Crutch and Warrington emphasized that since abstract concepts have multiple meanings based on contextual information, an associative network provided a better representational framework for multiple meanings than hierarchical networks (Crutch & Warrington, 2005). This qualitatively different organizational network theory as opposed to the concreteness effect explains an important nature of abstract concepts by postulating that abstract concepts primarily activate their semantic associates, such that their conceptual content is derived from associative and thematic relations.

Another line of work that further supports this claim comes from observation in healthy participants. Using a picture-world paradigm, Dunabeita, Aviles, Afonso, Scheepers and Carreiras (2009) presented participants with oral sentences containing either an abstract or a concrete target word and with visual scenes that contained a target object. On critical
trials, the oral target word was thematically associated with the visual target picture. (e.g., hearing the word *happiness* and seeing a visual item *smile*). They observed that eye fixation onto the visual target was quicker for pictures which were thematically associated to the abstract target words. Thus, upon hearing an abstract word, the attention span of participants was rapidly engaged towards and stayed longer on target pictures that were thematic associates of the word.

Finally, Wiemer-Hastings and Xu (2003) assessed the effect of thematic integration on the similarity judgements of abstract concepts. Wiemer-Hastings and Xu suggested that given the nature of abstract concepts, the cognitive process of thematic integration might be more suitable for their processing and representation compared to taxonomic comparison. Using a similarity-rating task, with justifications for responses, Wiemer-Hastings and Xu (2003) assessed the effect of taxonomic versus thematic relations on similarity judgements between abstract and concrete word pairs. They predicted that because abstract concepts are flexible and are less constrained into their category membership, they would be easily integrated into meaningful thematic relations even when they belong to different taxonomic categories compared to concrete concepts. In their study, Wiemer-Hastings and Xu (2003) found evidence confirming their predictions. They observed that pairs of abstract concepts that were not taxonomically related (e.g., *purchase* and *melancholy*) were reliably rated as being highly similar and some of the justifications given by participants were, for example, “*occasionally, purchases lead to feelings of remorse which may lead to melancholy*” (Wiemer-Hastings & Xu, 2003, p. 1240). This implies that the similarity judgement between “*purchase* and *melancholy*” was derived from the construction of an integrational thematic relation between the two concepts. Wiemer-Hastings and Xu, (2003) argued that participants were able to construct meaningful scenarios that enabled them to thematically integrate the two concepts. This observation was not made for concrete concepts. In other words, abstract concepts mostly represent and capture relational sequences between events and thus, are mostly compatible with thematic organization.

In summary, the quantitative differences between abstract and concrete words evolved from *concreteness effect* theories, and were based on the quantity of information available during the processing of abstract or concrete concepts. The underlying assumption was that the processing of concrete concepts involved greater amounts of information (verbal and perceptual) compared to the processing of abstract concepts (only verbal), as explained by DCT (Paivio, 1986). The second assumption was that the quantity of contextual information readily available for the processing of abstract concepts was lower compared to concrete concepts, as proposed by the Context-Availability Theory (Schwanenflugel & Shoben, 1983).
However, recent work on abstract concepts has revealed that this difference might be more of a qualitative nature rather than quantitative, based on the type of organization for the two kinds of concepts. This type of account (e.g., Breedin et al., 1994; Crutch & Warrington, 2005) suggests that abstract words activate predominantly other words that are related to them by a variety of associations and thematic relations (e.g., judgement and punishment rather than judgement and sentence), and that an associative neural network may have a greater capacity to accommodate the multiple and dynamic meanings generated by abstract concepts.

6.3. Abstract concepts, situated conceptualizations and thematic organizations

Almost all abstract concepts exit, act or interact with other entities. In other words, abstract concepts conserve some sort of relations with other concepts within a specified spatio-temporal context. Thus, abstract concepts almost always have a representational background that contains entities, elements and relational information about the nature of the concept in question. This means that contexts or situations within which an abstract concept exists could provide relevant and meaningful information about how the conceptual system processes the concept.

Many empirical studies have demonstrated the presence of extensive situational information as people use and mentally represent abstract concepts (e.g., Barsalou & Wiemer-Hastings, 2005, Wu & Barsalou, 2009; Hampton, 1981). For example, the mental representation of the concept “care” might include two agents in a hospital, on the street or at an airport etc., where agent A offers help or shows empathy or sympathy to agent B who is in distress. Depending on the goals or the reasons why a person needs to mentally represent the concept care, some focal elements in the settings enlisted above may become more salient than others (Barsalou, 1999). For example, if a person is expressing care to a strange child, semantic knowledge about the caregiver’s age, legal implications, parenting skills etc., may become salient and more accessible for conceptual processing than if the care was extended to an adult. Thus, as much as relevant situations are important to the processing of abstract concepts, depending on the goals or intentions, certain situational information becomes more salient and hence pertinent than others. We refer to situated conceptualization as the salient organization of the most relevant settings, agents, behaviours and introspective states required for the conceptual representation of concepts within a meaningful situation. Stated differently, situated conceptualization enables the most pertinent core contents of abstract concept to be grounded in relevant situations (Barsalou, 2003, 2005; Barsalou, Niedenthal, Barbey, & Ruppert, 2003; Wilson-Mendenhall, Barrett, Simmons & Barsalou, 2011).

A Situated Conceptualization is usually defined as the “representation of a concept in
a background situation” (Wilson-Mendenhall et al., 2011, p. 4.). According to this view, abstract concepts develop to represent situated conceptualizations of situations and events within which the core elements of the concepts are experienced. As evoked under section (5.0 - 5.1), the content of most abstract concepts may include situational entities and information such as people, objects etc., as well as other relational abstract concepts representing subjective experiences and introspective states. For example, the situated conceptualization for the concept “convince” may arise from one’s experience in a situation where an agent interacts with another agent with the aim of getting them to change their mental state, (Wilson-Mendenhall et al., 2013).

Considering the numerous studies which have supported the idea that abstract concepts rely heavily on situations, introspective and relational information (e.g., Barsalou, 1999; Wilson-Mendenhall et al., 2011), we advance the assumption that situated conceptualizations play a central role in the representation of abstract concepts (Barsalou, 2005). Specifically, we assume that since abstract concepts like “care” have situations as their referents, in order to process them the conceptual system brings together a group or combinations of entities such as settings, agents, objects, people, actions, events, introspections, intentions, such that different instances and meanings of the concept “care” could be represented in accordance with the situation framing the concept. For example, a situated conceptualization for “care” could be simulated in a hospital between patients and doctors, in a home between parent and child, in a marriage between husband and wife or at schools between teachers and pupils. In each situated conceptualization, a different set of entities combine to represent the concept “care,” such that the subtle nuances in the different semantic interpretations for “care” becomes salient and meaningful.

So, situated conceptualizations seem to play a major part in producing the variations in meanings of the same abstract concepts across several situations. Thus, if different situated conceptualizations could represent the same abstract concepts with respect to the situation being experienced, then it will imply that different sensory modalities that process the agents, objects, actions, events, introspections are likely to be engaged in situating the concept. Hence, extensive variability and flexibility in our understanding and representation of abstract concepts as a function of the situation within which they are instantiated are grounded partly in modality-specific systems (Barsalou, 1999).

Furthermore, novel situated conceptualizations are constructed and emerge “online”, corresponding to the current situations being experienced (Wilson-Mendenhall et al., 2011). When faced with a new and/or unfamiliar abstract concept in a situation, novel situated conceptualizations could be constructed such that relevant information from the situation is
integrated with semantic knowledge from long-term memory. As a consequence, a “situationally” adapted novel situated conceptualization emerges, making the abstract concept meaningful. The construction of novel situated conceptualizations in situations with abstract concepts instantiated in them is central for our predictions, as well as for the interpretations of some of our results in this thesis.

More crucially, we assume that thematic organization could be an essential part of the novel situated conceptualizations used to represent abstract concept in situations. We assume that novel situated conceptualizations and thematic organization or “situated thematic conceptualizations,” allow the cognitive system to represent and process abstract concepts embedded in texts. A novel situated thematic conceptualizations brings together the most optimal thematically organized entities such as agents, actions, events-sequences and introspective states needed to simulate the content of an abstract concept within a meaningful situational background. Thus, a specific abstract concept could be processed differently as a function of the situation within which it is experienced. As a result, a cluster of semantically dissimilar abstract concepts could be thematically reorganized with each other in dynamic situations.

The literature on cognitive psychology and neuroscience is still relatively impoverished in theories and models that explain the conceptual representation of abstract concepts. We believe that perceptual symbols, and most specifically, situated conceptualizations provide a plausible explanation for how the conceptual system processes, organizes and represents abstract concepts. The hypothetical reasoning for the current thesis is therefore based on the views advanced by PSS and Situated Conceptualization theories. In that, we aim at providing support for the prediction that relevant situations play a central role in the emergence of novel thematic reorganization of abstract concepts through the construction of “novel situated thematic conceptualizations.”

6.4. Cultural effects on categorization

Because humans are social beings, social norms and cultural beliefs affect the thoughts and behaviour of people. This being the case, it appears that people from different societies and with different cultures process information from their environment differently. Extensive research from the social psychology have shown that people from different parts of the world have different cognitive styles when asked to perform certain tasks such as categorization, similarity judgements and decision-making (e.g., Nisbett, Peng, Choi, &
One area of research that has dominated cultural psychology is the differences in cognitive styles between Asian and European-influenced (or Western culture) societies. Generally speaking, East-Asian societies have been claimed to be predominately holistic, collectivist and orientated towards the group, whereas Western societies are claimed to be predominantly analytic and individualistic in cognitive orientation. As, Chiu (1972) reported: “Chinese are situation-centred. They are obliged to be sensitive to their environment. Americans are individual-centred. They expect their environment to be sensitive to them. Thus, Chinese tend to assume a passive attitude while Americans tend to possess an active and conquering attitude in dealing with their environment. [The American] orientation may inhibit the development of a tendency to perceive objects in the environmental context in terms of relationships or interdependence. On the other hand, the Chinese child learns very early to view the world as based on a network of relationships; he is socio-oriented, or situation-centred” (Chiu, 1972, p. 241).

In general, holistic thought is defined as mental states and cognitive processes focused on the context or relationship between an entity and its environment. Its orientation is based on association between different elements, and it reflects continuity, change and consideration for multiple perspectives. This focus on relationships and roles between concepts and their contextual elements is essentially what thematic organization is about, in view of the fact that thematic relations are based on external relations between concepts from different semantic categories. Conversely, analytical thought is linked to taxonomic organization, which on the other hand is focused on decontextualizing structures from relations and the use of rules about physical intrinsic features to predict categories. Analytic thought processes view entities as separate from their environment, and power is attributed to the individual, whereas holistic perspectives attribute power to the group (Nisbett et al., 2001).

Substantial evidence from cross-cultural studies and socio-cognitive psychology have shown that culture affects categorization and perceived similarity between concepts. For example, Norenzayan, Smith, Jun Kim and Nisbett, (2002) showed that East-Asian thought is more holistic, whereas Western cultures that have been previously influenced by Greek civilization exhibit more analytic thought. Masuda and Nisbett (2001) argued that East-Asians use contextual elements in situations more often when making similarity judgements than their Western counterparts. In their study, Norenzayan et al. (2002) showed that East-Asian participants were more likely to base their similarity judgements of concepts on holistic properties of the concepts compared to Western participants who used individual properties or
features of the stimuli to judge their similarity. In this sense, analytic thought is implicated to taxonomic organization, which is attributed to Western culture, whereas, thematic organization is associated with holistic thought and hence attributed to East-Asian culture. Unsworth, Sears and Pexman (2005) went a step further to show that cultural differences could also affect the activation of semantic concepts in participants of Western and Chinese background. In one of their experiments, participants were shown a picture prime (e.g., car) and then a picture target that was either taxonomically related (e.g., bus) or thematically related (e.g., tire) to the target. The hypothesis was that if Westerners used analytical cognitive styles, then their responses latencies would be shorter for the taxonomic pairs compared to those for the thematic pairs. Their results confirmed their predictions, indicating that Western participants responded faster to the taxonomic pairs compared to the thematic ones. Unsworth, Sears and Pexman concluded that Westerners predominately activated mostly concepts which shared categorical relations with prime concepts. Thus taxonomic organization between concepts was more salient for the Westerners compared for the Chinese.

One may ask at this point, how do such cultural dichotomies affect the objectives of this thesis? If indeed Westerners are claimed to have a predisposition for analytic thoughts, and hence, more prone to processing information based on taxonomic organizational principles, and if most of their cognitive processes such as categorization, similarity judgement, problem-solving etc., are achieved from uni-dimensional rule-based reasoning, then the issues that interest us are:

*Are Westerners able to categorize abstract concepts using thematic relational information? If so, under what conditions could Westerners be “induced” to manifest thematic organizational thinking patterns for conceptual processing of abstract concept?*

If one assumes that Westerners are analytical by nature, and hence, are most likely to produce taxonomic organizational thought patterns during conceptual processing as indicated by the studies presented above, then are we taking a risk in trying to engage them in conditions where a conceptual thematic reorganization is expected to take place? Does that mean that our hypothesis is flouted in doubt from the start? Upon what basis are we then assuming that there would be an emergence of thematic reorganization between abstract concepts experienced in situations? Indeed, these issues are worth discussing as we intend to use participants from western cultural backgrounds in our studies.

Recent theories within the cross-cultural literature are beginning to pioneer the view that the holistic – analytic dichotomy attributed to Chinese and Westerners respectively is not as mutually exclusive as it may appear to be, and that there could be considerable overlap between the two depending on the cognitive task at hand. For example, across several
cognitive tasks, Saalbach and Imai (2007) did not find any reliable differences between Chinese and German participants concerning their taxonomic or thematic organizational patterns. Similarly, in all three of their experiments, Unsworth, Sears and Pexman (2005) observed that the Chinese participants were equally likely to activate both taxonomic and thematic relational pairs. Specifically, concepts that belong to the same taxonomic category were equally activated and as quickly as concepts that were thematically related to each other.

In summary, the literature on cultural effects in categorization styles is not conclusive but rather suggestive. Moreover, so many ecological factors such as language, education and the type of cognitive task demanded could affect the outcomes of such effects. Indeed, the purpose of the current study was not to directly investigate cultural differences on thematic or taxonomic organizational styles, although it is a factor that we should not totally ignore. The aspect of this phenomenon that mainly concerned the current thesis is whether situations could influence conceptual reorganization produced by our participants, assuming that they are more likely to sort concepts taxonomically. Within the cross-cultural literature, two schools of thoughts oppose each other on the explanations attributed to the different cognitive predispositions between Westerners and East-Asian people. The theory of universality of cognition assumes that fundamental cognitive processes such as categorization, reasoning, inference, decision-making, similarity judgements etc., are innate and resistant to social situations and changes (e.g., Hirschfeld, 1996, Sperber, 1985). The alternative standpoint to universality is the theory of “culture as a situated cognition” (e.g. Oyserman & Lee, 2007; Oyserman & Lee, 2008; Resnick, 1994), according to which culture is situated, such that people adapt their cognition to the pragmatic of problem-solving within the constraints of specific situations. This view argues that culture is internalized in the form of a loose network of knowledge such as categories and naïve theories (Bruner, 1990; Strauss, 1992). Thus, possessing a particular disposition to organize concepts taxonomically or thematically does not prevent one from switching between the two when the situation demands. This dynamic constructivist approach entails the notion that situations prime the conceptual organizational style with respect to the stimuli presented to people (e.g. Oyserman & Lee, 2007). It assumes therefore that people in general are capable of both taxonomic and thematic organization of concepts, independent of their cultural background.

As far as our objectives are concerned, the universality theory would predict that considering the western cultural background of our presumed participants, they would be expected to reorganize the abstract concepts taxonomically despite the situational information in which the concepts are processed, experienced and instantiated. Conversely, the “culture as situated cognition” view, would assume that despite their western cultural backgrounds and
education, the type of organization that will emerge depends on the situations within which the abstract concepts were meaningfully processed and experienced. Thus, Western participants should be quite capable of generating thematic reorganizations as a function of relevant situations.

6.5. Basic forms of relatedness: Taxonomic is to comparison as thematic is to integration

The judgement of relatedness between concepts consists of the perception of how similar concepts appear to people during their interaction with them with respect to certain criteria or cognitive principles. The principles by which perceived similarities are judged may include semantic features, perceptual properties, cognitive functions, temporality, as well as the co-occurrences and/or associations of concepts in the same scenario or context. Consequently, relatedness judgements based on perceived similarity could be interpreted from diverse relations which concepts generally entertain between each other with respect to or independent of contextual elements.

One basic possibility is that similarity relations are taxonomic, namely, similarity based on comparing the commonalities and differences between the semantic features and perceptual properties of concepts, independent of contextual elements (e.g., Rosch & Mervis, 1975; Hampton, 1979). Most classic models of similarity such as the Structural Alignment Model (e.g., Markman & Gentner 2000) and the Contrast Model (e.g., Tversky, 1977) have mainly defined the cognitive process of similarity along the lines of comparison between features, properties and physical functions of concepts. Furthermore, the representational structure of one concept is aligned with the representational structure of another concept, such that the featural dimensions of one is mapped onto the analogous dimensions in the other. For example, the tail of a “dog” is aligned with that of a “lion,” revealing a commonality, and the roar of the “lion” is compared with the bark of the “dog,” showing a difference. As a consequence, comparison elicits alignment which leads to the judgement of similarity based on the detection of commonalities and differences (Gentner & Markman, 1997; Tversky, 1977). Thus, concepts that belong to the same taxonomic category tend to share more featural commonalities than concepts that do not (Mervis & Rosch, 1981), but they also have more differences related to these commonalities (Markman & Wisniewski, 1997), compared to concepts from different taxonomic categories. Thus, the properties of taxonomically related concepts make them more compatible with the comparison process that drives similarity judgements (Wisniewski & Bassok, 1999).

More recently, new theories of similarity have proposed that there is more to similarity
than comparison between semantic features and properties. In particular, similarity can also be perceived as an integration process that utilizes thematic relation, that is, similarity based on complementary functions and the co-occurrences of different concepts in the same situation/context (e.g., Wisniewski & Bassok, 1999; Gentner & Gunn, 2001; Estes, 2003). Wisniewski and Bassok, (1999) argued that thematic relations are more compatible with the cognitive process of integration than to comparison because the latter relies on the perceptual features of concepts and hence draws upon taxonomic relations between concepts. Based on these assumptions, they proposed the Stimulus-Compatibility model. According to this model, concepts that belong to the same taxonomic category are alignable because they share features and structural relations. In contrast, nonalignable concepts with no featural commonalities have less structural relations and thus rely more on thematic integration for similarity judgements. For example, the pair “milk-cow” is judge to be similar based on their thematically integrated relations (Wisniewski and Bassok, 1999).

Moreover, two concepts that have an extant thematic relation (e.g., cow-milk) are judged to be similar; two concepts that have an extant taxonomic relation (e.g., coffee-milk) are also judged to be similar. However, two concepts that have no pre-existing thematic or taxonomic relation, i.e. completely unrelated (e.g., paediatrician-cat) may also be judged similar through newly derived thematic integrations. That is, participants may invent new thematic relations between unrelated concepts in order to thematically integrate them, such as by saying, “a paediatrician might own a cat” (Bassok & Medin, 1997). Wisniewski and Bassok (1999) concluded that most often, participants create “arbitrary” thematic relations between nonalignable concepts that are unrelated (e.g., “an electrician doesn’t repair chairs” for the similarity between the pair ‘chair-electrician’). This implies that even in the absence of pre-existing thematic relations, participants are able to instantly construct novel thematic integrations (Estes, 2003). This account is very important to our work, since we intend to show that novel thematic organizations could emerge between different clusters of abstract concepts, after their instantiation in situations.

An important question is why do people often thematically integrate unrelated concept pairs rather than taxonomically comparing them? Wisniewski and Bassok (1999) suggest that since thematic relations instantiate concepts that are dissimilar (but that co-occur and play complementary roles in the same scenario or event), it is much easier to thematically integrate dissimilar and unrelated concepts than to compare them on taxonomic basis, since the latter typically requires that the two concepts have at least some relatively obvious featural overlap.

Despite the large body of evidence indicating the important role that thematic integration plays during similarity judgements, not many studies have assessed the same
phenomenon for abstract concepts. One of the very few studies dedicated to assessing the effects of thematic integration on similarity judgements between abstract concepts was carried out by Wiemer-Hastings and Xu (2003). They argued that abstract concepts have the capacity to represent temporal sequences expressed in events, because they are flexible and can be used to describe a wide variety of situations. In view of this, they showed that thematic integration between abstract concepts is easily achieved through flexible construction of new thematic relations between them, even when the concepts have no pre-established taxonomic relations.

For example, Wiemer-Hastings and Xu presented participants with abstract concept pairs that were either taxonomically related (e.g., sadness – surprise) or thematically related (e.g., weight – fullness) or unrelated (e.g., melancholy – purchase). They asked participants to rate the similarity of each pair and justify their responses. They observed that participants often thematically integrated abstract concepts pairs which were taxonomically related. That is, despite underlying taxonomic relations, participants ignored the latter and thematically integrated (sadness – surprise). Hence, the latter were thematically integrated into a meaningful relation by participants such as ‘sometimes, surprises are bad, which can lead to sadness’ and consequently were judged as being similar (Wiemer-Hastings & Xu, 2003, p. 1241). Interestingly and more crucial to our work, Wiemer-Hastings and Xu also observed that abstract concept pairs that had no pre-existing thematic or taxonomic relation (i.e., unrelated; e.g. melancholy – purchase) were often thematically integrated by the construction of thematic scenarios such as “a person may purchase a life long dream or wish and find out that they are unhappy with their purchase” (Wiemer-Hastings & Xu, 2003, p. 1240). They argued that the flexible nature of abstract concepts facilitates the construction of novel and creative thematic relations between them.

In view of these arguments (described above), similarity judgements would seem to be one of the best test-beds for assessing the presence of thematic reorganization between different abstract concepts that co-occur in the same situation. By investigating the extent to which similarity judgements for unrelated abstract concepts pairs are sensitive to situational information, we obtain evidence regarding the effect of situations on the thematic integration, and hence, on the reorganization of abstract concepts.
Chapter II

Linguistic co-occurrences, word associations and priming effects on semantic knowledge organization

7.0. Introduction

People’s encounters with words, in terms of how they co-occur in linguistic contexts, have been known to influence language acquisition as well as the organization of knowledge in semantic memory (Kwantes, 2005). Specifically, the co-occurrence of words both at the local level (two words appearing next to each other) and at a global level (words that co-occur at non-adjacent positions in text) affects several cognitive processes such as similarity, lexical priming and recall (e.g., Coane & Balota, 2011; Simmons & Estes, 2006). In this second part of the theoretical background for the current thesis, we will succinctly present a few models and theories on how word co-occurrence influences the organization of semantic knowledge and explain their relevance to our work. Later we will discuss their implications with respect to certain aspects of our results in the General Discussion.

7.1. Priming effects on semantic knowledge organization

Semantic knowledge consists of the general world knowledge that people acquire regarding concepts and the relations between them. The notion that previously acquired knowledge is used to understand and recall new information dates back to Bartlett (1932). Over the years, the main classic paradigm for assessing the organization of semantic memory has been the semantic priming task. Thus, semantic priming could be considered to reflect, to a certain extent, the similarity or the proximity of concepts in semantic space. On that account, semantic priming could reveal underlying conceptual relations and similarities between concepts in the semantic system.

The literature on semantic priming gives us numerous findings, theories and models concerning the parameters of semantic priming and how it could affect conceptual organization (e.g., Hutchison, 2003; McNamara, 2005; Lucas, 2000; Meyer, Schvaneveldt & Ruddy, 1975). Our interest in priming here in this thesis is surgically and succinctly focused on differentiating between standard semantic priming and the emergence of thematic organization between concepts as a function of their co-occurrence in naturalistic situations recently experienced. Although priming as whole is not the focus of this thesis, we consider it necessary to briefly address different sources of priming, as well as different models that explain the organization of knowledge, based on how information recently experienced is
supposedly primed from memory. In this section, we briefly summarize the most relevant models of priming. Later in the General Discussion, we will assess whether any of them could account for effects of situational information and thematic reorganization between abstract concepts as per our main hypotheses.

7.2. Models of priming

7.2.1. Spreading Activation models of priming

Spreading Activation Models for explaining priming effects originate mainly from classic semantic memory network theories (e.g., Collins & Quillian, 1969; Anderson, 1976; Collins & Loftus, 1975). As described previously (Ch. I, section 1.4.), these models propose that concepts are represented holistically as nodes in a densely interconnected network. Because each node represents a concept, and because connections between nodes represent semantic relations between concepts, the retrieval of information from memory arises from the activation of an input concept that spreads through the network. The main assumptions in this model are that, first, the intensity of activation arriving at any particular node is a decreasing function of the number of connections (distance) that the activation has to travel. Second, associations between two concepts are mainly based on their shared category membership (i.e., number of shared connections). For example, cat and dog are associated and related because they belong to the same category of animals. Thus, priming essentially emanates from a pre-activation of the target word through its category association with the prime.

7.2.2. Feature-based models of priming

Feature-based Models, also known as distributed representation models, assume that concepts are not represented by individual holistic nodes, but rather a distribution of features of concepts across different brain regions are responsible for semantic priming (e.g., McRae, 2004; Masson, 1995). Thus, the more features two concepts share, the more similar or associated they are. When a prime is presented, its features are activated. If there is an overlap between the features of the prime and those of the target, responses are facilitated. Feature-based accounts of priming have contributed to computational simulations for priming, given that the number of features between primes and targets can often easily be quantified (e.g., Plaut & Booth, 2000). This model readily explains priming between semantically similar concepts (e.g., cat – lion), but also has some limitations in accounting for priming between concepts from different categories that do not share many features (e.g., cat – sink).
7.2.3. Compound-cue model

According to the Compound-cue Model on priming (e.g., Ratcliff & McKoon, 1988; McKoon & Ratcliff, 1992), faster responses for related primes and targets are produced by the joining of the prime and the target to form a compound-cue in short-term memory, which is then matched against items in long-term memory. In the compound-cue model, the degree of facilitation observed in priming is based on the extent to which the prime and target are associated and the degree of familiarity between the compound-cue and other concepts in memory.

7.2.4. Expectancy generation

The Expectancy Generation Model (e.g., Neely, 1991, Becker, 1980) accounts for priming by assuming that a presented prime item could be used to anticipate the likelihood of potential target to be presented. Within this model, priming effects are supposed to emanate from a cultivation of expectancy towards the target through a strong underlying semantic relation or association. For example, baby may instigate expectancy for targets such as “milk” or “nappies.” Thus, for expectancy to be generated, there has to be some form of semantic association or relatedness. However, it has been argued that expectancy generation may only be possible during priming conditions with long stimulus onset asynchronies (e.g., de Groot, 1984; Stolz & Neely, 1995).

7.2.5. Priming with newly formed associations

Associative relatedness priming is the extent to which the activation of a prime (e.g., cat) will bring into memory and hence facilitate a faster response for a target (e.g. mouse) based on their frequent spatio-temporal or functional co-occurrences in the environment (e.g., Lucas, 2000). Associative priming therefore arises from words that are highly associated as per the norms of word associations.

However, do unrelated or unassociated words prime each other and if so how? To be clear, when we say unrelated, we imply words that do not have pre-existing associative, thematic or taxonomic relations between them. Perhaps they could be brought together by random co-occurrences in similar contexts. Traditionally, priming for new associations has been investigated through episodic priming. That is, unrelated words are studied together during an initial learning phase, followed by a test phase that assesses priming effects between the new associations. However, the literature on episodic priming for new associates is inconsistent. Some studies have shown that priming does occur between unrelated or newly associated words. For example, using a lexical decision task, McKoon and Ratcliff, (1979,
found consistent episodic priming for unassociated words by presenting participants with pairs of unrelated words during the study phase (e.g., city – grass), followed by a list of target words presented individually during the test phase. However, their results have been subsequently criticized on the basis of being potentially contaminated by explicit retrieval strategies (e.g., Durgunoglu & Neely, 1987). Other studies have found no reliable evidence for episodic priming between unrelated words studied once during an initial learning phase (e.g., Durgunoglu & Neely, 1987; Den Heyer, 1986). Thus, Durgunoglu and Neely argued that episodic priming for new associations can be obtained only under very limited conditions. For example, Pecher and Raaijmakers (1999) found reliable episodic priming only when the task used at the study phase (either lexical decision or perceptual identification) was identical to the task used during the test phase. They argued that even though their observed effects were not very large, episodic priming for new associations resulted from an automatic process, implying that the new associations were incorporated into semantic memory. Carroll and Kirsner (1982) also observed priming only for pre-established associated pairs but not for newly formed ones. Den Heyer (1986) found episodic priming for new associations at a relatively long SOA (>500 ms), but not at shorter SOA (<100ms). In summary, episodic priming for new associations can be unpredictable and appears susceptible to various experimental conditions. Hence it is difficult to reliably compare episodic priming to priming effects observed from standard pre-existing semantic “prime-target” word pairs (Lucas, 2000).

7.2.6. Integrative priming

An integrational compound relation between two nouns results from combining an item (aka, modifier noun) with another item (aka, head noun) to form a new unitary conceptual phrase, whereby its meaning is semantically different from that of each of the items forming the integrational compound unit (Estes & Jones, 2009). For example, the combination of the two nouns, table and lamp to create “table lamp” expresses the conceptual unitary relation of “a lamp that sits on tables.” Furthermore, the meaning attributed to “table lamp” is conceptually different from the meanings of “table” and from “lamp” as individual items. Therefore integrative priming emerges from the extent to which “table” can prime “lamp,” based on their integrational relation (e.g., Estes & Jones, 2009; Xu & Ran, 2011; Gagné & Shoben, 2002).

Thus, integrative priming arises from relational integration constructed between dissimilar, unassociated and unrelated words (Estes & Jones, 2009). However, most

aka denotes ‘also known as’.
integrational relations also instantiate some thematic relations. For example, “chocolate cake” instantiates a composition relation, “mountain lion” instantiates a location relation and “water bottle” instantiates a holding relation. Indeed, Gagné (2000) argued that people usually rely on their prior knowledge about thematic relations between concepts in order to construct the meaning and interpretation for integrative relations. Furthermore, the processing of integrative relations is facilitated when the two nouns can be thematically integrated. That is, the more readily a thematic relation can be established between two nouns, the easier it is to combine them into an integrational relation (Xu & Ran, 2011).

It is important, however, to emphasize here that thematic relations are fundamentally different from integrative ones, even though the two are not mutually exclusive and there is much overlap between them. Integrative and thematic relations share aspects whereby they both instantiate concepts pairs that belong to different semantic categories, but play complementary roles in a given situation or event-sequence. However, there are many pairs of concepts that are thematic but cannot be integrated (e.g. “medicine – hospital”). Thus, thematic relations are more elaborate than integrative relations.

Previous studies have shown that integrative relations affect priming (Jones & Golonka, 2012). Using a lexical decision task on word pairs that were dissimilar and unassociated, Estes and Jones (2009) found that when the target and the prime could be integrated into a new meaningful phrase (e.g., “wine – box”, implying a box that contains wine), there was an integrative priming effect. They further argued that relational integrative priming is rapid and automatic, indicating a deep conceptual processing that enables new associations to be integrated using semantic background knowledge. More specifically, Estes and Jones (2009) explained integrative relations through role assignments, suggesting that an integrational relation does not only instantiate a possible relation between two words, but they also consists of “assigning those concepts to complementary semantic roles” (Estes & Jones, 2009, p. 124). Thus, the role that each concept plays in the complementary relation and the direction of the relation are necessary for the two to be integrated, else the relation will not be sensible and there will be no priming effect. This is one of the main aspects that differentiates integrative relations from thematic ones. For example, “baby sitter” is integrative hence, sensible but “sitter baby” is not. Conversely, in thematic relations, the direction of the relation is not necessarily important. Instead, what is critical in thematic relations is that the two concepts co-occur in the same event or situation, and that they perform complementary roles that instantiate a relation of a meaningful nature.
8.0. Priming effects from texts and discourse

Could priming for isolated word pairs be comparable to priming from text processing and discourse analysis? How does language comprehension affect priming? As noted in the previous chapter, section 3.2, thematic organization of concepts represents or captures the external relations between items that perform complementary roles in the same scenario or event (Lin & Murphy, 2001). Studies on the effects of pre-existing thematic relations in language comprehension have shown that with experience concepts acquire a frequency distribution of thematic relations, and hence these frequency relations affect language processing (e.g., Estes, Golonka & Jones, 2011). As people frequently encounter different items that occur in the same situation and that preform similar functions frequently, they establish stable thematic relation between them that can be activated in future situations. Thus, encountering a familiar concept may automatically activate other concepts with which it is likely to interact or co-occur, thereby facilitating the processing of relevant thematic relations. For example, Gagné and Shoben (1997) showed that word pairs having a highly frequent thematic relation (e.g., paper – note) are understood more quickly in a sentence compared to word pairs that have a less frequent thematic relation (e.g., paper – cut).

Sentence comprehension is a complex process compared to the processing of individual words. Hence it is very difficult to control for associative or semantic relationship of primes and targets in sentence processing studies (Lucas, 1999). Priming in sentence processing builds across several words in sentences and paragraphs, and it is subjected to discourse processing constraints far beyond the lexical level (Lucas, 2000). Hess, Foss and Carroll (1995) argued that during text processing, participants seek meaning at the highest global level. As a consequence, embedding a priming task within a text could be problematically influenced by global comprehension processes rather than by local level lexical effects.

To summarize, as mentioned earlier, the focus of the current thesis is not to directly investigate priming phenomena. Instead, what is crucial to us at this point is whether the presumed emergence of thematic reorganization of abstract concepts, as a function of their co-occurrence within relevant situations, can simply be explained by some form of lexical semantic priming. An answer to this question will be presented in the General Discussion.

8.1. Word co-occurrence in similar contexts - Latent Semantic Analysis

Latent Semantic Analysis, LSA (Landauer & Dumais, 1997) is a complex computational and statistical approach to word learning that is able to infer semantic relationships among words without taking into account word syntax. The success that LSA
has had in modelling a variety of semantic tasks, makes it necessary for us to consider whether the predictions and hypotheses upon which the current thesis is based could be explained within the theoretical framework of LSA. In this section, we will first synthesize the principles of LSA as well as its limitations and then present previous studies that have compared LSA’s similarity judgements between concepts to those obtained from participants.

LSA is based on the principle that the “psychological similarity between any two words is reflected in the way they co-occur in small subsamples of language” (Landauer & Dumais, 1997, p. 215). Explained in its simplest terms, LSA represents words as vectors that reflect their frequency of occurrence in specific texts. That is, from numerous textual contexts (e.g., sentences, paragraphs, books, encyclopaedias etc.), a frequency count is made of the occurrence of each target word that occurs in it. These frequency counts can be transformed into vectors such that each word has a single vector representing how frequently it occurs in a context. The vector of co-occurrence values for the contextual words surrounding a target word can be translated as a reference to a specific point in a multi-dimensional semantic space that represents semantic memory. Words with similar meanings are closer in this semantic space than words that are less similar in meanings, as reflected in the similarity of the vectors for their context words.

Because the corpora used to provide linguistic input for LSA are texts created by people, they are reflections of how people use language, which also reflects how people think. The linguistic co-occurrence vectors in LSA might also reflect the actual distribution of the physical referents of words in the real world situations, since human language typically refers to concepts and situations in the real world, (Louwerse & Zwaan, 2009). LSA learns the meanings of words by relying on the contexts in which the words are used, just like children who learn meanings of words from their usage rather than from their explicit dictionary definitions. As people interact with the world, they keep semantic traces of the co-occurrences of words that they use in language, and LSA tries to imitate these linguistic co-occurrences (Burgess, Livesay & Lund, 1998).

Unlike people, LSA does not process the perceptual experiences associated with words. Additionally, it does not take into account features of words, syntax, grammar nor relations between words. Irrespective of the roles or relations that link words together, the fact that they co-occur in similar contexts makes their meanings appear similar. By tracking the contexts within which words commonly appear, LSA establishes that words cited in similar contexts are semantically related and hence similar. For example, gun and bullet-proof jacket would be considered as similar by LSA because across contexts, these two items would often occur together (e.g., shootings, crime scenes, police, security etc.). Hence, by virtue of their
common co-occurrence, they are rated to be semantically similar.

The utility and applications of LSA are diverse and it has been used to reliably mimic and model several human cognitive behavioural processes such as language use, text comprehension and concept organization. For example, Landauer and Dumais (1997) used LSA to model typical vocabulary growth rate in children. LSA has also been used in prior studies to measure similarity (e.g., Gagné, Spalding & Ji, 2005), the coherence of texts (e.g., Foltz, Kintsch & Landauer, 1998) and to grade essays (e.g., Landauer, Foltz & Laham, 1998).

The major limitation of LSA is the fact that the semantic meaning that it attributes to concepts is not “grounded.” For example, LSA does not make embodied differentiations between the meanings of sentences such as “… Erik used his shirt to dry his feet” and “… Erik used his glasses to dry his feet” (Glenberg & Robertson, 2000, p. 384). More crucial to our work is whether LSA would be capable of differentiating between thematic and taxonomic relations of abstract concepts from their co-occurrences in similar texts. Further discussion of this issue will be provided in the General Discussion.
Chapter III

Text and discourse processes

9.0. Introduction

Throughout the previous chapters, we have spoken about how abstract concepts are known to be heavily dependent on linguistic contexts (Wiemer-Hastings, 1998; Schwanenflugel & Shoben, 1983). We have also extensively spoken about how situations are central to the processing and representation of abstract concepts (Barsalou & Wiemer-Hastings, 2005). One of our aims in this thesis is to show that indeed, the co-occurrences of different abstract concepts in situations influence their thematic reorganization. That is, as abstract concepts frequently co-occur in relevant situations, the conceptual system processes them by reorganizing them thematically with respect to the type of situations within which they were experienced. The implication therefore is that textual processing and comprehension of the situations containing abstract concepts both constitute integral parts of the entire process. It is therefore relevant to consider how textual information is cognitively represented, and whether the manner in which it is represented could influence the thematic organization of the abstract concepts read in them.

In view of the fact that abstract concepts have no directly perceivable referents, it is conceivable that the language reader needs to analyse the situational texts in which an abstract concept is used, and to construct its meaning from the text itself, in conjunction with background semantic knowledge. Thence, language comprehension and processing is a major step in processing abstract concept. An important function and property of the human cognitive system is the ability to extract important information out of textually and/or verbally described situations. This ability plays a vital role in comprehension and inference generation. But what happens to this information after it is extracted, how do we cognitively represent it, and how do we use it to process abstract concepts?

This chapter will give a brief outline of the extant theories on text and discourse comprehension processes. It will then introduce the Language and Situated Simulation theory, LASS (Barsalou, Santos, Simmons & Wilson, 2008) and its implications for the cognitive representation of texts, and the various forms that these representations might take. Finally, it will speculate on how this theory provides a credible account of the manner in which abstract concepts could be conceptually and thematically reorganized as a function of the simulation of the situational texts in which the concepts are read.
9.1. Text and discourse comprehension - traditional models of text representation

9.1.1. The Propositional Theory

Traditional models of language processing assume that amodal symbols systems underlie the conceptual representation that enable people to comprehend a text and to construct a mental representation of its words and sentences. For example, the Propositional Theory (e.g. Kintsch, 1988; van Dijk & Kintsch, 1983) argues that when reading a text, individuals construct a mental representation in a propositional format close to the linguistic forms of the words. That is, conceptual representations of language are typically non-perceptual. According to the theory, propositions are the basic units that represent the meaning of texts. A proposition consists of arguments and predicates. For example, a proposition like [STOPPED (JOHN, CAR)] represents the sentence “John stopped the car.” From the amodal based proposition assumption, Kintsch (1988) developed a two-step Construction-Integration Model. According to this model, the first step of discourse comprehension involves the activation and the construction of propositions without regard to contextual information. The output of the construction phase is a bottom-up process that utilizes a loose network of associations. The propositional network corresponding to the text base is formed through concepts and propositions directly corresponding to the verbal input. The second stage, which is integration, involves representing and incorporating the global discourse context. Thus, during the integration phase, the construction phase’s incoherent and unstable network of propositions and associations are transformed into a coherent and stable textbase using several cognitive mechanisms such as spreading activation.

9.1.2. The Structure Building Framework

A parallel model of text comprehension was proposed by Gernsbacher (1990), known as the Structure Building Framework, SBF. This model is based on the assumption that language comprehension and language production rely on similar cognitive processes and mechanisms. According to SBF, the goal of comprehension is to build a coherent, mental representation or “structure” of the information being read. Thus, building this mental structure according to SBF requires the comprehender to first, lay a mental foundation structure which is then developed by mapping onto it coherent incoming information. That is, as the reader proceeds through their reading, they map incoming information that is coherent onto the same mental structures. However, if the new incoming information differs from what has already been read, a new structure is commenced. So most mental representations of a text comprise several branching substructures. Gernsbacher refers to the building blocks of
these mental structures as amodal memory nodes. In other words, memory nodes within a mental structure constructed from reading a text are activated by incoming stimuli. Initial activations form the foundation of the mental structure. Subsequent information is then mapped onto a developing structure if the two are coherent. In contrast, if the incoming information is less coherent with the structure being built, a new foundation is activated for the foundation of a novel substructure.

Another important aspect of the SBF is that the memory nodes that underlie the building of a mental structure also transmit “processing signals.” These processing signals either facilitate or suppress other nodes of activations, and hence, control the structure building process. Thus, if the information that the memory nodes represent is pertinent for the foundation being built, they enhance the structure. However, if the information they represent is no longer necessary or is redundant, the mechanism of suppression deactivates the incoming information. This way, comprehenders are able to understand the context-appropriate meanings of words, such as homographs (Gernsbacher & Faust, 1991).

9.2.0. The grounded cognition view of language representation

Any symbolic system when isolated from the physical world, cannot escape becoming circular in its conceptual explanations. For example, consider a modern English dictionary’s system for words definitions. Each word is defined in terms of other words. So the entry for “table” will be expressed with other words such as “furniture,” “legs” etc. But then, what does “table” mean if one has no knowledge whatsoever of “furniture?” This question lies exactly in the heart of the symbol-grounding problem (e.g. Harnad, 1990), and is also central to the highly relevant transduction argument. Specifically, this is amodal symbols’ "failure to provide a satisfactory account of the transduction process that maps perceptual states into amodal symbols” (Barsalou, 1999, p.5).

9.2.1. Language and Situated Simulation Theory (LASS)

Based on the grounded cognition views on language processing described above, Barsalou and colleagues proposed the Language and Situated Simulation theory, LASS (Barsalou, Santos, Simmons & Wilson, 2008) on how language and textual information are represented in the conceptual system. According to the LASS theory, the representation and processing of concepts relies on both the linguistic system and the situated simulation system. Furthermore, these two systems interact continuously in varying combinations to produce a situated semantic representation of concepts and texts. The LASS framework involves linguistic processing, situated simulation and the statistical underpinnings or foundations of language and situated simulations. That is, the frequency of occurrences of linguistic and
situated simulation experiences influence the conceptual representation of knowledge. LASS assumes that when a word or sentence is presented, both the linguistic and the simulation systems are activated initially, although the linguistic system reaches an activation peak before the simulation system. This is because the mental representations of linguistic forms are modal and hence are very similar to words or texts. The linguistic system encodes and represents purely linguistic cues such as word associations, syntactic structures etc. This is a rapid but shallow processing since it is related to the lexical and associated linguistic representation of words. The linguistic system enables shallow representations derived from information explicitly provided in the text. These pure linguistic processes can support some linguistic tasks such as lexical decision and other lexical strategies, such as those in LSA (also see Glaser, 1992).

As word recognition is performed by the linguistic system, situated simulations associated to the word are also activated. The simulation system produces a deeper form of processing for situated action that includes the activation of information from all modalities (introspection, visual, auditory, motor etc.). Within the simulation system, situated simulators represent the statistical frequencies of modal perceptual properties and the interaction between them in experiences, whereas the linguistic system captures the statistical frequency of linguistic forms, as well as their relations to syntactic structures. This statistical information within the two systems can support the processing and the situated simulations of multiple concepts in text. Thus, as the frequency of occurrence increases for a concept, so does the ease with which its simulations is achieved by the conceptual system.

![Figure 6. Various levels of mixtures and interactions between language and situated simulation systems (courtesy, Barsalou et al., 2008).](image)

Linguistic and the situated simulations systems interact with each other at different levels in order to carry out a wide variety of cognitive tasks. Thus, depending on the task at hand, different mixtures of the two systems could combine to support the task as shown in Figure 6 above. Thus, when shallow linguistic processing is adequate to support a specific
task (e.g., lexical decision), processing may be achieved predominantly within the linguistic systems and much less on simulations. However, when the task requires deeper semantic processing (e.g., comprehension, inferences, reasoning), the simulation systems may be solicited up to a higher degree than the linguistic one (Solomon & Barsalou, 2004). In most cases, both systems rely on each other for most conceptual processes, but to different degrees (Barsalou et al., 2008).

Several lines of evidence support the LASS theory in conceptual processing. For example, using word association and feature listing tasks, Santos, Chaigneau, Simmons and Barsalou (2008) showed that linguistically related responses were produced significantly earlier than responses that involved descriptions of situations. Another line of evidence comes from property generation using fMRI. Simmons, Hamann, Harenski, Hu and Barsalou (2008) scanned participants as they provided properties for a set of target concepts. During the first session, the critical conceptual task was to provide properties that are typically true of a target word (e.g., ‘what properties are typically true of a bee?’). In the second session after a week, participants received two groups of concepts. For the first group, they had to generate word associates and for the second group they had to imagine a situation that contained the words while being scanned. They observed that the word association task produced activations mainly from the left inferior frontal regions (Broca area) and other areas associated with verbal processing. Whereas, for the situation generation task, there were higher activations in areas usually associated with the generation of mental imagery such as in the right middle temporal gyrus and in the precuneus. These results implied that conceptual processes rely indeed on two main systems: linguistic and situated simulation.

One important aspect of the LASS theory that bears relevance to the current thesis here is its assumption on abstract concept processing. The LASS theory proposes that, logically speaking, “language” on its own cannot represent any concept without references being made to situations or contexts (the symbol grounding problem). Thus, simulations of situations should be a part of the conceptual representations for all concepts and most especially for abstract concepts (Barsalou, 2008; Barsalou, 1999; Schwanenflugel, 1991). If the brain attempts to simulate a perceptual experience when representing a concept, it should typically simulate a situation, because situations are intrinsic to perception. Thus, the LASS theory argues that situated simulations play a significant role in processing information related to social situations, introspective states, events and settings that abstract concepts usually stand for. Stated differently, as most abstract concepts represent descriptions of social contexts and introspective states, the linguistic and situated simulation systems play a central role in their conceptual processing. Textual situations containing relevant abstract concepts
are therefore expected to be simulated by the language and situated simulation systems, in order to conceptually represent and reorganize the concepts instantiated in them.

9.2.2. Sensorimotor simulations of textual information

Aside from LASS predictions about language comprehension, recent studies from across the discourse processing literature have proposed that language comprehension involves the simulation of textual information in modality-specific systems. Converging evidence from diverse set of paradigms suggests that sensorimotor representations are routinely activated during comprehension (e.g., Stanfield & Zwaan, 2001; Zwaan, Stanfield & Yaxley, 2002; Glenberg & Kaschak, 2002).

During texts or situation reading, people construct rich and complex mental representation of the information described in the text as if they are “reliving” the situation. The reader feels “immersed” in the story situation in order to experience what the protagonists of the situations are experiencing (Zwaan, 1999). Thus, readers can feel the emotions of a protagonist, follow the spatial displacement around objects, and be involved in the temporal sequence of events described in the story. Indeed, situation model studies have established numerous findings supporting the claim that language comprehension and the construction of situation models are not amodal. Rather, the process involves a grounded simulation of textual information, such as emotions, perspectives, motion etc., that may recruit modality-specific brain regions and hence perceptual symbols systems. For example, verbally described actions are understood faster when participants form a shape of their hand that matches the action read (e.g., Klatzy, Pellegrino, McCloskey & Doherty, 1989), visual representations of object shapes and orientations are often activated during word and sentence comprehension (e.g., Zwaan, Stanfield, & Yaxley, 2002; Stanfield & Zwaan, 2001), visio-spatial information primes sentence processing (e.g., Boroditsky, 2000) and can interfere with comprehension (e.g., Fincher-Kiefer, 2001) and finally, information that is present in a situation described in a text is more active in the comprehender’s mind than information that is absent from the situation being read (e.g., Zwaan, Madden & Whitten, 2000). Thus, in contrast to amodal theories of semantic and discourse processes, grounded cognition theories such as PSS (Barsalou, 1999) and LASS (Barsalou et al., 2008) propose that modal simulations and situated conceptualizations of actions and events are grounded in bodily states.

Theories that address the construction of situation models during comprehension also assume that situation models contain perceptual and modal information. For example, Zwaan (2004) developed the “Immersed Experiencer Framework” (IEF) for language comprehension. IEF proposes that in order to comprehend a sentence, the comprehender has
to “construct an experiential (perception plus action) simulation of the described situation” (Zwaan, 2004, p. 38). Thus, the comprehender is “an immersed experiencer.” When an individual reads a text, situated simulations are activated while reading, through which the reader simulates events described in the story mentally. Finally, the reader integrates what is read with existing situation models. Hence, this model explains that, to comprehend a text, readers actively process texts and integrate these texts in their own human experiences. Indeed, there is evidence suggesting that seeing or reading about another person experiencing specific emotions and events activates the same neural structures as if one were experiencing them oneself, consequently producing empathy (e.g., Gallese, 2001). Although embodied views and grounded cognition theories have been very effective in explaining and supporting the representation and processing of concrete words and texts, it is far more of a challenge to show how an embodied account could be used to explain the processing of abstract concepts. This is one of the reasons Perceptual Symbols Systems (Barsalou, 1999) and LASS (Barsalou et al., 2008) are relevant theoretical backgrounds for our work, namely, because they are some of the few embodied theories that have made explicit effort to account for and incorporate abstract concepts into their framework.

9.2.3. Sensorimotor simulations of textual information involving abstract concepts

How are abstract concepts grounded in sensory-motor processes? The direct answering of this question is beyond the scope of the current thesis. However, the view that mental simulations are necessary for cognitive processing predicts that the representation of abstract concepts should involve some form of situated simulations, especially as these concepts are heavily dependent on situations. Moreover, such a view predicts that in the absence of grounding and situational information, the full understanding of abstract concepts could be difficult (Barsalou & Wiemer-Hastings, 2005). Due to the fact that abstract entities typically seem to elicit and represent settings, situations, social contexts, introspective states etc., (Wiemer-Hastings & Xu, 2004), we should not expect sensory-motor effects to arise in the same manner as they arise for the representation of concrete concepts. Rather, sensory-motor effects for abstract concepts could emerge from the simulations of abstract concepts via the processing of situational information within modality-specific systems. In other words, the situated simulation of specific situations could lead to the grounding of abstract concepts embedded and experienced within those situations. Much remains to be learned about such processing.

Because numerous past studies have already ascertained that the comprehension of textual information involves sensorimotor simulation within modality-specific systems as...
evoked above, the current thesis does not focus on the presence of simulation per se. Instead, we intend to go a step further based on conclusions from previous studies and assume that because abstract concepts are experienced frequently in situations, comprehenders upon simulating the situation would also mentally simulate the abstract concepts, and thus process them using both the linguistic and situated simulation systems. In this way, comprehenders are able to ground the abstract concepts in the situation being read, leading to the conceptual processing, representation and organization of the abstract concepts. Thus, we will assume that situated simulations play a significant role in the processing of the situations within which the abstract concepts will be experienced in the forthcoming experiments, enabling them to become thematically reorganized.
Chapter IV

The current experimental studies

10.0. Introduction

Abstract concepts are not easy to study empirically. Situational-based theories (e.g., PSS, Contextual Constraints, Situated Conceptualization, Context-Availability etc.) provide promising accounts into the understanding of their contents and representations, but more research is still needed to further explore and develop these theories. The purpose of this thesis was therefore to use the views from the situational-based theories to evaluate the processing, organization and representation of abstract concepts.

Fundamentally, unlike concrete concepts, the meanings of most abstract concepts vary across situations, hence, these meanings must be construed from the situational context within which a particular abstract concept is experienced. We can reasonably suppose therefore that “analysing and/or manipulating” the situations in which abstract concepts are experienced could give some insights into their organizations and representations within the conceptual system.

In the present thesis, we aim at investigating the assumption that thematic organization could play a significant role in the conceptual processing and representation of abstract concepts through situations. That is, situational information could be important in how people thematically reorganize abstract concepts in order to represent and understand them. Our line of reasoning is as follows. We assume that in order to fully understand and to conceptually represent abstract concepts, there is the need to thematically process and reorganize them with other entities (abstract and concrete) within a meaningful situational background. Thus, without situations or the ability to thematically organize abstract concepts within a meaningful context, they become difficult to fully process and comprehend, as suggested by Barsalou (1999).

An interesting manner therefore in which the effects of thematic reorganizations and situational information on the conceptual processing of abstract concepts could be examined is to use clusters of unrelated abstract concepts inserted into relevant situations. This is because using pre-established thematically related concepts will not reveal the central role that situational information and thematic relations played in the organization or representations of the concepts. Whereas investigating the extent to which novel thematic relations would emerge between unrelated abstract concepts through their co-occurrences and their instantiations in situations would demonstrate the central role that thematic
reorganization and situational information occupy in the conceptual representation of abstract concepts. This is the core of our main experimental hypothesis.

Before moving on to our studies, it is first necessary to outline the differences between previous experimental paradigms within the literature that are frequently used to assess abstract concepts and the one used in the current thesis. The reasons as to why a different experimental approach was used to assess the organization of abstract concepts in the current thesis will be explained. Afterwards, the main experimental objectives for the current studies will be presented, followed by a series of four behavioural experiments that address the main experimental hypothesis.

10.1. Paradigms used to study abstract concepts

Despite the fact that the aforementioned studies in previous sections provide support for the view that situations and contextual information are fundamental to the processing of abstract concepts (e.g., Barsalou & Wiemer-Hastings, 2005; Schwanenflugel & Shoben, 1983), this view still remains underexplored. The aim of this section is to present three studies that to our knowledge have used situations as part of their experimental protocol to evaluate the representations of abstract concepts. Discussions on how the current thesis hopes to extend their findings concerning the importance of situational information for the organization of abstract concepts using a different experimental approach will then follow.

Previous studies that have shown the importance of contextual information on the processing of abstract concepts have included concrete concepts in their methodology (once again using a comparative approach). Such paradigms explain the differences between abstract and concrete concepts, and mainly tell us that abstract concepts do not show the same effects during certain cognitive tasks compared to concrete concepts (e.g., serial recall, word recognition etc.), namely, classic concreteness effects. Again, such tasks are rarely informative on the intrinsic nature and characteristics of abstract concepts. Although the concreteness effect is a well-established phenomenon using various paradigms (section 4.0 – 4.3), and yet it is still unclear as to why abstract concepts remain relatively neglected compared to concrete concepts in most cognitive theories.

The main shortcoming of most paradigms that assess the role of situational information for the processing of abstract concepts is that they mostly assess abstract concepts in isolation, and situations are measured as dependent variables. Despite the considerable evidence that has shown the effect of situational information on processing abstract concepts, situations are hardly used as an independent variable, from which a measure of their influence on the processing of abstract concepts could be observed. It has been well documented from
feature generation tasks that abstract words activate situations, but the questions now worth considering are: what do situations activate about abstract concepts? What influence or effects do situations exert on abstract concepts during important conceptual processes? As stated by Pecher, Boot and Van Dantzig (2001, p. 232), “words for abstract concepts might activate specific concrete situations that are instances of the concept or provide a context for the concept. There is at present still very little evidence for this view, so more research will be needed in order to draw stronger conclusions.” We believe that it is time to study how situations affect the representation of abstract concepts by developing a paradigm in which situations play the major role as an independent factor, thus enabling an evaluation of their effects on the processing of abstract concepts. This is one aim of this thesis.

To our knowledge relatively few studies have used situations or contextual information as part of their independent factors to show that they facilitate the activation or the processing of abstract concepts. Three such studies will be discussed henceforth.

First, the study of Schwanenflugel and Shoben (1983) was one of the first few that evaluated the effect of contextual information on the processing of abstract concepts. They primed abstract and concrete concepts using a sentence completion task by providing single sentences, such as “the evidence proves his - innocence,” where ‘innocence’ was the target word needed to complete the first part of the sentence in italics. However, one must bear in mind the objective of Schwanenflugel and Shoben’s studies, which was to explain the differences between abstract and concrete concepts on the basis of the concreteness effect on context availability. They basically argued that the concreteness effect is mainly due to the differences in the availability of contextual information between concrete and abstract concepts as proposed by the Context-Availability Model. Thus, when sufficient contextual information is provided for abstract concepts, they are learned, recalled and recognized as quickly as concrete concepts. Schwanenflugel and Shoben’s contextual materials had strong sentence final word expectancies, leading to a possible influence of phrasal priming (i.e., “evidence proves his innocence.”), given that the contextual information provided was made up of single and simple sentences. The abstract concepts at the end of their abstract sentences could have been affected by sentential expectancy, following a supportive sentence content. In our view, Schwanenflugel and Shoben did not provide sufficient situational information that would explain how abstract concepts are represented and organized in the semantic system. Their studies were interesting because they provided empirical support for the importance of contextual information in the processing of abstract words. However, they shed very little light on the specific form of conceptual organization that enabled the cognitive processes described in their studies to be achieved, as far as abstract concepts are concerned.
We believe that more extensive evidence is required.

A second line of work, which demonstrated that situational information activates abstract concepts was carried out recently by King and McRae (2012). They provided empirical support for the view that situational knowledge facilitates the conceptual processing of abstract concepts. In a lexical decision task, they matched abstract concepts to related and unrelated situations and evaluated whether target abstract concepts could be primed when they are preceded by related situations. One very interesting aspect of this study was the fact that they used only abstract concepts. Hence, providing behavioural evidence for abstract concepts which does not include comparative information on differences between abstract and concrete concepts. They also manipulated situations, thus directly assessing their effects on abstract concepts. They constructed three-sentence situations that described abstract concepts. For example, “You are walking to get some food when you see a homeless man out of the corner of your eye. You don’t turn your head. You keep walking.” This situation, presented acoustically, was followed either by the related target word “ignore” (an abstract concept) or an unrelated word and lexical decisions were made on the target words. Their results showed that when the target word was related to the situation, it was processed faster.

A minor limitation of this study is that the situations used appeared to be more or less definitions of the target abstract concepts. Certainly, if one is provided with the following information: ‘An entity that has fur and four legs, meows, drinks milk and likes to rub its tail against your legs,” one would immediately think of a cat pet. Thus, the situations used in the King and McRae study were, in our view, situational definitions of the target abstract concepts. Nevertheless, it demonstrates that situational descriptions of abstract concepts prime them, implicating situational information in their representation.

A third line of work, which used situations as independent variables and assessing their effect on abstract concepts was carried out by Wilson-Mendenhall et al. (2011). They studied patterns of neural activation for abstract concepts such as “observe,” when they were processed as part of a physical threat or social threat situation. In a neuroimaging experiment, Wilson-Mendenhall et al. presented participants with two types of situations: a physical or social threat situations. The situations, acoustically presented, were followed by a target abstract concept, and participants had to rate how easily they experienced the concept given the situation. The results showed that activation profiles differed depending on situation type. That is, in a social threat situation, the concept “observe” showed a widely spread activation in the dorsal and ventral visual systems, as well as the auditory regions. However, in the physical threat situation, activation was more restrained to the sensory regions. These
differing situational patterns suggest that the same abstract concept is processed differently as a function of the situation in which it was experienced. Though this study manipulated situations as an independent variable, they only used four abstract concepts (fear, anger, plan and observe) and their main objective was to evaluate how different situations influenced the representation of emotional concepts. Furthermore, Wilson-Mendenhall et al. provide relatively little insight into the detailed content of the abstract concepts under study, which can be difficult to infer from brain activations via reverse inference.

Logically, representations and organization of the semantics for abstract concepts become sterile when studied in isolation, given that they are heavily dependent on situations. Yet, there is still at present relatively little empirical evidence from studies on abstract concepts only that explain how and in what form and under which conditions situational information supports the processing and organization of abstract concepts. This thesis attempts to shed more light on this view.

10.2. Overview of the four Experiments

The general hypothesis motivating the experiments to follow was that situational information would facilitate the emergence of newly formed thematic reorganization between clusters of unrelated abstract concepts through their co-occurrence and processing in specific situations. Furthermore, concepts, which have previously been organized taxonomically, could be split up and thematically reorganized depending on the situations within which they were processed.

Our method consisted of first, sampling a set of 24 taxonomically related abstract concepts from 6 taxonomic categories. From these 24 original taxonomic abstract concepts, we derived 6 clusters of unrelated abstract concepts, whereby no 2 items in an unrelated cluster came from the same taxonomic category. The unrelated clusters were referred to as “newly derived thematic clusters” because we assumed that in order for them to become organized after they are read in meaningful situations, newly constructed conceptual relations would have to be formed between them, and that these new conceptual relations would be of a thematic nature (not taxonomic). Why? Because, if the a group of unrelated concepts co-occur and are experienced frequently in similar contexts/situations, each concept in the group would play a complementary role in the context, and integrate with the others, such that the entire context as well as each concept in the group would become conceptually meaningful to the reader. This is essentially the basis of thematic relations (Lin & Murphy, 2001; Estes et al., 2011). It is also the basis upon which LSA is conceptualized through the extraction of
meanings from the co-occurrences of different words in similar contexts (Landauer & Dumais, 1997).

Six experimental situations were constructed. In the latter, the set of taxonomically related abstract concept clusters were inserted, thereby creating a “taxonomic situation condition.” Then, the sets of “newly derived thematic clusters” were analogously inserted into the same experimental situations creating a “newly derived thematic situation condition.” A sorting task and a similarity judgement task were used to determine the type of organizing principle that would emerge from the processing of the clusters of concepts in situations. Three norming studies were carried out beforehand that empirically evaluated the experimental materials used for the four experiments presented in this thesis.
11.0. The Experimental phase

11.1. Norming Studies

Objective

The main aim of the norming studies was to empirically evaluate and test the validity of the experimental stimuli.

11.1.1. Selection of abstract taxonomic categories

The first step was to select the main superordinate abstract concept categories based on two main dimensions: concreteness and familiarity. Concreteness captures the extent to which a concept is perceived to be abstract or concrete on a scale from 1 (abstract) to 7 (concrete), whereas familiarity refers to how familiar people believe a particular concept to be on a scale of 1 (not familiar) to 7 (very familiar). These scales express means multiplied by 100, so if an average score is 5.32 for example, it is reported as 532.

Norming the superordinate abstract concept categories was important for several reasons. First, it was necessary to verify that they were indeed considered to be abstract. Nine superordinate concepts, with average familiarity ratings higher than 500 and concreteness ratings of less than 400 were chosen from the MRC psycholinguistic database (Coltheart, 1981; Wilson, 1988). The MRC database is an online published word norms that provides linguistic resources for research purposes. MRC contains approximately 150,837 words and provides information on 26 different linguistic properties. Previous research has classified abstract concepts as those with concreteness scores of less than 400, (Paivio, 1986; Schwanenflugel & Shoben, 1983; Wiemer-Hastings & Xu, 2005), so this standard was used to select the nine abstract categories. Table 1 shows the nine superordinate category concepts matched in concreteness and familiarity levels using MRC normed ratings.
Table 1. MCR database ratings of concreteness and familiarity of the nine main superordinate categories.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Ratings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abstract Categories</td>
<td>Concreteness</td>
</tr>
<tr>
<td>Crime</td>
<td>387</td>
</tr>
<tr>
<td>Feeling</td>
<td>262</td>
</tr>
<tr>
<td>Society</td>
<td>335</td>
</tr>
<tr>
<td>Religion</td>
<td>375</td>
</tr>
<tr>
<td>Relations</td>
<td>383</td>
</tr>
<tr>
<td>Time</td>
<td>343</td>
</tr>
<tr>
<td>Personality</td>
<td>311</td>
</tr>
<tr>
<td>Sin</td>
<td>273</td>
</tr>
<tr>
<td>Science</td>
<td>366</td>
</tr>
<tr>
<td>Means Ratings</td>
<td>331</td>
</tr>
</tbody>
</table>

11.1.2. Norming Study 1 – exemplar generation

11.1.2.1. Objective

Previous findings have shown that taxonomic abstract item categories have less structure than concrete concepts and that they further exhibit large individual differences concerning the instances that people might consider as typical exemplars (Hampton, 1981). The objective of norming Study 1 was to get participants to produce exemplars that could be considered generally as “typical” taxonomic instances for each of our nine selected abstract categories.

11.1.2.2. Method

11.1.2.3. Participants

20 undergraduate students from Lumièrè University of Lyon took part in this study voluntarily.

11.1.2.4. Materials and procedure

The nine superordinate categories of abstract words presented in Table 1 above were presented on a sheet of paper and participants were asked to generate exemplars for each category (i.e., crime, society, feelings, relationships, religion, time, sins, personality, disciplines). Each participant was asked to list typical exemplars for all categories. There was

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3 All the participants who took part in all the norming and the experimental studies were native French speakers and all the studies were conducted in French.
no time limit, and the task was performed in a pencil-and-paper format. The instructions informed participants to list as many exemplars for each category as they could think of and then to indicate which exemplars they considered as being the most typical for that category. They were also asked to provide situations or contexts, in which these concepts were normally implicated. Data were collected in individual sessions. Full instructions and a copy of the task can be found in Appendix A. The entire task took approximately 20 minutes to complete.

11.1.2.5. Results and Discussion

It was expected that more participants would give similar exemplars that were typical for each superordinate category. Thus, exemplars that were listed consistently across participants were selected to be the most typical for that category. This was done for all nine categories. We estimated the typicality for each exemplar by computing the number of participants who mentioned it. Thus, the typicality of an exemplar was measured as a percentage of the number of participants mentioning that exemplar for that category. For each of the nine categories presented to participants if an exemplar for that category was elicited by at least 70% of the participants, that exemplar was retained and considered as being typical for that category. For example, over 70% of participants gave “murder” as an exemplar for the category crime, and hence murder was retained. Any exemplar that was not cited by at least 70% of participants was removed from the final list. Using this criterion of selection, we obtained 5 typical taxonomic exemplars for each of the nine categories. Table 2 shows the exemplars that were retained for each category. In total therefore, we obtained 45 typical exemplars from all the 9 categories combined. The 45 exemplars were used as stimuli in norming Study 2.

Table 2. Typical taxonomic exemplars given by at least 70% of participants in norming Study 1.

<table>
<thead>
<tr>
<th>Abstract superordinate categories</th>
<th>Typical Taxonomic exemplars  obtained from norming Study 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crime</td>
<td>murder, corruption, fraud, treason, rape.</td>
</tr>
<tr>
<td>Time</td>
<td>past, present, future, second, month</td>
</tr>
<tr>
<td>Socio-political regimes</td>
<td>aristocracy, liberalism, monarchy, democracy, dictatorship</td>
</tr>
<tr>
<td>Feelings</td>
<td>sadness, guilt, terror, compassion, joy</td>
</tr>
<tr>
<td>Personality</td>
<td>extravert, paranoiac, depressive anxious, maniac</td>
</tr>
</tbody>
</table>
Relationship | neighbourliness, friendship, marriage, partnership, parentage.
---|---
Religion | catholicism, islam, evangelism, puritanism, protestantism.
Sins | adultery, envy, fornication, lust, blasphemy.
Disciplines | psychology, economics, history, languages, archaeology.

11.1.3. Norming Study 2 – category formation from exemplars

11.1.3.1. Objective
The objective of norming Study 2 was to reverse the procedure used in Study 1, by giving the exemplars obtained from Study 1 to a different group of participants and asking them to sort them into categories. This second norming Study was used to establish whether the same exemplars given by the participants in Study 1 for a particular category would be grouped together for that category by a different and independent group of participants.

11.1.3.2. Method

11.1.3.3. Participants
20 undergraduate students from Lumière University of Lyon took part in this study voluntarily.

11.1.3.4. Materials
From norming Study 1, we obtained 45 typical exemplars (5 for each category) as described above. In order to mask the objective of the Study 2, filler words were added to the 45 main abstract exemplars. The reason for adding fillers was that presenting only the 45 typical exemplars to a second group of participants without any additional words might prevent them from deeply thinking about the task. It could have made the task too easy for deeper processing. It was important for participants to think and process the categories deeply before providing exemplars. The fillers were made up of abstract words that were semantically related to the main categories, but that were not mentioned in norming Study 1. These fillers were randomly selected from the MRC database. For each main category, 4 fillers were selected from the database. So, for example, for the category crime, the following 4 words, (homicide, prostitution, espionage and genocide) were used as fillers and, hence, added to the original 5 typical exemplars obtained from Study 1. Using this procedure, each of the categories had 9 exemplars in total. Overall, there were 81 randomly mixed words
constituting the list material for Study 2. Table 3 below shows all the words used in norming Study 2.

Table 3. Typical taxonomic exemplars and fillers used in norming Study 2.

<table>
<thead>
<tr>
<th>Abstract superordinate categories</th>
<th>Typical Taxonomic exemplars from norming Study 1</th>
<th>Fillers added to each category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crime</td>
<td>murder, corruption, fraud, treason, rape.</td>
<td>homicide, prostitution, espionage, genocide</td>
</tr>
<tr>
<td>Time</td>
<td>past, present, future, second, month</td>
<td>hour, year, decade, century</td>
</tr>
<tr>
<td>Socio-political regimes</td>
<td>aristocracy, liberalism, monarchy, democracy, dictatorship</td>
<td>urbanism, tribalism, traditionalism, egalitarianism</td>
</tr>
<tr>
<td>Feelings</td>
<td>sadness, guilt, terror, compassion, joy</td>
<td>jealousy, surprise, stress, happiness</td>
</tr>
<tr>
<td>Personality</td>
<td>extravert, paranoiac, depressive anxious, obsessive</td>
<td>introvert, nervous, sociopathic, neurotic</td>
</tr>
<tr>
<td>Relationship</td>
<td>neighbourliness, friendship, marriage, partnership, parentage.</td>
<td>concubinary, romantic, kinship, professional</td>
</tr>
<tr>
<td>Religion</td>
<td>catholicism, islam, evangelism, puritanism, protestantism.</td>
<td>atheism, paganism, judaism, buddhism</td>
</tr>
<tr>
<td>Sins</td>
<td>adultery, envy, fornication, lust, blasphemy,</td>
<td>gluttony, pride, greed, idol-worship</td>
</tr>
<tr>
<td>Disciplines</td>
<td>psychology, economics, history, languages, archaeology.</td>
<td>astronomy, sociology, geography, chemistry</td>
</tr>
</tbody>
</table>

**11.1.3.5. Procedure**

The list of 81 words was presented to participants in a pencil-and-paper format. They were asked to read the words carefully and perform 3 tasks: 1. Sort into the same group the words that could go together to form a category. 2. Suggest a main category name for the groups of concepts formed. 3. Justify how they formed their categorisation. The entire task took approximately 25 minutes to complete. Full instructions and copies of the task can be
found in Appendices B1 and B2.

11.1.3.6. Results and Discussion

The following procedure was used to select the final exemplars: All the categories formed by all the participants were assessed and the names suggested to represent the categories were compared. Participants who suggested appropriate names or their synonyms to represent their categories were retained (e.g., synonyms for religion such as cult and churches were accepted).

Next, for each category constructed, the words that the participants had selected to be the most typical exemplars of the category, which were also identical to those given for the same category by participants in Study 1 were circled. For example, if a participant grouped exemplars of religion that were identical to those suggested in Study 1 together, and named the category “religion” or its synonym, those exemplars were retained for religion.

It was observed that the exemplars for the categories personality traits, time and sins were problematic for most participants to categorize, and hence, were excluded from the analyses. Over 66% of participants systematically grouped the same exemplars for the following 6 categories: crime, society, feelings, relationship, religion and disciplines. The exemplars they gave were identical to those given by participants of Study 1 for the same categories. Table 4 below summarizes all the exemplars that were retained for each category. These exemplars were used in the final experimental stimuli. In total, norming Study 2 yielded 24 typical taxonomic exemplars.

NB: Most of the participants used the term ‘socio-political regimes’ to designate the category ‘Society.’ Therefore, ‘socio-political regimes’ was retained as a category name for the final stimuli.

Table 4. The 6 main superordinate taxonomic categories with their corresponding exemplars retained from norming Study 2.

<table>
<thead>
<tr>
<th>Superordinate categories</th>
<th>Exemplars retained as experimental stimuli</th>
</tr>
</thead>
<tbody>
<tr>
<td>CRIME</td>
<td>Murder, Corruption, Fraud, Treason.</td>
</tr>
<tr>
<td>4SOCIO-POLITICAL IDEOLOGIES</td>
<td>Aristocracy, Liberalism, Monarchy, Democracy.</td>
</tr>
<tr>
<td>FEELINGS</td>
<td>Sadness, Guilt, Terror, Compassion.</td>
</tr>
</tbody>
</table>

4 NB: The category name SOCIETIES was replaced by socio-political ideologies.
11.1.4. Norming Study 3 - verifying the level of concreteness and familiarity of the 24 exemplars

11.1.4.1. Objective

In total, 24 taxonomic exemplars were obtained from the results of norming Studies 1 and 2. Since MRC database was used to norm the 6 main superordinate categories for familiarity and concreteness as explained in norming Study 1, we decided to use MRC standard ratings to norm the exemplars that were present on the database as shown in Table 6. Some of the exemplars were absent from the database, and hence, were normed in Study 3 described below for familiarity and concreteness. Table 5 presents the list of words rated according to the MRC database and those normed in Study 3.

Table 5. List of words in the first column were normed on MRC for concreteness and familiarity. Words in second column were normed in Study 3.

<table>
<thead>
<tr>
<th>Exemplars normed according to MRC</th>
<th>Exemplars normed in Study 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fraud</td>
<td>Corruption</td>
</tr>
<tr>
<td>Aristocracy</td>
<td>Treason</td>
</tr>
<tr>
<td>Democracy</td>
<td>Languages</td>
</tr>
<tr>
<td>Guilt</td>
<td>Liberalism</td>
</tr>
<tr>
<td>Terror</td>
<td>Archaeology</td>
</tr>
<tr>
<td>Friendship</td>
<td>Evangelism</td>
</tr>
<tr>
<td>Marriage</td>
<td>Partnership</td>
</tr>
<tr>
<td>Psychology</td>
<td>Murder</td>
</tr>
<tr>
<td>History</td>
<td>Protestantism</td>
</tr>
<tr>
<td></td>
<td>Puritanism</td>
</tr>
<tr>
<td></td>
<td>Parentage</td>
</tr>
<tr>
<td></td>
<td>Catholicism</td>
</tr>
<tr>
<td></td>
<td>Compassion</td>
</tr>
<tr>
<td></td>
<td>Monarchy</td>
</tr>
<tr>
<td></td>
<td>Sadness</td>
</tr>
</tbody>
</table>
Table 6. MRC database ratings for concreteness and familiarity.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Ratings</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Concreteness</td>
</tr>
<tr>
<td>Abstract concepts</td>
<td></td>
</tr>
<tr>
<td>Fraud</td>
<td>304</td>
</tr>
<tr>
<td>Aristocracy</td>
<td>371</td>
</tr>
<tr>
<td>Democracy</td>
<td>289</td>
</tr>
<tr>
<td>Guilt</td>
<td>299</td>
</tr>
<tr>
<td>Terror</td>
<td>326</td>
</tr>
<tr>
<td>Friendship</td>
<td>335</td>
</tr>
<tr>
<td>Marriage</td>
<td>398</td>
</tr>
<tr>
<td>Psychology</td>
<td>350</td>
</tr>
<tr>
<td>History</td>
<td>238</td>
</tr>
</tbody>
</table>

Means Ratings 323,33 523

11.1.4.2. Method

11.1.4.3. Participants
Twenty-four students from Lumières University of Lyon took part in this study voluntarily.

11.1.4.4. Material
The following method was therefore used to norm 15 exemplars not present on MRC database. A list of the 15 exemplars was created to which the following 5 filler concrete words were added: (building, river, sky, wind, family). The fillers were added in order to provide participants with a contrast between concreteness and abstractness. In total there were 20 words randomly mixed on the final norming list that was presented to participants. For each word, two Likert scales of 1 to 7 were provided. One for rating levels of concreteness whereby 1 represented “not at all concrete” and 7 represented “very concrete.” The other scale was for rating levels of familiarity, upon which 1 represented “not at all familiar” and 7 represented “very familiar.” The words were presented on a sheet of paper with the rating scales presented underneath each one. Full instructions for dimensions and copies of the task can be found in Appendix B3. The concreteness and familiarity ratings for the 5 filler words were taken from the MRC Psycholinguistic database for familiarity and concreteness and they are presented in Appendix B4.

11.1.4.5. Procedure
Participants completed the task individually at their own pace in a pencil-and-paper format. The instructions informed them that they were to rate various words according to how concrete and familiar each word was to them. Concreteness was defined to them as the extent
to which they perceive a word to be physical in nature (i.e., perceivable through vision, hearing, touch etc.). Familiarity was defined to them as the extent to which they considered the word to be familiar to them in a written and spoken context. The entire task took approximately 15 minutes.

**11.1.4.6. Results**

Mean ratings and standard deviations on each dimension for the 15 abstract exemplars for all participants are presented in Table 5. All the items obtained average concreteness scores of less than 400 and familiarity ratings of more than 500 and thus were retained (Wiemer-Hastings & Xu, 2005). The global mean and standard deviation for all the words were 243 and 34 respectively for concreteness and 559 and 44 respectively for familiarity as indicated in Table 7.

Table 7. Mean ratings for concreteness and familiarity of the 15 words in norming Study 3. Standard Deviations in parentheses.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Mean Ratings (SD)</th>
<th>Mean Ratings (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abstract words</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corruption</td>
<td>2.48 (1.1)</td>
<td>6.24 (1.5)</td>
</tr>
<tr>
<td>Treason</td>
<td>1.90 (1.2)</td>
<td>6.33 (1.5)</td>
</tr>
<tr>
<td>Languages</td>
<td>3.05 (1.3)</td>
<td>6.86 (0.7)</td>
</tr>
<tr>
<td>Liberalism</td>
<td>1.76 (0.9)</td>
<td>4.71 (1.9)</td>
</tr>
<tr>
<td>Archaeology</td>
<td>3.09 (1.8)</td>
<td>5.90 (1.7)</td>
</tr>
<tr>
<td>Evangelism</td>
<td>1.66 (1.0)</td>
<td>4.48 (2.1)</td>
</tr>
<tr>
<td>Partnership</td>
<td>2.78 (1.5)</td>
<td>5.66 (1.9)</td>
</tr>
<tr>
<td>Murder</td>
<td>3.95 (1.2)</td>
<td>6.66 (0.9)</td>
</tr>
<tr>
<td>Protestantism</td>
<td>1.76 (0.9)</td>
<td>4.76 (2.0)</td>
</tr>
<tr>
<td>Puritanism</td>
<td>1.38 (0.6)</td>
<td>3.66 (1.9)</td>
</tr>
<tr>
<td>Parentage</td>
<td>2.57 (1.5)</td>
<td>5.09 (1.9)</td>
</tr>
<tr>
<td>Catholicism</td>
<td>2.14 (1.4)</td>
<td>5.95 (1.7)</td>
</tr>
<tr>
<td>Compassion</td>
<td>2.62 (1.4)</td>
<td>6.19 (1.5)</td>
</tr>
<tr>
<td>Monarchy</td>
<td>2.29 (1.0)</td>
<td>4.71 (1.4)</td>
</tr>
<tr>
<td>Sadness</td>
<td>3.00 (1.8)</td>
<td>6.67 (0.9)</td>
</tr>
<tr>
<td>Global means</td>
<td>2.43 (0.34)</td>
<td>5.59 (0.44)</td>
</tr>
</tbody>
</table>
12.0. The Experimental phase

This section presents the experimental objectives and four experimental studies. The objectives presented below describe the main core of the experimental hypotheses that formed the basis of the four studies.

12.1. Experimental objectives

Objective 1. The first objective was to assess only abstract concepts. By doing this we focused our attention on their nature, rather than on the mere differences between them and concrete concepts.

Objective 2. The second objective was to study abstract concepts by taking into account one of the most important aspects relevant to them, i.e., situational information. We aimed at determining the conditions under which situations support the processing of abstract concepts by constructing an experimental paradigm in which situations were part of the manipulated independent factors, thus enabling an empirical evaluation of their fundamental effect on the processing of abstract concepts.

Objective 3. The third objective was to show that thematic organization could be the principal framework in which abstract concepts are structured. Different abstract concepts embedded in a specific situation should lead to the construction of a “novel” thematic relationship between the concepts by virtue of their continuous processing within the situation. Such an observation would further extend previous findings that support the claim that abstract concepts are flexible during thematic integration in situational sequences, (e.g., Wiemer-Hastings & Xu, 2004).

Objective 4. The fourth objective was to determine whether situational experience could produce a “shift” between taxonomic and thematic organisation of abstract concepts. If such a switch were possible, it would further support the flexible integrative network model for abstract concepts. If it is true that thematic organization is the network that represents abstract concepts in the conceptual system, and if situational information provides the necessary representational constraints that enable abstract concepts to be processed, then we must be able to reorganize abstract concepts through our experiences with situations, namely, change their organization from taxonomic to thematic through situational experience. Thus, abstract concepts represented in such an integrative thematic network must be capable of reorganizing themselves constantly.
12.2. Experiment 1

The goal of Experiment 1 was to observe the role that situations play in reorganising abstract concepts, previously belonging to categories reflecting a taxonomic structure. The general assumption was that abstract concepts previously organized in a taxonomic framework, when processed in situations, would be integrated thematically, thus, forming a completely different “non-taxonomic” cluster with respect to the context within which they were previously experienced. In other words, abstract concepts that existed together within a taxonomic structure would dissociate from each other and reorganize themselves into new thematic clusters. The basis of the formation of these new thematic clusters would be their co-occurrence, processing and simulations within situations manipulated experimentally. It was assumed that, as the conceptual system processes a group of concepts meaningfully situated within a given situational background over and over, the system would restructure and integrate these concepts together, in such a way that even if these concepts were previously part of a taxonomic category, they would disengage from this category, enter into a new cluster, and thus, form “novel” relations. The latter will represent the current situational theme within which the concepts were processed, hence a thematic reorganisation. If this assumption were correct, then we would observe a trace of the new thematic structure through a sorting task.

Experiment 1 manipulated two main experimental situation conditions and a baseline condition. For the two experimental situation conditions, one had taxonomic related clusters of target abstract concepts inserted into them. The second had new-thematic clusters of target abstract concepts inserted into them (more details are given in the method section). The procedure of Experiment 1 was in two phases. In phase one, participants read the situations with either taxonomic or new-thematic clusters of target abstract concepts embedded into them. In phase two, participants performed a sorting task on all the target abstract concepts that were previously embedded in the situations. In the baseline condition, participants did not read any situations; they simply performed the sorting task involving the target abstract concepts. The main prediction was that if indeed abstract concepts are fundamentally simulated and represented in thematic or associative frameworks, then a sorting task should reveal new situated “thematic” relations among the target abstract concepts that have been experienced together in the same situation, compared to baseline and taxonomic situation conditions.
12.3. Hypotheses

**Hypothesis 1:** Organization of target concepts in the absence of situational information.

As reviewed earlier, Schwanenflugel and Shoben (1983) showed that it is difficult to retrieve a situation and process abstract concepts in the absence of contextual information. Thus we hypothesized that in the absence of situations, (i.e., at baseline), there would be less background information for thematically integrating the concepts. Hence, categorization would be mainly based on the comparison between the ‘intrinsic’ features of the abstract concepts themselves, leading to the taxonomic organization of the abstract concepts. Specifically, since the target concepts were originally selected from typical taxonomic abstract categories.

**Hypothesis 2:** Organization of target concepts in the presence of situational information.

Barsalou and Wiemer-Hastings (2005) found that situations are central to the conceptual representation of abstract concepts. Wiemer-Hastings and Xu (2003) suggested that thematic relations could be prominent in the classification of abstract concepts despite the presence of taxonomic relations. In view of these facts, we postulated that we should observe significant traces of novel “thematic” relations emerging among the “unrelated abstract words” that had been mentally simulated (Barsalou, 1999) together in the same situation. Conversely, if abstract concepts are principally understood and represented in taxonomic network, then despite their situated conceptualizations, instantiations and experiencing in relevant situations, their organization through a sorting task must remain in taxonomic categories. Such an observation will shed more light on the extent to which the situations affected the on-going processing and reorganizations of abstract concepts.

12.4. Method

12.4.1. Participants

170 undergraduate psychology students from Lumière University of Lyon were recruited as participants in exchange for course credits. They were randomly assigned to the five experimental groups constituted for the experiment. Their participation in the experiment took place on an individual basis. All participants had French as their native language.
12.5. Materials

12.5.1 Phase 1: text stimuli

Story situations

6 stories were created from English, Russian and Roman history. They were about: Mary Tudor, Emperor Nero, Florence Nightingale, The Bronte Sisters, Forensic science in 19th century England and Rasputin.

12.5.2 Structure of paragraphs for each story

There were 4 paragraphs in each story, making 24 paragraphs in total. Each paragraph had between 6 to 7 sentences and 113 words on average. The stories were systematically paired with the six superordinate categories selected from norming Study 1. For example, religion was paired with the Mary Tudor story. This meant that the 4 exemplars of the category religion were randomly embedded in the Mary Tudor story. Table 8 below shows the systematic combinations of stories with each of the six superordinate categories. The six stories into which the 24 concepts were embedded became our experimental situations. It must be noted that the situations were not descriptions or definitions of any of the 24 target concepts.

Table 8. Pairwise combinations between stories and categories.

<table>
<thead>
<tr>
<th>Categories</th>
<th>Stories</th>
</tr>
</thead>
<tbody>
<tr>
<td>Religion</td>
<td>Mary Tudor</td>
</tr>
<tr>
<td>Crime</td>
<td>Emperor Nero</td>
</tr>
<tr>
<td>Disciplines</td>
<td>Florence Nightingale</td>
</tr>
<tr>
<td>Relationships</td>
<td>The Bronte Sisters</td>
</tr>
<tr>
<td>Feelings</td>
<td>Forensic science C19th England</td>
</tr>
<tr>
<td>Socio-political ideologies</td>
<td>Rasputin</td>
</tr>
</tbody>
</table>

Comprehension questions

At the end of each paragraph, a comprehension question based on the information described in the paragraph was asked, to which participants had to respond yes or no. There were 24 questions in total with equal numbers of positive and negative answers. The paragraphs were randomly paired with positive and negative answers. The purpose was to ensure that participants read and comprehended the situations.

12.5.3. Taxonomic target concepts

The 24 exemplars from the 6 categories selected from the 3 norming studies described earlier became our 6 original taxonomic targets clusters. Each cluster had 4 words that were taxonomically as shown in Table 9.
12.5.4. “Newly derived thematic clusters” targets concepts

6 new clusters referred to as “newly derived thematic clusters” were randomly created from the 6 original taxonomic clusters. Putting together 4 words, where each word was from a different taxonomic category created each “newly derived thematic” cluster. In other words, there were 6 “newly derived thematic clusters” and each cluster had 4 members. Each of the 4 members in one “newly derived thematic cluster” came from a different taxonomic category, such that no 2 words from the same taxonomic category appeared together in the same “newly derived thematic cluster.” For example, *puritanism* was taken from the *religion* cluster, *history* from *discipline*, *murder* from *crime* and *democracy* from *socio-political ideologies*. So (*puritanism, history, murder, democracy*) formed a “newly derived thematic cluster.” Following the same procedure, six “newly derived thematic clusters” were generated. Table 9 above shows all the “newly derived thematic clusters” constructed from the taxonomic categories.

Table 9. Recapitulation of situations and their corresponding clusters and categories.

<table>
<thead>
<tr>
<th>Original categories</th>
<th>Taxonomic clusters</th>
<th>Newly derived thematic clusters</th>
<th>Paired situations</th>
</tr>
</thead>
<tbody>
<tr>
<td>CRIME</td>
<td>Murder, Corruption, Fraud,</td>
<td>Archaeology, Corruption,</td>
<td>Nero</td>
</tr>
<tr>
<td></td>
<td>Treason.</td>
<td>Aristocracy, Marriage.</td>
<td></td>
</tr>
<tr>
<td>SOCIO-POLITICAL</td>
<td>Aristocracy, Liberalism, Monarchy,</td>
<td>Fraud, Friendship, Catholicism, Democracy.</td>
<td>Rasputin</td>
</tr>
<tr>
<td>IDEOLOGIES</td>
<td>Democracy.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FEELINGS</td>
<td>Sadness, Guilt, Terror, Compassion.</td>
<td>Partnership, Guilt, Puritanism, Murder.</td>
<td>The dead can talk</td>
</tr>
<tr>
<td>RELATIONSHIPS</td>
<td>Friendship, marriage, partnership,</td>
<td>Psychology, Evangelism, Sadness, Parentage.</td>
<td>The Bronte Sisters</td>
</tr>
<tr>
<td></td>
<td>parentage.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RELIGION</td>
<td>Catholicism, Evangelism, Puritanism,</td>
<td>History, Terror, Monarchy, Treason.</td>
<td>Mary Tudor</td>
</tr>
<tr>
<td></td>
<td>Protestantism.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DISCIPLINES</td>
<td>Psychology, History, Languages,</td>
<td>Compassion, Protestantism, Languages, Liberalism.</td>
<td>Florence</td>
</tr>
<tr>
<td></td>
<td>Archaeology.</td>
<td></td>
<td>Nightingale</td>
</tr>
</tbody>
</table>
12.5.5. Phase 2. Experimental situation stimuli - insertion of target concepts into situations

12.5.6. Taxonomic situations - situations containing taxonomic clusters

In each story situation, the 4 exemplars in each set of taxonomic clusters were randomly inserted into each of the 4 paragraphs. Importantly, this cluster was not inserted in any other situation. Since each situation had 4 paragraphs, a cluster of taxonomic concepts, (or a taxonomic cluster with 4 exemplars) was inserted into each paragraph of the situation. Specifically, each taxonomic cluster was repeatedly inserted into all 4 paragraphs of the same situations but not into any other situation. For example, taking the Mary Tudor story situation, the taxonomic cluster containing the exemplars of religion (catholicism, puritanism, protestantism, evangelism) was inserted into each of its 4 paragraphs, and only the Mary Tudor situation contained the religion cluster. The average number of words in each paragraph of the taxonomic situations was about 112. The above procedure yielded 6 taxonomic experimental situations.

12.5.7. Newly derived thematic situations - situations containing “newly derived thematic clusters”

The newly derived thematic situations consisted of the same 6 situations used for the taxonomic clusters as indicated above, except that clusters containing the “newly derived thematic” words were inserted into the 4 paragraphs of each situation, respecting the same guidelines as the taxonomic ones. Each of the 6 “newly derived thematic clusters” was systematically paired with a specific situation, such that a “newly derived thematic cluster” containing 4 exemplars was embedded in the paragraphs of the situation to which it was paired. For example, the “newly derived thematic cluster” (history, terror, monarchy, treason) was paired with the Mary Tudor situation, such that the cluster was inserted into each of the 4 paragraphs of the Mary Tudor situation only. The average number of words for each “newly derived thematic situation” paragraph was about 113. The above procedure yielded 6 “newly derived thematic” experimental situations. Table 9 above summarizes the 2 types of situations with their corresponding clusters generated from the six original categories.

12.5.8. Precautions taken during the insertion of target concepts into the situations

During the creation of the situations, the target concept clusters co-occurred randomly in each situation so as to create meaningful and comprehensible texts that were ecologically valid. However, we needed to make sure that their insertion did not affect how they would be processed and organized during reading. Secondly, since the exact positions of the concepts
were different in the two types of situations and in each paragraph, (for comprehension purposes), we had to ensure that their distribution in the “newly derived thematic” situations compared to that of the taxonomic ones was not significantly different and thus, would not influence the effect expected. This led to the implementation of the two control precautions described below.

12.5.9. Control for the distances between target concepts in situations

The average distances between all the target words in each paragraph of each situation was computed. To do this, in each paragraph, the number of words from each target word to the other was counted and a value was obtained. Then, the average for all the values obtained in each paragraph was calculated to obtain the global mean for that specific paragraph. Since each situation had four paragraphs, there were 4 global means for each situation. Consequently, following this procedure, 24 global means were obtained from the “newly derived thematic” situations and another 24 global means from the taxonomic situations. A paired t-test was performed on the 24 taxonomic global means compared to the 24 “newly derived thematic” global means, paragraph by paragraph. All comparisons were done using the statistical software Statistica. The results were statistically non-significant at \( p > .05 \). (Detailed results are presented in Appendix C).

12.5.10. Control for the positions of the target concepts in situations

The second control measure was done by counting the number of words from the beginning of each paragraph to each of the target concepts inserted. This counting yielded a cumulative value from the beginning of each paragraph to each target abstract concept. Since there were 4 target abstract words in each paragraph, 4 values were obtained from each paragraph. The global mean of the 4 values was computed for each paragraph. Consequently 24 global means were obtained from the six “newly derived thematic” situations and 24 global means from the six taxonomic situations. A paired t-test was carried out on the 2 groups of global means from the 2 types of situations, paragraph by paragraph. The results were statistically non-significant at \( p > .05 \). (Detailed results are presented in Appendix D).

Table 10 below shows an example of the two versions of the Rasputin story situation (“Newly derived thematic” and Taxonomic), with comprehension questions. The target abstract words are highlighted in bold, (see Appendices E1 and E2 for all the experimental situations used in Experiment 1).
Table 10. Situation Rasputin presented in 2 versions (newly derived thematic and taxonomic) with comprehension questions. Target words appear in bold characters.

<table>
<thead>
<tr>
<th>Situation 1. Title: Rasputin</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Paragaphs</strong></td>
<td><strong>Version:</strong> Newly derived thematic. <strong>Concepts inserted:</strong> Fraud, Democracy Friendship &amp; Catholicism.</td>
</tr>
<tr>
<td><strong>1ST</strong></td>
<td>In 1916, the blotted castrated body of a man was dragged from a river near Saint Petersburg, almost beyond recognition; it was later identified as that of the notorious monk Gregory Rasputin. To his enemies he was the incarnation of evil; he destroyed anyone who dared to cross his path to power. He was implicated in fraud, the destruction and the execution of the Romanov family. He spoke against the doctrines of catholicism and he developed a reputation as a faith healer and mystic. He benefited from a privileged friendship with the tsarina Alexandra and was instrumental in wiping out the 300yr old dynasty, thus changing Russian democracy forever.</td>
</tr>
<tr>
<td>C. <strong>Question 1</strong> Gregory Rasputin was found in Germany?</td>
<td></td>
</tr>
<tr>
<td><strong>2ND</strong></td>
<td>Gregory Rasputin was born in Siberia. As a teenager his shameless exploits earned him a reputation as a thief. Rasputin began to search for an alternative power to God. He created a strong friendship with the leader of a heretical cult, and together they openly opposed the teachings of catholicism, by proclaiming that it is only after a man had sinned greatly could he truly be repentant and pleasing to God. In reality, Rasputin was a fraud and he abused countless God fearing peasant women. St Petersburg in 1900 was a very vibrant cosmopolitan place and the orthodox members were beginning to flirt with the ideas of democracy.</td>
</tr>
<tr>
<td>C. <strong>Question 2</strong> Gregory Rasputin was born in St Petersburg.</td>
<td></td>
</tr>
</tbody>
</table>
In 1903, there was a general cry for democracy by the Russian people. Catholicism was losing its popularity, and the church was looking for genuinely spiritual types among the common people. In the Tsar’s family, despite the opulence and the luxury, the one dark cloud was that the heir to the throne suffered from haemophilia, an agonising blood disorder. The empress saw her only son’s illness as a punishment from God. In November 1906, Rasputin was summoned to the palace to see if his mystical ability to heal could help. The empress was convinced that only a miracle could save her son. This encounter secured a solid friendship between them, which he later used to fraud the Russian government for his own interest.

C. Question 3

The Tsar had two sons

4TH He took immense pleasure in insulting his social superior. He engaged in humiliating friendships with the women and shamed their husbands in public gatherings. He publicly criticised Catholicism and the Russian Orthodox Church. The seat of government was filled with fraud, incompetence and fortune hunters, many of whom were happy to pay large sums to Rasputin. He had immense political power and all feared and revered him. Russia’s last chance for democracy and an honest government was in the hands of the prime minister Peter Voinovich, who was compiling a file of evidence against Rasputin. There is much controversy over Rasputin’s mystical healing powers. But what is certain is that he had an irrefutable affect on the Romanov family and the Russian Empire.

C. Question 4

Gregory Rasputin opposed and criticised the Russian Orthodox church.

12.5.11. Implicit situations

In order to determine whether the reorganization of the target words expected was due to the processing of the experimental situations, a control version of the experimental situations was created. We will refer to the control versions as “implicit situations.” The implicit situations were identical to the experimental situations in terms of format, content and presentation, except that they did not have the 24 target words inserted into them. These
Implicit situations were used as a control situations condition, which was compared to the experimental situations conditions during analyses in order to examine the effect of situations with target words versus situations without target words on organization. Table 11 below shows the implicit versions of the Rasputin situations presented above. Please refer to Appendix F for the entire implicit situations used in Experiment 1.

Table 11. Implicit situation: Rasputin presented in 2 versions (newly derived thematic and taxonomic). Target concepts are absent.

<table>
<thead>
<tr>
<th>Implicit Situation 1. Title: Rasputin</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Paragraphs</strong></td>
<td><strong>Version:</strong> Newly derived Thematic.</td>
</tr>
<tr>
<td>1&lt;sup&gt;st&lt;/sup&gt;</td>
<td>In 1916, the blotted castrated body of a man was dragged from a river near Saint Petersburg, almost beyond recognition; it was later identified as that of the notorious monk Gregory Rasputin. To his enemies he was the incarnation of evil; he destroyed anyone who dared to cross his path to power. He was implicated in several brutalities such as the execution of the Romanov family. He spoke against the doctrines of orthodox church and he developed a reputation as a faith healer and mystic. He benefited from the tsarina Alexandra and was instrumental in wiping out the 300yr old dynasty and contributed in changing Russia forever.</td>
</tr>
<tr>
<td>2&lt;sup&gt;nd&lt;/sup&gt;</td>
<td>Gregory Rasputin was born in Siberia. As a teenager his shameless exploits earned him a reputation as a thief. Rasputin began to search for an alternative power to God. He was associated with the leader of a heretical cult, and together they openly opposed the teachings of the Russian Orthodox church by proclaiming that it is only after a man had sinned greatly could he truly be repentant and pleasing to God. In reality, Rasputin was a criminal and he abused countless God fearing peasant women. St Petersburg in 1900 was a very vibrant cosmopolitan place and the orthodox</td>
</tr>
</tbody>
</table>

Question 1: Gregory Rasputin was found in Germany?
Members were beginning to flirt with the ideas of social freedom.

Question 2  
Gregory Rasputin was born in St Petersburg.

3rd  
In 1903, there was a general cry for social justice by the Russian people. The Orthodox church was losing its popularity, so it started looking for genuinely spiritual types among the common people. In the Tsar’s family, despite the opulence and the luxury, the one dark cloud was that the heir to the throne suffered from haemophilia, an agonising blood disorder. The empress saw her only son’s illness as a punishment from God. In November 1906, Rasputin was summoned to the palace to see if his mystical ability to heal could help. The empress was convinced that only a miracle could save her son. This encounter secured a solid bond between them, which he later used against the Russian government for his own interest.

Question 3  
The Tsar had two sons

4th  
He took immense pleasure in insulting his social superior. He engaged in humiliating conversations with the women and shamed their husbands in public gatherings. He publicly criticised the spiritual leaders and the Russian Orthodox Church. The seat of government was filled with conspiracy, incompetence and fortune hunters, many of whom were happy to pay large sums to Rasputin. He had immense political power and all feared and revered him. Russia’s last chance for freedom and an honest government was in the hands of the prime minister Peter Voinovich, who was compiling a file of evidence against Rasputin. There is much controversy over Rasputin’s mystical healing powers. But what is certain is that he had an irrefutable affect on the Romanov family and the Russian Empire.

Question 4  
Gregory Rasputin opposed and criticised the Russian Orthodox church.

In 1903, there was a general cry for social changes amongst the Russian people. The royal family was losing its popularity and the church was looking for genuinely spiritual types from the common people. In the Tsar’s family, despite the opulence and the luxury, the one dark cloud was that the heir to the throne suffered from haemophilia, an agonising blood disorder. The empress saw her only son’s illness as a punishment from God. In November 1906, Rasputin was summoned to the palace to see if his mystical ability to heal could help. The empress was convinced that only a miracle could save her son. This encounter secured a solid bond between them, which he later used against the Russian government for his own interest.

In socialising with the Russian upper class, he took immense pleasure in insulting his social superior. He humiliated the women and shamed their husbands in public gatherings. He publicly criticised political ideologies of social equality and religion. The seat of government was filled with incompetent fortune hunters, many of whom were happy to pay large sums to Rasputin. He had immense political power in the royal family and all feared and revered him. Russia’s last chance for justice and an honest government was in the hands of the prime minister Peter Voinovich, who compiled a file of evidence against Rasputin. There is much controversy over Rasputin’s mystical healing powers. But what is certain is that he had an irrefutable affect on the Romanov family and the Russian Empire.
12.5.12. Phase 3: Programming of the sorting task

The second phase of the experiment was to construct a word sorting task that would be used to measure the type of conceptual organization being deployed from the processing of the situations with the target abstract concepts embedded in them. The computer software Adobe Flash Builder (mac version 4.7.0) was used to design a simple computerized sorting task program specifically for this experiment. The sorting task program was named “Word Game” so that participants would not link it directly to the situation-reading task. Word Game was programmed with the following features:

1. Eight rectangular boxes on the computer screen split into 2 sets of boxes: a set of 4 boxes appeared on the upper part of the screen and another set 4 boxes on the lower part of the screen, with a space between the 2 sets of boxes.
2. Each box was demarcated with a different colour for identification.
3. A Start button to click on to launch the program.
4. Clicking the start button enabled ALL the target words to appear on the screen together.
5. The possibility to click on a word and then click immediately on a box; the word gets displaced into the chosen box.
6. The possibility to put as many words into as many boxes as possible.
7. A Finish button, enabling the stopping of the program at the end of the task.
8. A Save button that enables the file of participants to be saved as image files.
9. An Analyse button that opens the saved data files containing the participant’s categorized words.

The program enabled the categorisation of words presented in random order. Different words could be sorted and mixed with others, if the participant considers that they could “go together,” according to any type of relation. Figure 7 below shows an example of the interface of the Word Game as presented to participants, with all the target words appearing together on the screen. (Appendix G gives more details on the program).
12.5.13. Experimental sorting list – target abstract words stimuli

The experimental sorting stimuli consisted of a list of the 24 target abstract words in French, namely, 4 exemplars of the 6 original abstract categories. There were two versions of this list to compensate for the order effect of presentation. The first version had a randomized list of the 24 target words. On the second version list, the words were written in a reversed order to the first list. So half the participants were given the first version list and the other half had the second version list in order to counterbalance and compensate for order effect. (Please see Appendix H for the two versions of the sorting list).


In order to avoid demand on the critical target concepts after the processing of situations, two extra lists of 24 concrete verbs (e.g., talk, walk, drive) and 24 concrete nouns (e.g., plane, river, wine) were sorted before the target abstract words. This was also an intermittent task used to mask the purpose of the critical sorting task. It also prevented participants from directly linking the situation reading task to the sorting of the target abstract words. Each of the two extra lists was randomized and counterbalanced into two versions for presentation, following the procedure described above (see Appendices I and J for the list of
verbs and nouns respectively).

**12.6. Procedure**

The procedure for the experiment was in two phases.

![Diagram of Procedure](image)

Figure 8. The two phases of the procedure of Experiment 1.

12.6.1. Phase 1 procedure: situation reading

This phase of the experiment was created and presented with the experimental psychology software program, Psyscope (Cohen, MacWinney, Flatt, & Provost 1993), on an Apple Macintosh computer. The texts were presented on a computer screen, paragraph by paragraph. Thus, participants read the situations one paragraph at a time, and each paragraph was followed by a comprehension question. Participants were first told that they were going to participate in two entirely different experiments, one on comprehension and the other on classification. Everything was done to ensure that participants did not link explicitly the two experimental tasks. Therefore, the two tasks were presented on two different computers situated in different areas within the experimental room. These precautions were taken to avoid demand on the sorting of words.

After giving their consent and reading the instructions, participants pressed the space bar, and the first paragraph of the first story appeared on the screen. When they had finished reading the paragraph at their own pace, they pressed the space bar again and the comprehension question for the paragraph just read appeared underneath the paragraph. The paragraph and the question remained on the screen until participants answered “yes or no”, by pressing the “S” or “K” key, respectively, on the keyboard. After the question had been answered, the second paragraph appeared, followed by its question, etc. This continued until the last question for the last paragraph of the last situation was answered. All the situations were presented in the same order to all participants. (Please refer to Table 9 above for examples of the comprehension questions).

12.6.2. Instructions for reading situations

Participants were instructed to read the situations attentively at their own pace, and to answer each question at the end of each paragraph as accurately as possible. They were told...
that answering the questions was an important part of the experiment. The paragraphs remained on the screen whilst the participants answered the questions. These questions were to ensure that participants paid attention and processed the situations, and were not meant to be difficult. The reading task took approximately 25 minutes.

12.6.3. Phase 2: Sorting of target abstract concepts/words

The second phase of the experiment was presented on a different Apple Macintosh computer, set up on a separate area in the experimental room, again to make participants believe that they were participating in a second, completely different experiment. The experimenter set up the “Word Game” program for each participant. They were told that when the “Start” button was clicked, a group of words would appear in the middle of the screen, with 4 boxes on the upper part of the screen and another 4 on the lower part of the screen. The experimental protocol was structured such that ALL the target concepts were presented together to participants for sorting at the same time. Participants were instructed to read and study the group of words attentively, then put into the same box all the words that they thought could “go together.” When they had finished, they were to click on the “Stop” button. They placed words into the boxes by simply clicking on a word and then clicking on any of the boxes, the word automatically appeared in the selected box. Once words were placed in boxes, they could not be moved again. The clusters of words sorted into different boxes were recorded and saved as image files for analyses. The specific instructions for sorting the concepts were: “Study attentively the words that appear in the middle of the screen. Then put into the same box, creating a group, those words that go together. Feel free to use all the boxes.”

An experimental trial began with the sorting of all 24 concrete nouns appearing at once, followed by the sorting of all the 24 concrete verbs, also appearing all at once. Finally, the trial ended with the sorting of all 24 experimental target abstract concepts presented all at once (please refer to Figure 7 above for the presentation of concepts). The order of presentation of the three lists was identical for all participants, (i.e., nouns, verbs and targets). Each list had two counterbalanced versions. For each experimental group, half the participants received one version, and the other half received the second version. All participants were free to create as many groups as possible.
12.7. Experimental conditions

NB:

In order to simplify the statistical analyses of experimental conditions and independent variables, in the rest of experimental sections, the “Newly derived thematic” target clusters will be referred to as “novel-thematic” target variables. And the “Newly derived thematic” situations condition will be referred to as “New-thematic” situation conditions. The main experimental conditions were:

1. Baseline condition (n=32)

No processing of situations: In this condition, participants did not read any situations. They performed the sorting task on the 3 sets of the 24 randomized words: nouns, verbs and critical target abstract concepts.

2. Taxonomic situations condition (n=32)

Processing of taxonomic situations followed by the sorting task. In this condition, participants read the taxonomic situations that had target abstract concepts related to each other taxonomically inserted into them. Afterwards they performed the sorting task on the 3 sets of 24 words.

3. Implicit taxonomic situations condition (n=38)

Processing of implicit taxonomic situations without target concepts, followed by the sorting task. This condition served as a taxonomic sub-control group. The situations were identical to the taxonomic ones explained above except that they did not have the 24 critical abstract concepts inserted into them. Participants first read the “implicit” taxonomic situations. Afterwards they performed the sorting task on the 3 sets of 24 words.

4. New-thematic situations condition (n=32)

Processing of novel-thematic targets clusters inserted into situations, followed by the sorting task. In this condition, participants read the new-thematic situations that had the “novel-thematic” clusters inserted into them. Afterwards they performed the sorting task on the 3 sets of 24 words.

5. Implicit new-thematic situations condition (n=36)

Processing of implicit new-thematic situations without target concepts, followed by the sorting task. This condition served as a new-thematic sub-control group. The situations were identical to the new-thematic ones, except that we did not embed the 24 critical “novel-thematic” abstract concepts into them. Participants first read the implicit new-thematic situations. Afterwards they performed the sorting task on the 3 sets of 24 words.
12.8. Experimental design

The experimental design consisted of a 5 (Situations: baseline vs. implicit taxonomic vs. implicit new-thematic vs. taxonomic vs. new-thematic) by 2 (Sorting Type: taxonomic vs. novel-thematic). Where, Situations was a between-participant variable, Sorting Type was a within-participant variable and Subject was a random factor.

The dependent variable was the level of clustering correlation, corresponding to the measure of the level/amount of clustering of abstract concepts that participants created after processing the situations.

12.9. Predictions

Prediction 1 – Baseline

It was predicted that in the baseline condition, the amount of taxonomic sorting would be significantly greater than novel-thematic sorting. This prediction was anticipated based on previous studies that had shown that in the absence of contextual/situational information, abstract concepts are very difficult to process (e.g., Schwanenflugel & Shoben, 1983; Barsalou & Wiemer-Hastings, 2005). Moreover, since the target concepts were originally selected from “typical” exemplars of superordinate taxonomic categories (obtained from exemplar generation tasks in the norming studies), we expected significant taxonomic sorting in the absence of situational information.

Prediction 2 – Baseline vs. taxonomic situation

The amounts of taxonomic sorting of abstract concepts, after their processing in taxonomic situations was expected to be significantly greater than what would be observed at baseline. This prediction was anticipated, since the situations were expected to reinforce the organization between the target abstract concepts instantiated within them.

Prediction 3 – Baseline vs. new-thematic situation

It was predicted that compared to baseline, the new-thematic situations would show a significantly greater amount of novel-thematic sorting than taxonomic sorting of abstract concepts, given the importance of situational information in the processing of abstract concepts (e.g., Barsalou & Wiemer-Hastings, 2005; Wiemer-Hastings & Xu, 2005; Schwanenflugel & Shoben, 1983).
Prediction 4 – New-thematic situation vs. taxonomic situation:

It was predicted that if the reorganization of abstract concepts is dependent on or affected by the type of situations in which they were recently experienced, then after their processing in new-thematic situations, there should be significantly greater amount of novel-thematic sorting and smaller amounts of taxonomic sorting of abstract concepts. Conversely, for the taxonomic situations, one should observe significantly greater amounts of taxonomic sorting and smaller amounts of novel-thematic sorting.

13.0. Data collection and analyses of Experiment 1.

13.1. Comprehension questions

The answers to the comprehension questions were recorded, enabling the selection of participants who only got correct answers for all the questions. The assumption was that since these questions were simple, a participant who reads the situations reasonably carefully should be able to get all the answers right. Two participants did not obtain correct answers to all comprehension questions and hence they were removed from the final analyses.

13.2. Concept sorting

Data were collected on a computer screen, where participants put into rectangular boxes the clusters that they created. Participants were given the freedom to make different numbers of clusters, up to 8 maximum and they could put as many concepts into each cluster as they desired. The files were stored as images (.jpeg). Thus, the number of concepts in each cluster and the total number of clusters could be viewed, counted and recorded. Only the data for the sorting of target abstract concepts were analysed.

13.3. Concept sorting task analyses

Our central question was how similar the clusters formed by participants were to the six original taxonomic and six novel-thematic clusters as shown previously in Table 8 (section 12.4.5). To reiterate, in the 6 original taxonomic clusters, each cluster had 4 exemplars that were taxonomically related. Concerning the six original novel-thematic clusters, each cluster had 4 exemplars, each taken from a different taxonomic category.

In order to determine the effect of situations on the reorganization of the clusters of abstract concepts inserted into them, a comparison between the clusters formed by each participant after processing the situations and the two types of original clusters: taxonomic and novel-thematic was effectuated. Then, a measure of the coefficient of correlations corresponding to the similarity between them was calculated.

To determine the similarity between the original clusters and those formed by participants, an n by (n-1/2) matrix of correlation was constructed. This is a half-matrix that
represented each possible pair of the concepts to be sorted derived for each participant. If a participant put 2 concepts belonging to the same original cluster into the same cluster, a “1” was entered into the matrix, if they did not put them into the same cluster, a “0” was entered. In other words, a “similarity proximity matrix” for pairwise sorting was constructed for each participant. The matrices of all participants were filled out in this manner.

Two solution matrices were created: one for the six original taxonomic clusters and another for the six original “novel-thematic” clusters. Figures 9, 10 and 11 below show examples of a taxonomic matrix solution, a novel-thematic solution matrix and a single participant’s matrix respectively.

The coefficient of correlation (Pearson r) was computed between each participant’s matrix and each of the two solution matrices in order to determine the level of similarity between them. In doing this we were aggregating across participants. This aggregation across participants gave a graded similarity value between the participants’ matrices and the two solution matrices. The higher the correlation value obtained, the more similar a participant’s organization is to a solution matrix.

As each participant’s matrix was correlated to both the taxonomic and “novel-thematic” solution matrices, there were 2 coefficient scores for each participant. This method of analyses has been used in previous studies involving the clustering and categorization of concepts, (Majid, Bowerman, Van Staden & Boster, 2007; Boster, Berlin & O’Neil, 1986; Boster, 1994).

![Figure 9: Example of the taxonomic solution matrix of abstract concepts.](image_url)
Figure 10. Example of the novel-thematic solution matrix of abstract concepts.

Figure 11. Example of a single participant’s matrix based on his sorting data.

13.4. Results

Statistical Analysis 1: comparing means of the 5 groups

In order to be able to carry out analyses of variances (ANOVA), the Pearson’s correlation r-scores were transformed into Fisher values for analyses at an alpha level of 0.05. The means and standard deviations are reported in Pearson's r- scores. All analyses were done using the statistical software Statistica.
14.0. Results – Main effects

Table 12. Mean coefficient of correlations (r) for the sorting type as a function of the 5 situations: baseline, taxonomic, new-thematic, implicit taxonomic and implicit new-thematic in Experiment 1. (Standard errors shown in parentheses).

<table>
<thead>
<tr>
<th>SORTING TYPE</th>
<th>SITUATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Baseline</td>
</tr>
<tr>
<td>TAXONOMIC</td>
<td>0.54 (0.05)</td>
</tr>
<tr>
<td>NOVEL-THEMATIC</td>
<td>-0.07 (0.02)</td>
</tr>
<tr>
<td>M</td>
<td>0.24 (0.02)</td>
</tr>
</tbody>
</table>

Figure 12. The effect of situations on the organization observed among the 5 groups.

From the ANOVA analyses revealed a marginal effect for Situations, $F (4, 163) = 2.29$, MSE = .04 r to z units, $p = .06$, partial $\eta^2 = .05$. As presented in Table 12 and Figure 12 above, generally there were marginal differences between the means of the 5 groups. However, the mean, M level of correlation for clustering was highest in the implicit new-thematic situation (Mean = 0.32), followed by the taxonomic group (Mean = 0.3), then by implicit-taxonomic (Mean = 0.28). There was no difference between baseline and new-thematic groups (Mean = 0.24).
There was however a significant effect for Sorting Type: \( F (1, 163) = 589.27, \text{MSE} = .06 \) r to z units, \( p < .00 \), partial \( \eta^2 = .78 \). The mean level of correlation for clustering was significantly greater for taxonomic (Mean = 0.54) compared to novel-thematic (Mean = -0.06), indicating that taxonomic sorting was predominant across all the five groups as shown in Figure 12 above.

Interestingly, there was a significant interaction between Situations and Sorting Type: \( F (4, 163) = 3.11, \text{MSE} = .06 \) r to z units, \( p < .02 \), partial \( \eta^2 = .07 \).

Pairwise planned comparisons were computed to further explore the main effect and interaction. The planned comparisons showed no significant differences in Sorting Types between Baseline (Mean = 0.24) compared to new-thematic situation (Mean = 0.24), to taxonomic situation (Mean = 0.3) and finally to implicit-taxonomic (Mean = 0.28), \( p > .05 \).

The only significant difference observed was between baseline (Mean = 0.24) and implicit new-thematic situation (Mean = 0.32), \( F (1, 163) = 4.86, p < .03 \). Contrast analyses showed that this difference was based only on reliable differences in taxonomic sorting, which were baseline (Mean = 0.54) and implicit new-thematic (Mean = 0.72); \( F (1, 163) = 5.96, p < .02 \). But the differences in novel-thematic sorting between them was not reliable: baseline (Mean = -0.07) and implicit-thematic (Mean = -0.08), \( F (1, 163) = .28, p = .6 \).

To test the prediction of the interaction between taxonomic and new-thematic situations, a comparison was carried out between taxonomic and new-thematic situations with respect to Sorting Type. A significant interaction was observed: \( F (1, 163) = 6.05, p < .02 \). This indicated that reading the novel-thematic clusters in new-thematic situations reliably affected the reorganization of the clusters. In that, after the processing of the novel-thematic abstract concepts in the new-thematic situations, there was a significantly greater amount of novel-thematic sorting (Mean = -0.02) compared to that observed from the taxonomic situation (M= -0.07), \( F (1, 163) = 4.02, p < .05 \). At the same time, there were also significantly smaller amounts of taxonomic sorting (Mean = 0.50), compared to that observed in the taxonomic situation (M= 0.67), \( F (1, 163) = 4.97, p < .03 \).

14.1. Statistical analysis 2: comparing means of correlations between the 3 main experimental groups

A second analysis of variance was performed on only the three main experimental groups: baseline, new-thematic and taxonomic with respect to Sorting Types: taxonomic vs. novel-thematic. The aim was to reexamine the predictions for the main experimental groups, without the 2 sub-control groups (implicit taxonomic and implicit new-thematic) in order to determine whether there would be any differences in the results obtained from the first
analysis. Table 13 below shows the means and standard errors in parentheses for the three experimental groups.

Table 13. Mean coefficient of correlations (r) for the sorting type as a function of the 3 situations: baseline, taxonomic, new-thematic in Experiment 1. (Standard errors shown in parentheses).

<table>
<thead>
<tr>
<th>SORTING TYPE</th>
<th>SITUATIONS</th>
<th>Baseline</th>
<th>Taxonomic</th>
<th>New-thematic</th>
<th>M</th>
</tr>
</thead>
<tbody>
<tr>
<td>TAXONOMIC</td>
<td></td>
<td>0.54 (0.04)</td>
<td>0.67 (0.04)</td>
<td>0.50 (0.05)</td>
<td>0.57 (0.03)</td>
</tr>
<tr>
<td>NOVEL-THEMATIC</td>
<td></td>
<td>-0.07 (0.02)</td>
<td>-0.07 (0.02)</td>
<td>-0.02 (0.03)</td>
<td>-0.05 (0.01)</td>
</tr>
<tr>
<td>M</td>
<td></td>
<td>0.24 (0.02)</td>
<td>0.30 (0.02)</td>
<td>0.24 (0.03)</td>
<td>-</td>
</tr>
</tbody>
</table>

(M denotes means of groups for situations and sorting types).

14.2. Main effects 2 – from the 3 experimental groups

Situations

The ANOVA showed a significant effect for the factor Situations: \( F(2, 91) = 3.27 \), MSE = .02 r to z units, \( p < .05 \), partial \( \eta^2 = .07 \). Thus, comparing the mean level of correlations for clustering in the 3 situations, the highest was observed in the taxonomic situation (Mean = 0.30). There was no difference between baseline and new-thematic situations (Mean = 0.24) as indicated in Figure 12.

Figure 13. The effect of situations on the organization observed among the 3 main experimental groups.
Sorting Type

There was a significant effect of Sorting Type: $F(1, 91) = 312.54, \text{MSE} = .06 \text{ r to z units, } p < .00$, partial $\eta^2 = .77$. The mean level of correlations for clustering was significantly greater for taxonomic (Mean = 0.57) than novel-thematic (Mean = -0.05), indicating again that taxonomic sorting was predominant across all the three groups as shown in Figure 12.

Interaction between Situations and Sorting Type

A significant interaction was observed between Situations X Sorting Type: $F(2, 91) = 3.39, \text{MSE} = .02 \text{ r to z units, } p < .04$, Partial $\eta^2 = .07$.

Comparing new-thematic and taxonomic situations, planned comparison revealed a significant interaction between them: $F(1, 91) = 6.64, p < .02$. Details from contrast analyses revealed that this significant interaction was only due to significant amounts of correlations for taxonomic sorting, but not for novel-thematic sorting as shown in Figure 12 above.

Thus, when the target abstract concepts were processed in the new-thematic situation, the correlations for taxonomic organization significantly decreased (Mean = 0.5), compared to that observed in the taxonomic situation, which was reliably greater, (Mean = 0.67), $F(1, 91) = 7.12, p < .00$. However, the amounts of novel-thematic organization did not increase as was expected: $F(1, 91) = 2.39, p = .12$, indicating that the correlations for novel-thematic organization observed in the new-thematic situation (Mean = -0.02) were not reliably different from those observed in the taxonomic situation (Mean = -0.07). So, the new-thematic situations did not significantly influence the processing of the novel-thematic clusters read in them.

In the first analysis presented above, we observed a significant difference between the 2 types of sorting for new-thematic and taxonomic situations, whereas here, only taxonomic sorting was significant. This could be due to the fact that in the previous analysis, there were more participants included in the analysis (all 5 groups), whereas the second analysis had only the 3 main groups. Observing the two groups, it is however quite evident from the two analyses that taxonomic effects far exceed those of novel-thematic.

Comparing baseline and new-thematic situation, one expected to see a significant interaction between taxonomic and novel-thematic sorting types, but this was not the case, $F(1, 91) = 1.04, p = .3$. Neither was there any significant difference or interaction between baseline and taxonomic situations concerning sorting type, $F(1, 91) = 2.5, p = .1$. No other effects or interactions came out significantly.
15.0. Discussion

The effect of situations on the reorganization of abstract concepts was investigated. We expected to observe reliable novel thematic integration between abstract concepts that were previously processed and conceptually represented in new-thematic situations. Such an observation would have supported theories which claim that thematic integrations and situational information are central to the comprehension and representation of abstract concepts (Wiemer-Hastings & Xu, 2003; Barsalou & Wiemer-Hastings, 2005; Schwanenflugel & Shoben, 1983).

However, the general results observed did not go in the same direction as our expectations. The differences observed across all situations were marginal, specifically when all the five groups were analysed together. Higher correlations for taxonomic organization appeared to be predominant across all situations. When the three main experimental condition of interest were analysed separately from the control groups, novel-thematic organizations did not show significantly. At baseline, i.e., when there were no situations prior to the processing of abstract concepts, the type of organization revealed was taxonomic. This was anticipated due to the fact that first, the target abstract concepts were typical exemplars selected from abstract taxonomic categories. However, the lack of differences between baseline and the conditions that had situational information meant that taxonomic organization persisted, making it difficult at this point to determine how far situations influenced the thematic reorganization of the target abstract concepts. The results did not yield conclusive evidence pointing to the assumption that participants constructed new thematic relations between the novel-thematic clusters when processing situations. It would seem at face value that the situations did not have relevant effects on the processing of the target abstract concepts. This observation appeared to be contradictory to the fundamental claims of the situational-based theories on the processing and representations of abstract concepts (Barsalou & Wiemer-Hastings, 2005; Wiemer-Hastings et al., 2001; Ghio & Tettamanti, 2010; Wiemer-Hastings & Xu, 2005; Wiemer-Hastings et al. 2003; Barsalou 1999b; King & McRae, 2012; Schwanenflugel & Shoben, 1983). It was also incoherent with previous findings which proposed that the flexible nature of abstract concepts makes them compatible with conceptual integrative processes, capable of capturing and representing new thematic relations between different concepts (Wiemer-Hastings & Xu, 2003). The results are also inconsistent with neuropsychological findings which have shown that abstract concepts could be represented qualitatively within associative networks (e.g. Crutch & Warrington, 2005; Dunabeitia et al., 2009).

These discrepancies with our predictions led to a deeper and critical scrutinizing of the
theoretical and experimental methodology in order to find explanations for the present results and observations. Several questions were raised as to whether other factors present and/or absent could explain the predominant taxonomic organizations observed. Perhaps any novel thematic organizations that could have been constructed were “masked” by some unknown confounding variables!

First, could it be that in general, during the semantic processing of abstract concepts, the conceptual system uses a “default” semantic similarity organizational principle, which automatically organizes concepts within a “fixed” taxonomic schema, without taking into consideration, the situational theme and contextual background surrounding the concepts. This appeared to be antithetical to findings from previous studies that have shown that people form thematic relations with respect to contextual demands (e.g., Lin & Murphy, 2001). Other studies have shown that not only can situational information prime abstract concepts (King & McRae, 2012), but they are fundamentally important to the processing of abstract concepts (Barsalou, 1999). Moreover, studies using artificial neural networks on abstract concepts have shown that they depend heavily on contexts for their classification. In that, semantic contextual information is relevant to the representation of abstract concepts. More importantly, the meanings of abstract concepts could also be derived from their contexts (Wiemer-Hastings, 1998).

Stated differently, thematic relations expressed through situations become the background frame within which abstract concepts interact and play complementary roles. This enables first, the representation of the meanings of the abstract concepts themselves. Second, it enables the construction of a situation model involving other concepts, leading to the global representation of the situation being read. Accordingly, thematic organizational networks enable a level of flexibility for the thematic integration of abstract concepts experienced from situations (Wiemer-Hastings & Xu, 2003). As a consequence, abstract concepts, which may be previously organized taxonomically, could be conceptually reorganized into new thematic structures depending on the situational theme within which they are instantiated.

Second, could it be that the situational information used in Experiment 1 was not sufficiently sensitive to the abstract concepts embedded in them? Thus, the processing of the situations did not semantically assimilate with the new conceptual thematic relations deployed from the processing of the inserted concepts, and that could explain why it was not observed during sorting. As noted by the Abstract Structure Theory (Wiemer-Hastings & Graesser, 2000), abstract concepts are very sensitive to temporal, introspective and causal entities described in situations, and their representation is heavily dependent upon them. Abstract structures provide a frame in which a sequential integration of the relationships between
different abstract entities in a situation could be coherently processed together in a meaningful manner. For example, the concept “solution” generally happens in a situation where there is a problem, an agent who thinks about possible ways to address the problem, a thought (solution) which leads to solving the problem. All the temporal, causal and introspective elements must be united and sequenced in the abstract structure, in order to represent the concept “solution”, (Wiemer-Hastings & Graesser, 2000). Probably our situations did not provide all the necessary abstract structures needed to sequentially frame the integration of the necessary semantic contents of the abstract concepts.

Third, it might be possible that the situations did not provide relevant abstract constraints for the thematic representation of the target concepts? As suggested by the Contextual Constraints Theory (Wiener-Hastings et al., 2001), contextual constraints provide the necessary information or “pointers” utilized in guiding the construction of a mental situation model or a simulation (see, Barsalou, 1999) of the situation within which the abstract concepts are experienced, especially during comprehension. Contextual constraint elements could be people, intentions, emotions, cognitive processes and mental states. Though our situations made sense when they were read globally, they probably may not have contained pertinent elements constituting the contextual constraints needed to fully represent the theme described involving the target abstract concepts. In other words, if abstract concepts are organized thematically, and situations play a central role in this thematic representation, then when the situations contain the appropriate contextual constraints and structures needed for their processing, traces of the new thematic network constructed from the mental simulations could be ‘picked up” through behavioural observations. The possible absence of pertinent contextual constraints could explain some of our findings in Experiment 1.

Finally, a critical look was directed towards the methodology used in Experiment 1. The theoretical information and the strong empirical evidence from previous studies presented in previous sections support the assumption that situational information and thematic organization should be central to the representation of abstract concepts. We therefore speculated that perhaps another reason why we did not observe a significant newly derived thematic organization, when the abstract concepts were processed in situations might be related to drawbacks in the methodological paradigm. In other words, the problem could be less of a theoretical nature and more of a methodological one. To our knowledge, within the literature on abstract concepts, the methodology used in Experiment 1 was the first attempt of its kind employed in the assessment of abstract concepts’ organization. It therefore may not have been robust, sensitive or “perfected” enough to capture the effects expected from the manipulation of the experimental variables. We decided therefore to re-evaluate generally the
experimental protocol and methodology used in Experiment 1, whilst maintaining the original hypotheses. The aim was to determine whether certain aspects of it may have “masked” or confounded the effects on the variables. The next experiment was designed to retest the main hypothesis and predictions again using a revised experimental methodology based on the one used in Experiment 1. As a pure baseline condition had been compared with “sub control” groups (i.e., the two implicit conditions) and yielded no pertinent differences, only the pure baseline condition was applied in later experiments.

16.0. Experiment 2

16.1. Introduction and objectives

After deep reflection and detailed investigation upon all the factors absent and/or present that could have contributed to the inconclusive results obtained in Experiment 1, a second study was performed in order to redesign and improve the experimental protocol used previously whilst addressing the same experimental objectives and hypotheses. Consequently, Experiment 2 was methodically thought of to address the queries that were raised in Experiment 1. It examined from a different perspective, other possibilities for modifying the experimental material and protocol used previously in Experiment 1. The principal aim was to retest our original hypotheses by improving our experimental paradigm, in order to make it more efficient in capturing the effects that would emerge from the manipulation of the experimental variables.

The Contextual Constraints Theory (Wiemer-Hastings et al., 2001) emphasizes the assumption that the processing of abstract concepts and the manifestation of relations between them in situations are contingent on specific events and circumstances that must be present in the situation. Thus, the concept idea for example, according to the theory is contingent on an agent, a mental state, a scenario in which the mental state could be expressed either verbally or behaviourally and an outcome. For example, consider a medical scenario where a doctor (the agent) is looking at the x-ray results of his patient. He sees a dense mass in a section of the x-ray and is uncertain of what it might be. In his state of uncertainty (mental state), he consults a colleague who then proposes the idea of using an fMRI scan to examine the organ (the outcome). In this scenario, an idea has an outcome of problem resolution. So that if such contingent elements (mental state, agent, behaviour, medium of expression, scenario and outcome) are not present and related in the situation, the concept idea cannot be meaningfully processed nor mentally represented. Moreover, since abstract concepts have multiple meanings, such contingent elements constrain their meaning onto a specific context, thereby
facilitating their conceptual and semantic representations. Reconsidering the example above, the meaning of the concept “idea” could be constrained by the medical scenario, slightly modifying its meaning in comparison to other scenarios. For example, “marinating chicken in wine sauce is a great idea to improve its taste.” In this context, idea represents a better way to achieve an objective. Or “the idea that a parent could marry his offspring is unusual.” This example implicates “idea” as a state of affairs or a type of behaviour that is contrary to the norm. Or “he shared his ideas on running for president.” In this context, idea implies communicating one’s state of mind, intentions or plan of action. Based on this assumption, particular attention was drawn to the experimental situations used in the previous experiment and thus, logically raising the question: Could it have been that they did not contain the most pertinent contextual constraints needed to meaningfully process the abstract concepts expressed in them?

The Abstract Structure Theory (Wiener-Hastings & Graesser, 2000) suggests that abstract structures contain linguistic pointers which aid in expressing the causal, temporal, spatial, introspective and other relations between agents and entities in a situation for which abstract concepts represent. More importantly therefore, if the abstract structures in a situation do not have all the pertinent linguistic entities including relevant verbs and prepositions, the concepts and the relations between them would become difficult to represent semantically. Based on the assumptions of this theory, we could not hesitate to verify our situations and assess whether they contained the necessary linguistic pointers and abstract structures that would enable readers to fully experience the relationships and associations between the abstract concepts embedded in them.

In summary, the aim of the second experiment had a double focus. First, to re-investigate our original hypotheses through the modification of the experimental material used in Experiment 1. Second, as indicated previously, to our knowledge the paradigm used in this thesis to study the representation of abstract concept is the first of its kind. Thence, the aim was to improve its materials and procedure in the second experiment in order to make it more effective in tracing the type of conceptual reorganization and representations that readers mentally adopted during online processing of the abstract concepts instantiated in situations. Experiment 2 was therefore similar to Experiment 1 with several important exceptions that will be outlined later in this section.
16.2. Modifications in Experiment 2

So concretely, what differed in Experiment 2 from Experiment 1? We proceed here to outline five important modifications that were carried out on the backbone of the method of Experiment 1.

16.2.1 Modifications 1- Individual presentation of abstract concepts for sorting task after situation processing

In order to trace and render measurable the type of organization produced during the processing of the situations, a sorting task was administered to participants, after situation processing. The design of the sorting task was modified in Experiment 2, with the aim of making it more efficient in tracing the type of organization expected. The experimental protocol used in Experiment 1 was structured such that ALL the target concepts were presented together to participants for sorting (please refer to Figure 7, section 12.4.13). This way of presenting concepts i.e., “all at the same time” could have instigated participants to use semantic similarity and comparative processes for sorting. It is worth recalling here that the original 24 target concepts were selected based on “typical” taxonomic abstract categories and exemplars in the norming studies. We intuitively reasoned that as the concepts are presented together, there could be a stronger tendency for participants to use taxonomic comparisons processes to effectuate the sorting tasks, thus hindering any new integrative thematic relations that could have been constructed from the situations. The assumption here is that it was not that participants in Experiment 1 did not think about novel thematic organizations. Rather, the visual grouping of all the concepts together could have made categorical relations more salient, thereby suggesting to participants implicitly that taxonomic organization was what was expected from them.

In order to reduce any bias towards taxonomic relations and to render all types of conceptual organizations that could be constructed between concepts equally observable, the mode of presentation of concepts in Experiment 2 was modified. The presentation of target concepts on the screen was done on an individual basis. The presentation of the concepts was controlled in a quasi-random manner so that no 2 concepts from the same category appeared in succession. This was done to avoid concept category expectancy. Details on this issue are explained in the methods section.

16.2.2. Modifications 2 - The relevance of frequent occurrence of concepts in situations.

The conceptual representation and processing of abstract concepts are purported to be very sensitive to the context within which they occur. These contexts could be verbal, textual or physical situations. On the one hand, the linguistic context within which abstract concepts
are experienced is very pertinent to the differentiations between the subtle meanings they could have. On the other hand, thematic relations between concepts are also very sensitive to the frequency of co-occurrence between the concepts, especially when the thematic relation is a novel one (i.e., not pre-existing).

Several studies on thematic relations have shown that the more two concepts co-occur meaningfully in the same scenario, the higher the chance there is of establishing a thematic relation between them (Golonka & Estes, 2009; Lin & Murphy, 2001). For example, “car” and “firewood” are two different concepts. However, if one encounters over and over again a car and firewood together in the same scene, one will derive a form of thematic relation between them by considering that perhaps the car is used to transport the firewood. Over time, the thematic relation becomes entrenched in memory. Indeed, intuition tells us that if whenever one sees smoke there is always fire associated to it, then over frequent encounters one will construct a conceptual relation between fire and smoke, and this relation will be of a thematic nature that translates causality. Thus, frequency of co-occurrences plays a central role in the construction of almost all thematic relations (Gentner & Brem, 1999), especially novel ones.

Considering together, the sensitivity of linguistic context to the processing of abstract concepts and the importance of frequent co-occurrences of concepts in similar contexts for thematic relations, it becomes logical that the expectation for the construction of new thematic relations between abstract concepts within a linguistic context must heavily depend on the frequency of co-occurrences of those concepts within the linguistic situation/context. In the absence of which, new thematic relations between those “newly derived clusters” of abstract concepts might not be constructed, or they might be constructed but would not be “observable” enough at a metacognitive level for behavioural measurements in experimental conditions to capture them. This we suspect could have been partially responsible for the inconclusive results of Experiment 1.

As described in the theoretical background section (Ch. III, section 9.2.1.), one very important assumption made by the LASS Theory that bears relevance to the study here is that, frequent correlations between concepts which are experienced in real situations are equally represented in similar statistical information stored and used with words in the conceptual system. In other words, there must be sufficient linguistic statistical information about concepts in terms of their frequent co-occurrences within language or within our experiences, in order to facilitate their situated simulation. This assumption is corroborated by theories from the linguistic literature on the statistical frequency of words, their associations, and the relations between the syntax information expressed between them when used in language (e.g., Lété, 2006).
Based on these assumptions presented above, we assumed that in Experiment 1, the reduced regularity of the encounter with the target abstract concepts in the situations might not have produced the relevant linguistic statistical frequencies for the simulation of novel relations between the concepts experienced in the situations. This could have hindered a deeper processing of the relevant meanings of the abstract concepts in the situations. Thus, the methodological modification applied in Experiment 2 was to increase the frequency of co-occurrences of abstract clusters in situations. That is, first, each cluster of abstract concepts (both taxonomic and novel-thematic) was mentioned twice in each paragraph, in contrast to Experiment 1, where the clusters of abstract concepts were mentioned only once within each paragraph. Second, the complete experimental situations were also read two times. That is, participants read all the situations a first time during which they performed a comprehension task. Then, they read all the situations a second time during which they effectuated an emotional valence judgement task. In contrast, in Experiment 1, the situations were read only once, and participants performed only the comprehension task.

16.2.3. Modifications 3 - Limitation of number of categories

The target concepts were selected from six different abstract concept categories. The design of the sorting task in Experiment 1 made eight boxes available on the computer screen for the sorting task. A closer scrutiny of the types of clusters formed by participants in Experiment 1, indicated that some of them felt it necessary or implicitly obliged to use all the eight boxes, even though the instructions did not stipulate this demand. This led to the filling of all the boxes by some participants, thus leading to the constitution of clusters with combinations of concepts that could not be analysed. In order to avoid these implicit expectation and the compulsive filling of all eight boxes, a decision was taken to reduce the number of boxes from eight to six in Experiment 2. This we believed corresponded naturally to the six original abstract categories from which the target concepts were chosen. This way, participants could not create more than six clusters of concepts.

16.2.4. Modifications 4 - Sorting of verbs and nouns before the presentation of target concepts

The aim of this modification was to reduce cognitive fatigue and/or boredom during processing and improve the sustenance of attention span on experimental tasks. In order to prevent memory demand on the target abstract concepts, a simple distraction task was introduced by asking participants to sort a group of verbs followed by nouns and then finally the target concepts. This was the protocol used in Experiment 1. However, discussions and feedback from participants after the experiment revealed that there was a certain level of cognitive tiredness and habituation by the time they had to sort the experimental target
stimuli. Thus, the attention span mobilized for the sorting of the target concepts was limited. One must remember that before sorting the three groups of words, the participants had previously read the six situations and answered the comprehension questions. Understandably, their attention resources could have been reduced during their performance of the last task, which for our statistical analyses was the most relevant.

Therefore, in Experiment 2, the groups of words used for the sorting task was reduced from three to two. Thus, only the verbs were presented before the sorting of the target abstract concepts. Reducing the number of groups of words to be sorted was even more relevant considering that in Experiment 2, we had anticipated that participants would read the situations two times, each followed by a different experimental task.

16.2.5. Modifications 5 - Length of texts

This modification had a double focus. The first was aimed at revising the experimental texts in order to obtain a more precise, concise and interesting paragraph, whilst maintaining the semantic significance and coherence of the theme described in each story. Emphasis was also placed on ensuring that all the necessary contextual and linguistic elements were present in the texts in order to maintain global text coherence. The second focus was aimed at reducing cognitive fatigue, whilst maintaining sufficient attention on the experimental tasks. We therefore proceeded to trim out the experimental texts by taking out all redundant and impertinent information that bore no relevance to the core information described in the situational texts. Indeed, a closer look at the situations used in Experiment 1 revealed the presence of “peripheral” and inconsequential information that made the texts unnecessarily long and “heavy” to process. This “peripheral” information could have buried or masked the subtle but important meanings of the target abstract concepts in the texts. This modification was even more pertinent as situations were going to be read twice in Experiment 2. Each paragraph in Experiment 2 had an average of about 83 words compared to 113 in Experiment 1. Thus, even though the target abstract concepts were mentioned twice in each paragraph of Experiment 2, the average lengths of texts were shorter compared to Experiment 1.

17.0. Method

17.1. Participants

45 undergraduate psychology students from Lumière University of Lyon were recruited as participants in exchange for course credits. They were randomly assigned to the three experimental groups constituted for the experiment. Each group had the same number of participants.
17.2. Materials

17.2.1. Phase 1 – text stimuli - situations

The same six situations used in Experiment 1 were used as the experimental situations here, except for the modifications presented above.

17.2.2. Structure of paragraphs

Each paragraph had an average of 83 words. Particular care was taken so as to ensure that the target concepts blended and integrated harmoniously with the flow of the story-theme so that the situations would be meaningful and coherent during reading. Please refer to Table 14 for an example of a revised version of a paragraph from the Rasputin situation used in Experiment 2. Otherwise, the paired combinations between stories and categories, format and mode of presentation of the situations were identical to that of Experiment 1. (Please see Appendix K for a revised version of all the situations used in Experiment 2).

17.2.3. Experimental tasks associated with the situations

Contrary to Experiment 1, participants were required to read the situations twice, in contrast to Experiment 1, where they read the situations only once. In order to justify the two reading sessions to participants, two experimental tasks were designed to accompany each reading session.

17.2.3a. Situations with comprehension questions: session 1

The first reading session required participants to answer comprehension questions at the end of each paragraph identical to the one used in Experiment 1.

17.2.3b. Situations with emotional valence judgement task: session 2

The second reading session was accompanied by a task whereby participants were asked to judge the emotional valence of the scenario described in the paragraph just read. Thus, on a Likert scale of 0 – 2, (see Figure 14) participants had to judge whether the scenario presented in the paragraph was emotionally neutral, negative or positive. In other words, they had to make an emotional decision on each paragraph, as shown in Table 14.
Table 14. An example of the two versions of the Rasputin situation-revised (new-thematic and taxonomic), with comprehension and emotional valence tasks. The target concepts appear in bold characters.

<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Concepts inserted: Fraud, Democracy Friendship &amp; Catholicism.</td>
<td></td>
</tr>
<tr>
<td>Version: Taxonomic.</td>
<td></td>
</tr>
</tbody>
</table>

1st

<table>
<thead>
<tr>
<th>Situation 1. Title: Rasputin</th>
</tr>
</thead>
<tbody>
<tr>
<td>In 1916, the blotted castrated body of Gregory Rasputin was dragged from a nearby river near Saint Petersburg. To his enemies he was the incarnation of evil. He was implicated in fraud, and conspired against Russian democracy and Catholicism. He entertained an intimate friendship with tsarina Alexandra. He developed a reputation as a faith healer and spoke publicly against Catholicism and democracy. He used his privileged friendship with the tsarina Alexandra to commit fraud and was instrumental in wiping out the 300-year-old dynasty forever.</td>
</tr>
</tbody>
</table>

Question 1

<table>
<thead>
<tr>
<th>Gregory Rasputin was found in Germany.</th>
</tr>
</thead>
</table>

Valence judgement 1

<table>
<thead>
<tr>
<th>0 = NEUTRAL</th>
<th>1 = NEGATIVE</th>
<th>2 = POSITIVE</th>
</tr>
</thead>
</table>

2nd

| In 1916, the blotted castrated body of Gregory Rasputin was dragged from a nearby river near Saint Petersburg. To his enemies he was the incarnation of evil. He was implicated in fraud, and conspired against Russian democracy and Catholicism. He entertained an intimate friendship with tsarina Alexandra. He developed a reputation as a faith healer and spoke publicly against Catholicism and democracy. He used his privileged friendship with the tsarina Alexandra to commit fraud and was instrumental in wiping out the 300-year-old dynasty forever. | In 1916, the blotted castrated body of Gregory Rasputin was dragged from a nearby river near Saint Petersburg. To the Russian aristocracy Rasputin was the incarnation of evil. He was implicated in the destruction of Russian democracy and liberalism. He entertained privileged relations with the Russian monarchy and aristocracy. He developed a reputation as a faith healer and spoke publicly against democracy and social liberalism. He benefitted from his relationship with the tsarina Alexandra and was instrumental in wiping out the 300-year-old monarchy forever. |

Question 2

<table>
<thead>
<tr>
<th>Gregory Rasputin was born in St Petersburg.</th>
</tr>
</thead>
</table>

Valence judgement 2

<table>
<thead>
<tr>
<th>0 = NEUTRAL</th>
<th>1 = NEGATIVE</th>
<th>2 = POSITIVE</th>
</tr>
</thead>
</table>
In 1903, the Russian people accused the government of various fraudulent activities, and there was a general cry for democracy. The royal family was the sole holdout of Catholicism in the country. In the Tsar's family, the heir to the throne suffered from hemophilia. The empress summoned Rasputin to the palace to see if his mystical abilities could heal her only son. This encounter secured a solid friendship between them. Rasputin later used this friendship to fraud people and prevented the development of democracy in the Russian government.

Rasputin took immense pleasure in insulting his social superior. He engaged in humiliating relationships with the women and accused their husbands of fraud. Rasputin publicly criticised Catholicism and democracy, and he engaged many government ministers in fraud. He had immense political power due to his close friendship with the tsarina. Russia's last chance for democracy and an honest government was in the hands of the Prime Minister Peter Voinovich, who had strong beliefs rooted in Catholicism. He was the mastermind behind the annihilation of Gregory Rasputin.

Gregory Rasputin was the Prime Minister of Russia

(NB: During the actual experiment, the situations used did NOT have the target concepts written in bold or italic characters, and the 2 tasks were done separately during each reading session).
17.2.4. Experimental situation stimuli – insertion of target concepts into situations

17.2.4.1. Situations containing taxonomic clusters – taxonomic situations

In each situation, the 4 exemplars of each set of taxonomic clusters were mentioned twice in each of the 4 paragraphs and that cluster was not inserted in any other situation. Thus, in each paragraph, there were 8 target concepts randomly embedded in it (please refer to Table 14). This differs from Experiment 1, where the 4 exemplars for each cluster were mentioned only once in each paragraph of each story situation (please refer to Table 9 under Experiment 1, method section). For example, taking the Mary Tudor situation and the taxonomic cluster containing the exemplars of religion (catholicism, puritanism, protestantism, evangelism), each member of the cluster was mentioned twice in each of the 4 paragraphs, and only the Mary Tudor situation contained the religion cluster (see Appendix K for all the experimental situations used in Experiment 2). The 8 target concepts were randomly distributed into each paragraph in such a manner that global significance and coherence in meaning were maintained throughout the story. Each paragraph of the taxonomic situations had an average of about 82 words, compared to 112 for the taxonomic situations used in Experiment 1.

17.2.4.2. Situations containing novel-thematic clusters – new-thematic situations

The new-thematic situations consisted of almost identical situations used for the taxonomic clusters as indicated above (please refer to Table 14), except that the novel-thematic clusters were also randomly mentioned twice in the 4 paragraphs of each situation; respecting the same guidelines as the taxonomic ones described above. For example, each exemplar of the novel-thematic cluster (history, terror, monarchy, treason) was mentioned twice within each paragraph of the Mary Tudor situation, following the same precautions explained under the taxonomic situations. In all paragraphs, the 8 concepts were randomly distributed into it in order to maintain global coherence for the whole story. Each paragraph of the new-thematic situations had an average of about 84 words, whereas the new-thematic situations used in Experiment 1 had an average of 113 words. (NB: minor changes in syntax and grammar had to be made to the new-thematic situations compared to the taxonomic ones, in order to maintain meaning at a global level).

17.2.5. Precautions taken during the insertion of target concepts into situations

As the situations and the insertion of target concepts had been modified for Experiment 2, it was necessary to control again for the positions of the target concepts. Thus, in order to ensure that the distribution of target concepts in the revised situations was
statistically not significant, the same precautions were undertaken as in Experiment 1:

17.2.5.1. Control for the distances between target concepts

The procedure used to control the distances between the target words in each paragraph was identical to the one used in Experiment 1 (please refer to section 12.4.10). In Experiment 2, however, there were 8 target words in each paragraph. So, the number of words between the eight targets yielded 7 distance values for each paragraph. Next, the mean of the 7 values for each of the four paragraphs was calculated for the new-thematic stories and taxonomic stories. The comparisons were statistically non-significant at $p > .05$ (please see Appendix L for detailed results).

17.2.5.2. Control for the positions of the target concepts

The measure undertaken to control the positions of insertion for target words was also identical to the one described in Experiment 1 (section 12.4.11). The only difference was that Experiment 2 had 8 target words in each paragraph. Thus, the cumulative number of words from the beginning of each paragraph to each of the target concepts yielded 8 distance values for each paragraph. The results were statistically non-significant at $p > .05$ (please see Appendix M for detailed results).

17.2.6. Situation script construction

Six different situation scripts were created following the same method described in Experiment 1. The order of presentation of the story scripts was the same for all groups of participants. This was done so as to ensure that the flow and the pattern of the story reading remained consistent and coherent for all participants.

17.3. Phase 2: Programming the sorting task

17.3.1. Sorting program - Word Game II

The second phase of the experiment was to construct a concept-sorting task that would enable a trace and measure of the type of concept organization being deployed from the processing of the situations. The sorting Word Game program designed for Experiment 1 was revised based on the following three modifications:

1. Six rectangular boxes split into 2 sets: a set of 3 boxes appeared on the upper part of the screen and another 3 set of boxes on the lower part of the screen, with a space between the 2 sets of boxes.
2. Each target concept was presented once at a time in quasi-random order, with the constraint that 2 words from the same cluster were never adjacent. Each concept appeared in the middle of the 2 sets of boxes.
3. The possibility to click on a word and then click immediately on a box; the word gets displaced into the chosen box, and then the next word immediately appears, ready to be sorted.

The revised version of the program became known as Word Game II. Aside from the modifications presented above, all the other features of Word Game II were identical to those of the first version used in Experiment 1. Figure 15 shows an example of the interface of Word Game II as presented to participants, (see Appendix G for details on the program).

![Figure 15](image)

Figure 15. Presentation of the target concepts individually on the computer screen using “Word Game II.”

17.3.2. Experimental list - target concept stimuli list construction

The experimental stimuli consisted of a list of the 24 target concepts, as used in Experiment 1. However, the order of construction of the list was controlled by category. The 24 concepts were presented in a systematic order because it had to be ensured that no 2 concepts from the same category appeared in succession. So, the order of presentation was structured such that, first, when a concept appeared from one category the next concept that followed belonged to a different category until all the six categories had been represented, then the cycle began again with the first category of the very first concept. This delivered a category-controlled list. Second, two versions of the category controlled list were created to compensate for order effects. The first version had the 24 target concepts presented by
category as explained above. The second version had the concepts presented in a reversed order to the first version (please see Table 15 below for the order of presentation by category and the 2 versions of the experimental stimuli). So half the participants saw the first experimental list version, and the other half saw the second version in order to counterbalance and compensate for order effects. Each concept appeared once and alone in the middle of the 2 sets of boxes and stayed on the screen until it was sorted.

Table 15. The cycle of presentation of target concepts by category rotation and counterbalanced into two list-versions.

<table>
<thead>
<tr>
<th>Experimental list version 1</th>
<th>Categories</th>
<th>Experimental list version 2</th>
<th>Categories</th>
</tr>
</thead>
<tbody>
<tr>
<td>Puritanism</td>
<td>Religion</td>
<td>Liberalism</td>
<td>Socio-Political Ideologies</td>
</tr>
<tr>
<td>Murder</td>
<td>Crime</td>
<td>Guilt</td>
<td>Feelings</td>
</tr>
<tr>
<td>Friendship</td>
<td>Relationships</td>
<td>Psychology</td>
<td>Disciplines</td>
</tr>
<tr>
<td>History</td>
<td>Disciplines</td>
<td>Partnership</td>
<td>Relationships</td>
</tr>
<tr>
<td>Terror</td>
<td>Feelings</td>
<td>Fraud</td>
<td>Crime</td>
</tr>
<tr>
<td>Aristocracy</td>
<td>Socio-Political Ideologies</td>
<td>Evangelism</td>
<td>Religion</td>
</tr>
<tr>
<td>Catholicism</td>
<td>Religion</td>
<td>Democracy</td>
<td>Socio-Political Ideologies</td>
</tr>
<tr>
<td>Treason</td>
<td>Crime</td>
<td>Compassity</td>
<td>Feelings</td>
</tr>
<tr>
<td>Marriage</td>
<td>Relationships</td>
<td>Languages</td>
<td>Disciplines</td>
</tr>
<tr>
<td>Archaeology</td>
<td>Disciplines</td>
<td>Parentage</td>
<td>Relationships</td>
</tr>
<tr>
<td>Sadness</td>
<td>Feelings</td>
<td>Corruption</td>
<td>Crime</td>
</tr>
<tr>
<td>Monarchy</td>
<td>Socio-Political Ideologies</td>
<td>Protestantism</td>
<td>Religion</td>
</tr>
<tr>
<td>Protestantism</td>
<td>Religion</td>
<td>Monarchy</td>
<td>Socio-Political Ideologies</td>
</tr>
<tr>
<td>Corruption</td>
<td>Crime</td>
<td>Sadness</td>
<td>Feelings</td>
</tr>
<tr>
<td>Parentage</td>
<td>Relationships</td>
<td>Archaeology</td>
<td>Disciplines</td>
</tr>
<tr>
<td>Languages</td>
<td>Disciplines</td>
<td>Marriage</td>
<td>Relationships</td>
</tr>
<tr>
<td>Compassion</td>
<td>Feelings</td>
<td>Treason</td>
<td>Crime</td>
</tr>
<tr>
<td>Democracy</td>
<td>Socio-Political Ideologies</td>
<td>Catholicism</td>
<td>Religion</td>
</tr>
<tr>
<td>Evangelism</td>
<td>Religion</td>
<td>Aristocracy</td>
<td>Socio-Political Ideologies</td>
</tr>
<tr>
<td>Fraud</td>
<td>Crime</td>
<td>Terror</td>
<td>Feelings</td>
</tr>
<tr>
<td>Partnership</td>
<td>Relationships</td>
<td>History</td>
<td>Disciplines</td>
</tr>
<tr>
<td>Psychology</td>
<td>Disciplines</td>
<td>Friendship</td>
<td>Relationships</td>
</tr>
<tr>
<td>Guilt</td>
<td>Feelings</td>
<td>Murder</td>
<td>Crime</td>
</tr>
<tr>
<td>Liberalism</td>
<td>Socio-Political Ideologies</td>
<td>Puritanism</td>
<td>Religion</td>
</tr>
</tbody>
</table>
17.3.3. Intermittent trial stimuli – verbs

Contrary to Experiment 1, only the list of 24 verbs were used to avoid the effects of experimental demand on the processing of the target concepts in situations. It also prevented participants from directly linking the two phases of the experiment together. This list was randomized and counterbalanced into two versions for presentation, following the procedure described in Experiment 1. (Please see Appendix I for the list of verbs).

17.4. Procedure

Figure 16. The 3 phases of the procedure for Experiment 2.

17.4.1. Phase 1 & 2: Situation reading procedure

The creation and presentation of the reading phases of Experiment 2 were identical to the ones used in Experiment 1, except that participants read the situations twice in two separate sessions and performed two different tasks after each reading session. Participants were first told that they were going to participate in two entirely different experiments. Participants were further told that the first experiment, which was about reading texts, would be performed in two phases. During the first phase, they would read all the situations, a paragraph at a time and each paragraph would be followed by a comprehension question based on the information described in that paragraph. During the second phase, they would read the same situations again, presented in the same format as the first, except that after reading each paragraph, they would have to judge the emotional valence of the scenario described on a scale of 0 to 2, whereby, 0 denotes “neutral,” 1 denotes “negative” and 2 denotes “positive.”

The procedure of the first phase was identical to that described in Experiment 1. The procedure of the second phase consisted of participants reading the instructions. The presentation of the paragraphs was identical to the ones used in the first phase, except that upon pressing the space bar after the paragraph had been read, the emotional valence scale appeared on the screen. Participants selected their choice by using the numerical section on the keyboard. After the paragraph had been judged, the second paragraph appeared, followed...
by its scale etc. This continued until the last paragraph of the last situation was judged.

17.4.2. Instructions for reading situations

Participants were instructed to read the situations attentively at their own rhythm and then perform each task at the end of each paragraph as accurately as possible. They were told that answering all the questions and judging the emotional valence of all the paragraphs were important parts of the experiment. The paragraphs remained on the screen whilst the participants performed the two tasks. Each reading task took approximately 15 minutes.

17.4.3. Phase 3: Sorting of target concepts

![Diagram of VERBS and TARGETS]

Figure 17. Sorting of verbs followed by the target list of abstract concepts in Experiment 2.

Phase 3 of the experimental procedure consisted of sorting the verbs followed by the target concepts using the sorting program “Word Game II” (please refer to Figure 17 above). Similar to the procedure in Experiment 1, the experimenter launched the sorting program “Word Game II” for each participant. After giving their consent, each participant was told that when the Start button was clicked, a word would appear in the middle of the screen, with 3 boxes on the upper part of the screen and another 3 on the lower part of the screen. The task required the participant to place into the same boxes the words that went together. As each word was displayed, participants read the word attentively and then sorted it into a box. This action was followed by the appearance of a second word; they were then to decide if the second word “went together” with the first. If yes, they were to add the second word to the first, if not, they were to put the second word into a different box, indicating that it belonged to a different group. Words placed in boxes could not be moved again. Each concept was displayed once and alone in the middle of the 2 sets of boxes and stayed on the screen until the participant sorted it. This continued until the last concept was sorted, and then participants clicked on “Stop,” located on the top right corner of the screen, as shown in Figure 15. The clusters of words sorted into different boxes were recorded and saved as image files that could be viewed later for analyses.

The specific instructions for sorting were: “Study attentively each word that appears in the middle of the screen. Then put into the same box, creating a group, those words that go
To allow participants to become accustomed to the “Word Game II” program, they practised by sorting a list of 12 concrete nouns, (see Appendix J1 for this list). After the practice trials, they read the instructions again before starting the experimental trials. An experimental trial began with participants sorting the 24 verbs, following the procedure described above. Afterwards, they sorted the 24 experimental target abstract concepts. This phase of the experiment took approximately 25 minutes.

17.4.5. Experimental conditions

1. Baseline. In this condition, participants did not read any situations. They performed the sorting task on the two sets of 24 randomized words: verbs and critical target abstract concepts.

2. Taxonomic situation. In this condition, participants read the taxonomic situations, and then, they performed the sorting task on the two sets of 24 words afterwards.

3. New-thematic situation. In this condition, participants read the new-thematic situations that had novel-thematic clusters of abstract concepts inserted into them. Afterwards they performed the sorting task on the two sets of 24 words.

17.5. Manipulations of experimental variables

The experimental manipulation consisted of 2 independent variables: a between-participant variable **Situations** at 3 levels (baseline vs. taxonomic vs. new-thematic) and a within-participant variable **Organization** at 2 levels (taxonomic vs. novel-thematic). Subject was manipulated as a random factor. The dependent variable was the level of clustering correlation.

17.5.1. Predictions

Our predictions were identical to those formulated in Experiment 1. To reiterate, we expected a significantly greater amount of taxonomic organization compared to novel-thematic organization in the baseline condition. Concerning baseline and taxonomic situation, we expected to find the amounts of taxonomic organization of abstract concepts, after their processing in taxonomic situations to be significantly greater than what would be observed at baseline. Comparing baseline to new-thematic situation, we predicted significantly greater amounts of novel-thematic organization of abstract concepts after they were processed in new-thematic situations compared to those at baseline. Finally, our last prediction was an expectation of a significant interaction between new-thematic and taxonomic situations.
17.5.2. Data collection and analyses of Experiment 2

The procedure for our data collection, transformation and analyses was identical to the ones used in Experiment 1. The answers from the comprehension questions and the emotional valence judgements were recorded. Two participants were taken out of the analyses because they had 50% of their answers to their comprehension questions wrong. The final analyses of variances were carried out on the data from the sorting of critical target abstract concepts only.

17.6. Results

The analyses of variance (ANOVA) were carried out on the mean coefficient of correlation (Pearson r transformed to Fisher values) for each type of organization produced by the experimental groups. The means and standard deviations are reported in Pearson's r as shown in Table 16.

Table 16. Mean coefficient of correlations (r) for the organization of target concepts as a function of the 3 situations: baseline, taxonomic, and new-thematic in Experiment 2 (standard errors shown in parentheses).

<table>
<thead>
<tr>
<th>ORGANIZATION</th>
<th>SITUATIONS</th>
<th>Baseline</th>
<th>Taxonomic</th>
<th>New-thematic</th>
<th>M</th>
</tr>
</thead>
<tbody>
<tr>
<td>TAXONOMIC</td>
<td>Baseline</td>
<td>0.76 (0.14)</td>
<td>0.84 (0.14)</td>
<td>0.11 (0.14)</td>
<td>0.57 (0.08)</td>
</tr>
<tr>
<td>NOVEL-THEMATIC</td>
<td>Baseline</td>
<td>-0.07 (0.03)</td>
<td>-0.09 (0.03)</td>
<td>0.17 (0.03)</td>
<td>0.01 (0.02)</td>
</tr>
<tr>
<td>M</td>
<td>Baseline</td>
<td>0.35 (0.07)</td>
<td>0.37 (0.07)</td>
<td>0.14 (0.07)</td>
<td>-</td>
</tr>
</tbody>
</table>

(M denotes the global means for the main effects from situations and organization).

The ANOVA showed a significant main effect for Situations, $F (2, 41) = 3.18$, MSE = .15 r to z units, $p < .05$, partial $\eta^2 = .13$. Thus, comparing the mean levels of clustering correlations among the 3 groups, the one that yielded the greatest amounts was taxonomic situation (Mean = 0.37), followed by baseline (Mean = 0.35). New-thematic situation yielded the least amounts of overall clustering correlations (Mean = 0.14).

Similarly, a significant effect for the factor Organization of the target concepts was observed, $F (1, 41) = 38.41$, MSE = .18 r to z units, $p < .00$, partial $\eta^2 = .48$. The mean levels of correlations in clustering produced by participants were significantly greater for the taxonomic organization (Mean = 0.57) compared to the novel-thematic organization (Mean = 0.01).
A significant interaction between the factors Situations and Organization was also observed, $F(2, 41) = 12.08$, MSE = .18 r to z units, $p < .00$, partial $\eta^2 = .37$. (See Figure 18).

Figure 18. Levels of clustering correlations from the reorganization of target concepts as a function of the 3 types of situations. (* denotes statistically significant difference between the two levels of organization)

To test the main predictions, planned comparisons were carried out to compare the situations: Baseline vs. new-thematic situations

The planned comparison revealed a significant interaction between baseline and new-thematic situation: $F(1, 41) = 16.36$, MSE = .18 r to z units, $p < .0002$. Details from contrast analyses showed that the difference between the mean levels of correlation for taxonomic organization observed in baseline and the one which was observed in new-thematic situation was significant: $F(1, 41) = 10.08$, $p < .001$. Similarly, the difference between the mean levels of correlations for novel-thematic organization at baseline compared to those observed in new-thematic situations was also significant: $F(1, 41) = 26.96$, $p < .0001$.

Thus, the amount of taxonomic organization was reliably greater at baseline (Mean = 0.76) than in the new-thematic situations, as was expected (Mean = 0.11). Interestingly, the reading of the concepts in the new-thematic situations affected their reorganization, such that the amounts of novel-thematic organization were reliably greater (Mean = 0.17) than those which were observed at baseline (Mean = -0.07). Stated differently, when the novel-thematic clusters co-occurred in new-thematic situations, the levels of correlations for the novel-
thematic organization reliably increased compared to baseline. At the same time, the levels of correlations for the taxonomic organization reliably reduced, indicating as expected, the effect of the new-thematic situations on novel-thematic organizations of the target concepts.

**Taxonomic vs. new-thematic situations**

More interesting for our general hypothesis, we observed a significant interaction between the taxonomic and the new-thematic situations with respect to the organization of target concepts, \( F(1, 41) = 19.54 \), MSE = .18 \( r \) to \( z \) units, \( p < .000 \). Analyses of contrasts showed a significant difference between the mean correlation levels for novel-thematic organization observed in taxonomic situation (Mean = -0.09) and those observed in the new-thematic situations (Mean = 0.17); \( F(1, 41) = 30.96, p < .000 \). Thus, the amounts of novel-thematic organization were reliably greater when the target concepts were previously read and experienced in new-thematic situations compared to when read in taxonomic situations.

Conversely, concerning taxonomic organization, the contrast analyses showed that the difference between the mean correlation levels observed in the taxonomic situation compared to those from the new-thematic situation were significant, \( F(1, 41) = 12.21, p < .00 \). In other words, the amounts of taxonomic organization of target concepts were reliably smaller when they were read in new-thematic situations (Mean = 0.11), whereas the amounts were significantly greater after they had been read in the taxonomic situations (M = 0.76). This implies that the processing of the target concepts in the new-thematic situations facilitated their novel thematic integrations, leading to the significantly greater amounts of traces for novel-thematic organization. In contrast, such a phenomenon was not observed in the taxonomic situation, as shown in Figure 18.

However, post-hoc analyses using Tukey HSD test at an alpha level of .05 did not reveal a significant difference between taxonomic organization and novel-thematic organization within the new-thematic situation condition, \( p = 0.9 \), whereas the difference between the two types of organizations within baseline and also within taxonomic situation were significant, \( p < .00 \).

**Baseline vs. taxonomic situations**

One intriguing observation was that there were no significant differences nor interactions between baseline and the taxonomic situations, \( F(1, 41) < 1 \), though it was expected that experiencing the target concepts in the taxonomic situations would reinforce their taxonomic organization compared to baseline. This however was not the case. The target concepts, after they had been read in the taxonomic situations were clustered with no significant influence from the situational information. Thus, concerning the two types of organizations (novel-thematic and taxonomic), it seemed that both baseline and the taxonomic
situation groups processed the target concepts in the same manner, as shown in Figure 18. No other factors or interactions came out significantly.

18.0. Discussion

The main objective of this study was to assess the influence of situations on the processing, representation and organization of abstract concepts. It was hypothesized and predicted that if the nature of abstract concepts is such that they are more compatible with thematic integration processes and that situational information is pertinent to their processing and representation, then when the concepts were read in situations that facilitated the establishment of new thematic integrative relations amongst them, the organizational structure should be novel-thematic rather than taxonomic, even though the concepts originally belonged to abstract taxonomic categories. Overall, the data reported from this experiment suggest that indeed when the target abstract concepts were frequently instantiated and experienced in situations they thematically integrated with each other. Traces of these new conceptual thematic relations emerged and were observed as novel-thematic organizations.

We used abstract concepts that were heavily related to each other taxonomically as the target concepts for this study. If situations and thematic organization did not partake in the processing of abstract concepts, we should have observed persistent taxonomic relations between the concepts even after they had been experienced in new-thematic situations. The fact that taxonomic organization reduced reliably as novel-thematic organizations emerged indicated that not only do abstract concepts depend heavily on contextual elements, but the conceptual organization that structures their processing has a strong thematic foundation.

Interestingly, novel-thematic organizations were considerably predominant after the concepts were read in new-thematic situations, but they remained insubstantial at baseline, implying that new thematic organizations of abstract concepts are more dependent on situational information. Conversely, taxonomic organization remained identical to the one at baseline even after the concepts were read in taxonomic situations, indicating that taxonomic organization of abstract concepts, on the other hand, is less reliant on situational information. This could also be due to the fact that the target concepts had strong and pre-existing taxonomic relations between them, and hence are unaffected by situations.

On the contrary, the differences observed between baseline and new-thematic situations, as far as novel-thematic organization of the abstract target concepts is concerned indicates that conceptual associations and relations between different abstract concepts be it causal, temporal, functional, spatial and introspection, all translated into thematic organizations, are influenced by situational information, without which integration processes
might not be readily available for novel thematic clusters to emerge. Therefore, thematic organization was part of the main semantic framework that supported the mental representation of the concepts from their processing in the situations.

Our findings are consistent with the situational-based theories as well as with the claims of the qualitatively different representational framework for abstract concepts, (e.g., Crutch & Warrington, 2005, Dunabeitia et al., 2009). They are also coherent with the claims of the Stimulus-Compatibility processing theory (Wisniewski & Bassok, 1999), which suggests that items that are semantically similar are also highly alignable and thus rely on comparison processes to compare their semantic features, thereby leading to taxonomic representations. In order to carry out comparison processes between concepts, one focuses on the concepts themselves and less on contextual information. This is consistent with our observation of the equal levels of taxonomic organization at baseline and taxonomic situations. Contrarily, non-alignable items are mostly semantically dissimilar, and therefore compatible with thematic integration processes. Hence, processing them requires more focus on situational information and less on their intrinsic features, thereby leading to thematic representations as observed by the increased novel thematic organization from the new-thematic situations.

Previous studies have shown that situations form a major part of the features generated for abstract concepts during property generation tasks and also they heavily influence the representation of abstract concepts (e.g., Barsalou & Wiemer-Hastings, 2005). Other studies have also shown that thematic integration could be the “natural process” engaged during similarity judgement on abstract concepts (e.g., Wiemer-Hasting & Xu, 2003). To our knowledge, the work presented in this thesis is the first that has brought the two assumptions together into one study and provided empirical evidence for the view that situational information and thematic integration both interact and significantly influence the conceptual representation of abstract concepts.

After several pertinent modifications in our methodology with respect to the first experiment, the situations used in Experiment 2 had all the relational and contextual constraints necessary for the emanation of novel thematic organizations. Our observations seemed more reliable, indicating that indeed, when participants read and conceptually processed situations containing semantically dissimilar abstract concepts, the type of organization formed afterwards reflected the new thematic relations created during the integration of the concepts within the situations.

Taking a closer look at the overall results in Experiment 2, one cannot fail to notice that the new-thematic situations produced statistically significant but smaller increase in
novel-thematic organization, whereas the increase in taxonomic organization observed in the taxonomic situation was very prominent. Essentially, the proportions in correlations as a function of the two types of organizations were quite unbalanced. Thus, considering the levels of novel-thematic organizations observed from the new-thematic situations, it was quite unclear why a proportionately smaller increases, though statistically significant was observed.

One possible explanation for this proportionately lower increase in novel-thematic organization could be the influence of individual differences in creating new thematic categories for abstract concepts. Several studies have systematically shown that there are pervasive individual differences in how strongly thematic relations affect categorization (e.g., Lin & Murphy, 2001; Golonka & Estes, 2009; Simmons & Estes, 2008). For example, Simmons and Estes (2008) suggested that there are two types of people who use thematic relations to form categories; those who do not like participating in cognitive activities and those who have a contextual conception of similarity. Thus, individual preference for thematic thinking could also mean that different people perceive different thematic relations among similar types of abstract concepts, despite the contextual information available. So concerning the current results, it was observed that certain participants in the new-thematic situation condition did not create taxonomic clusters, neither did they create the novel-thematic organizations that resembled the original novel-thematic clusters used to generate the novel-thematic solution matrix. Hence, some of them created their own individual thematic associations between the concepts, probably based on inferences generated from their personal understanding of the situations. Consequently, their clusters resembled none of the two types of original clusters, (taxonomic or novel thematic) embedded in the situations.

A second possible explanation could be that the clustering task biased participants towards creating classic sorts of taxonomic categories. Because, a cognitive task that involves grouping concepts according to any dimensional rule, makes people believe that they are forming categories. Therefore, participants could have imagined that the clusters created should be taxonomic, given that this is their “stereotype” perception about what a category is. Thus, they are comfortable in forming taxonomic categories in the baseline and taxonomic situation conditions, but are quite reticent, however in forming new thematic categories in the new-thematic situation conditions. Therefore, this could have hindered the free emergence of novel and creative thematic organizations, even though participants might have thought about them mentally during the task. In fact, Gentner and Brem (1999) suggested that in situations where taxonomic relations are very low, the output of thematic relatedness or associations is sometimes difficult to call upon from direct introspection. Thus, participants sometimes find it difficult to show outwardly thematic relations when the latter are more salient than taxonomic
relations. Indeed, Gentner and Brem (1999) suggested that the ability to create thematic relations when underlying taxonomic relations are very low requires a high level of metacognitive skills.

Finally, previous research has shown that taxonomic relations can intrude on thematic processing. For example, Wisniewski and Bassok (1999) observed that the presence of taxonomic relations amongst concepts could interfere with thematic judgements despite explicit instructions, which suggested that the task should involve thematic integration. They argued that participants are sometimes affected by stimuli compatibility. In other words, participants are able to unconsciously or implicitly detect underlying pre-existing taxonomic relations among stimuli, thus, interfering with subsequent thematic integration. One must bear in mind that the 24 target concepts used in the sorting task were selected from pre-existing taxonomic abstract categories. Therefore, though the novel-thematic organization observed was reliable, the possible intrusion of taxonomic relations on the emergence of these newly formed thematic organizations, could explain why a proportionately lower increases of them was observed in the new-thematic situations compared to the higher levels of taxonomic organization in the taxonomic situations and at baseline.

In view of the reasons explained above, Experiment 3 was conceptualised. This experiment implemented a new experimental procedure and task: relatedness judgments on concept pairs. Perhaps relatedness judgments would show even stronger effects of the situations on novel-thematic organization, while minimizing individual differences on thematic and/or taxonomic processes.

19.0. Experiment 3

19.1. Introduction and objectives

The evidence presented from Experiment 2 is supportive of the claim that processing abstract concepts in situations facilitates the construction and emergence of newly situated thematic reorganizations of those concepts. In other words, experiencing clusters of unrelated abstract concepts in situations allows diverse thematic relations to be formed amongst them with respect to their co-occurrences and meaningful instantiations in those situations. Nevertheless, it was observed from Experiment 2 that the sorting task used to assess the organization of the target concepts after their processing in situations could have been influenced by intrusions from underlying taxonomic relations amongst the concepts, thus hindering to a certain extent the complete emergence of all the possible thematic representations that could have been created by participants in the new-thematic situation.
Additionally, another drawback was that the thematic organization observed could have been influenced by interferences from persistent individual differences in categorization styles and preferences, generally observed in sorting tasks. Indeed, previous studies have systematically shown that, some individuals always categorize using either thematic or taxonomic relations and criteria, regardless of the precise instructions or situations within which the concepts are instantiated (e.g., Gentner & Brem, 1999). So, though perhaps unlikely, one could validly imagine that the thematic organization observed was mostly due to the participants’ preferred style for concept categorization rather than situational effects on concept processing.

Thus, it became necessary to acquire some more direct evidence that would support our fundamental assumption that the co-occurrences and the processing of unrelated abstract concepts in situations are what allowed the establishment of newly derived integrational relations between them, leading to the thematic reorganization of the concepts. It became necessary therefore to address the general experimental hypotheses and predictions using a different experimental paradigm.

We needed to design a task that:

- Could trace the type of conceptual organization manifested during the processing of the concepts in situations.
- Could efficiently capture novel reorganizations of the target concepts when they emerge from situation processing.
- Would not involve the comparison between clusters sorted by participants and the pre-determined original clusters, thus nullifying individual differences in sorting styles.
- Would reduce possible intrusive effects from underlying taxonomic relations on the reorganization of the target concepts.

Also, a different experimental paradigm would demonstrate the robustness of the experimental hypotheses, predictions and effects, were we to observe similar results to those in Experiment 2. Hence, Experiment 3 had a triple focus:

1. Re-test the hypotheses and predictions with a different experimental paradigm.
2. Address the issues raised above that may have influenced the observations in Experiment 2.
3. Demonstrate the robustness of the predictions and effects, based on the results of Experiment 2.
19.2. Similarity judgements of concepts

It was illustrated in the theoretical section of this thesis (Ch. I, section 6.5) that thematic relations have been known from previous studies to affect the perception of similarity in a qualitatively different manner through the process of thematic integration (e.g., Wisniewski & Bassok, 1999; Golonka & Estes, 2009). For example, “pilots” and “planes” would be considered as being similar because of their frequent co-occurrences and the complementary roles that they play in a flying theme. Several studies have explored such thematic integrations in order to observe how pertinent they are to different cognitive processes such as categorization, induction and inferences (e.g., Golonka & Estes, 2009; Simmons & Estes, 2008). Most of these studies have concluded that thematic relations reliably affect similarity and are more compatible with integration processes whereas taxonomic relations are more compatible with comparison processes (e.g., Wisniewski & Bassok, 1999).

It was also mentioned in the same section that Wiemer-Hastings and Xu (2003) studied the conceptual representations and similarity judgements of abstract concepts based on the stimulus-compatibility theory. They suggested that integration processes could be more adaptable to the similarity judgement and representation of abstract concepts due to their relational nature. More importantly, they suggested that thematic integration play a central role in the manner in which participants evaluate similarity judgements between abstract concepts compared to concrete ones. Thus, independent of any pre-existing taxonomic relations, thematic relations were considered and used more consistently in similarity judgement for abstract items. Therefore, similarity judgement appeared to be a valid testbed for assessing the presence of thematic reorganization between different abstract concepts that co-occur in the same situation.

19.3. Reasoning behind the method of Experiment 3 with respect to our general hypotheses

The principal aim of Experiment 3 was to use similarity judgements on concept pairs to assess the type of conceptual organization utilized to process abstract concepts, instantiated and recently experienced in situations. We attempted to ascertain whether participants would thematically integrate and therefore judge pairs of abstract concepts that have no pre-existing thematic relations as similar when presented in isolation (i.e. without situations) compared to after they have been read and processed in relevant situations.

Our first assumption underlying the similarity judgement task on concept pairs was that if indeed situations influence the conceptual representation of abstract concepts (Barsalou, 1999, 2003, 2008; Wilson-Mendenhall et al 2011; Wiemer-Hastings & Xu, 2005),
then one way of testing this claim could be to assess the similarity judgements between pairs of concepts recently processed in the same situation. For example, imagine that cluster A (history, terror, monarchy, treason) was recently read in the new-thematic situation - Mary Tudor. If situations do influence the processing of unrelated abstract concepts, then after the cluster A has been conceptually processed in the Mary Tudor situation, novel thematic relations should become established between and emerge from the four words forming cluster A. If this were the case, then all the pairwise permutations between the four words of cluster A should be perceived as related and therefore judged as similar. Stated more precisely, after encountering the above new-thematic cluster A frequently in a situation, an integration process should enable new thematic organizations to become established among the concepts from their processing in the situation. Thus, if the situations did indeed influence and support the mental representation and the conceptual processing of the new-thematic cluster A, then a trace of the new thematic relations from cluster A should emerge from semantic memory after reading the situations. Therefore, participants should judge all the following pairs as similar (history - terror, monarchy - history, treason - history, terror - monarchy, treason - monarchy, terror - treason). On the other hand, it would be expected that in the absence of situations, (i.e. baseline), the paired concepts from cluster A would not be judged as similar or related since there would be insufficient situational information to readily support relevant thematic integration among them. Therefore, if thematic organization and situations do not influence the processing of abstract concepts, then there should be no differences observed between baseline and new-thematic situation conditions.

If our reasoning were valid, first, it would undoubtedly support the important role that situations play in the conceptual processing and the mental representation of abstract concepts. Second, it would also support the claim that thematic reorganization brings together the relevant and optimal clusters and associations between abstract concepts needed to support very important high-level conceptual processes such as categorization and similarity. Third, it would provide us with more direct evidence that would support the fundamental hypothesis that the co-occurrences and processing of unrelated abstract concepts in situations participate in the establishment of complementary relations between them, leading to their reorganization within a thematic conceptual framework. Finally it would provide further support to the findings of Wiemer-Hastings and Xu (2003) that thematic integration is the most instinctive and essential cognitive process apprehended for the conceptual representation of abstract concepts. Investigating the extent to which situational information and thematic integration would influence similarity judgements on unrelated abstract concepts pairs was thus the main objective for the next experiment.
20.0. Method

20.1. Participants

60 undergraduate psychology students from the Lumière University of Lyon participated as part of their course credits. Three experimental groups were constituted for the experiment and the participants were randomly assigned to each group.

20.2. Materials

20.2.1. Phase 1 – text stimuli - situations

The same six situations used in Experiment 2 were used for the experimental situations here.

20.2.2. Phase 2 – construction of target concept pairs

To reiterate, in Experiment 1 six sets of taxonomic clusters each having four exemplars were selected. Then, from the taxonomic clusters, six sets of novel-thematic clusters with four exemplars in each cluster were generated.

20.2.3. Generation of taxonomic paired combinations

For each set of the 6 taxonomic clusters, all the pairwise combinations amongst the members of the set were generated. For example, taking the religion cluster (catholicism, puritanism, protestantism, evangelism), the following 6-paired permutations were generated: catholicism-puritanism, catholicism-protestantism, catholicism-evangelism, puritanism-protestantism, puritanism-evangelism, protestantism-evangelism. Table 17 shows all the paired combinations derived from each of the 6 taxonomic clusters.

20.2.4. Generation of the target taxonomic pairs list

From the taxonomic paired combinations described above, a list was generated by alternating the six categories, such that the first pair on the list was taken from category 1 (catholicism-puritanism), the second pair which followed was from category 2, (murder-corruption), then the third pair came from category 3 (sadness-guilt). This alternating procedure continued until pairs from all the categories were represented. The cycle then started again from the first category. This procedure was utilized to ensure that 2 pairs from the same category did not follow each other successively on the experimental list, so as to avoid category expectancy during the experimental task (please refer to Appendix N for the full taxonomic pair list). In total there were 36 taxonomic permutated pairs.
Table 17. Paired permutations from each of the six taxonomic clusters, each containing 4 exemplars used in Experiments 3 and 4.

<table>
<thead>
<tr>
<th>Taxonomic categories</th>
<th>Taxonomic clusters</th>
<th>Taxonomic paired permutations</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 RELIGION</td>
<td>Catholicism Protestantism Evangelism Puritanism</td>
<td>catholicism-puritanism catholicism-evangelism catholicism-protestantism puritanism-protestantism puritanism-evangelism protestantism-evangelism</td>
</tr>
<tr>
<td>2 CRIMES</td>
<td>Murder Fraud Corruption Treason</td>
<td>murder-corruption murder-treason corruption-treason murder-fraud corruption-fraud fraud-treason</td>
</tr>
<tr>
<td>3 FEELINGS</td>
<td>Sadness Terror Guilt Compassion</td>
<td>sadness-guilt sadness-compassion guilt-compassion sadness-terror guilt-terror terror-compassion</td>
</tr>
<tr>
<td>4 RELATIONSHIPS</td>
<td>Friendship Marriage Partnership Parentage</td>
<td>friendship-marriage friendship-parentage marriage-parentage friendship-partnership marriage-partnership partnership-parentage</td>
</tr>
<tr>
<td>5 SOCIOPOLITICAL REGIMES</td>
<td>Monarchy Democracy Liberalism Aristocracy</td>
<td>monarchy-democracy monarchy-liberalism democracy-aristocracy democracy-liberalism aristocracy-monorachy aristocracy-monorachy</td>
</tr>
<tr>
<td>6 DISCIPLINES</td>
<td>Psychology Languages History Archaeology</td>
<td>psychology-history psychology-archaeology history-archaeology psychology-languages history-languages languages-archaeology</td>
</tr>
</tbody>
</table>

20.2.5. Novel-thematic paired combinations

The same procedure described above was followed to derive all the pairwise combinations from the 6 novel-thematic clusters having four members each, as detailed in Table 18.

Table 18. Paired permutations from each of the six novel-thematic clusters, each containing 4 exemplars used in Experiments 3 and 4.

<table>
<thead>
<tr>
<th>Novel-thematic groups</th>
<th>Novel-thematic clusters</th>
<th>Novel-thematic paired permutations</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>History Terror Monarchy Treason</td>
<td>history - terror history - treason terror - treason</td>
</tr>
<tr>
<td>2</td>
<td>Archaeology Corruption Aristocracy Marriage</td>
<td>archaeology - corruption archaeology - marriage</td>
</tr>
<tr>
<td>3</td>
<td>Partnership Guilt Puritanism Murder</td>
<td>partnership - puritanism partnership - murder</td>
</tr>
</tbody>
</table>
Derivation of the target novel-thematic pairs list

From the novel-thematic paired combinations shown in Table 18 above, a list was generated by group representation following the same procedure as the one used to generate the taxonomic pairs list described earlier. For example, the first pair on the list was taken from group 1 (history - terror), the second pair which followed was from group 2 (archaeology - corruption), then the third pair came from group 3 (partnership - puritanism). This procedure continued until pairs from all the groups were represented. There were 36 novel-thematic pairs in total derived from the pairwise permutations of the six novel-thematic clusters. (Please refer to Appendix O for the novel-thematic pairs list).

In order to ensure that similarity judgements would not be influenced by association strengths from established associative norms between the novel-thematic word pairs, we verified the associative strength between the word-pairs in each novel-thematic cluster. We obtained the free association frequencies of the word-pairs in each of the six clusters from which the novel-thematic target pairs were derived. These frequencies were obtained from published free association norms (Edinburgh Association Thesaurus, Kiss, Armstrong, Milroy, & Piper, 1973). For example, for the cluster (archaeology, corruption, aristocracy, marriage) each word was entered into the normed association database, to check whether any of the other words within the cluster appeared as established normed associates. The associated norms showed that almost all of the words forming the novel-thematic clusters were not or only very weakly associated. For example, for all the 36 novel-thematic clusters pairs used in Experiment 3, only “history – monarchy” and “guilt – murder,” were normed as very weakly associated and the frequencies were .01 (mean forward associative strength) and .01 (mean backward associative strength; Armstrong et al., 1973).

20.2.7. Filler categories and pairs

In order to mask the objective of the experiment, filler abstract word pairs identical to the experimental target pairs were constructed following the same procedure used in
Experiment 1 to create the original taxonomic abstract categories. Six filler taxonomic abstract categories with 4 exemplars for each category were selected. The filler taxonomic abstract categories were \((time, personality traits, sins, historical dating, mental states and growth stages)\). This led to the generation of 24 abstract taxonomic filler exemplars. The latter were normed in a pre-test following the procedure in norming Study 3 for concreteness and familiarity, but they were not inserted into the experimental situations. Following the procedure described in the method of Experiment 1, putting together 4 exemplars, each from a different filler taxonomic category generated filler novel-thematic clusters.

20.2.8. Filler taxonomic clusters and pairs

The same procedure used to derive the taxonomic experimental pairs described earlier was also used to create the taxonomic filler pairs by permutation of all the members of each cluster. Table 19 below shows the 6 filler taxonomic categories with exemplars and the pairwise combinations generated for each cluster. Finally, a taxonomic pairs filler list was created by category as described earlier, whereby the pairs on the list alternated by category. For example, if the first pair on the list was from category 1 \((future – minute)\), the second pair was from category 2 \((egoistic – timid)\) and so on until all the six categories were represented, then the cycle began again. In total there were 36 taxonomic filler pairs (please refer to Appendix P for the taxonomic filler pair list).

Table 19. Filler taxonomic categories with paired permutations from each of the six taxonomic clusters, each contained 4 exemplars used in Experiments 3 and 4.
20.2.9. Filler novel-thematic clusters and pairs

The procedure used to derive the target novel-thematic experimental pairs described earlier (section 20.2.6) was also used to create the filler novel-thematic pairs by permutation of all the members of each filler novel-thematic cluster. Table 20 shows the 6 derived novel-thematic filler clusters and all the pairwise permutations generated for each cluster. A novel-thematic pairs filler list was finally created following the same procedure as described earlier, whereby the pairs on the list alternated by groups. There were 36 novel-thematic filler pairs in total derived from the pairwise permutations of the six filler novel-thematic clusters. (Please refer to Appendix Q for the novel-thematic filler pair list).

Table 20. Filler novel-thematic categories with paired permutations from each of the six clusters, each contained 4 exemplars used in Experiments 3 and 4.

<table>
<thead>
<tr>
<th>Filler novel-thematic groups</th>
<th>Filler novel-thematic clusters</th>
<th>Fillers novel-thematic paired combinations</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>future lies fantasy antiquity</td>
<td>future - fantasy future - antiquity</td>
</tr>
<tr>
<td></td>
<td></td>
<td>fantasy - antiquity</td>
</tr>
<tr>
<td></td>
<td></td>
<td>future - lies fantasy - lies</td>
</tr>
<tr>
<td></td>
<td></td>
<td>lies - antiquity</td>
</tr>
<tr>
<td>2</td>
<td>egoistic minute thoughts</td>
<td>egoistic - infancy egoistic - thoughts</td>
</tr>
<tr>
<td></td>
<td></td>
<td>infancy - thoughts</td>
</tr>
<tr>
<td></td>
<td></td>
<td>egoistic - minute infancy - minute thoughts</td>
</tr>
<tr>
<td></td>
<td></td>
<td>infancy - minute</td>
</tr>
<tr>
<td></td>
<td></td>
<td>minute - thoughts</td>
</tr>
<tr>
<td>3</td>
<td>extrovert ancient puberty</td>
<td>extrovert - greed extrovert - puberty</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ancient - cheat</td>
</tr>
<tr>
<td></td>
<td></td>
<td>extrovert - ancient</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ancient - puberty</td>
</tr>
<tr>
<td></td>
<td></td>
<td>greed - puberty</td>
</tr>
<tr>
<td></td>
<td></td>
<td>pubert - contemporary</td>
</tr>
<tr>
<td>4</td>
<td>moment timid pride contemporary</td>
<td>moment - timid moment - contemporary</td>
</tr>
<tr>
<td></td>
<td></td>
<td>timid - contemporary</td>
</tr>
<tr>
<td></td>
<td></td>
<td>moment - pride timid - pride</td>
</tr>
<tr>
<td></td>
<td></td>
<td>pride - contemporary</td>
</tr>
<tr>
<td>5</td>
<td>maturity modern psyche blasphemy</td>
<td>maturity - psyche maturity - blasphemy</td>
</tr>
<tr>
<td></td>
<td></td>
<td>psyche - blasphemy</td>
</tr>
<tr>
<td></td>
<td></td>
<td>maturity - modern psyche - modern</td>
</tr>
<tr>
<td></td>
<td></td>
<td>modern - modern</td>
</tr>
<tr>
<td></td>
<td></td>
<td>blasphemy - blasphemy</td>
</tr>
<tr>
<td>6</td>
<td>eternity unconscious courage agedness</td>
<td>eternity - unconscious eternity - agedness</td>
</tr>
<tr>
<td></td>
<td></td>
<td>unconscious - agedness</td>
</tr>
<tr>
<td></td>
<td></td>
<td>eternity - courage</td>
</tr>
</tbody>
</table>
20.2.10. Final experimental list construction

The final experimental list was made up of 144 word pairs (72 targets and 72 fillers). The experimental list was constructed by systematically mixing the 72 target pairs with the 72 fillers by starting with a taxonomic target pair, this was followed by a novel-thematic target pair, then came a taxonomic filler pair, thereafter came a novel-thematic filler pair. The chain then began again with a taxonomic target pair, etc., until all the 144 word pairs were represented on the list. This yielded an initial mixture-list (please refer to Appendix R for a copy of the mixture-list 1). Next, in order to control for order effect, this initial mixture-list of 144 word pairs was introduced into an excel spreadsheet and the excel ‘RAND’ function was used to randomize the list in order to obtain the first version of the final experimental list. A second version of this final experimental list was obtained by reversing the order of presentation of word pairs on the first version. Thus, there were two versions of the final experimental list that was counterbalanced. Half of the participants were given one version of the final experimental list and the other half was given the second version. (Please refer to Appendices S1 and S2 for copies of the two versions of the final experimental lists).

20.3. Procedure

The schematic procedure and experimental tasks of Experiment 3 were the same as the ones in Experiment 2, except for the third phase, as indicated in Figure 19 below.

![Figure 19. Schematic protocol of Experiment 3.](image)

20.3.1. Phases 1 & 2: situation reading procedure

The procedure and instructions for the reading phases were identical to the ones used in Experiment 2.

20.3.2. Phase 3: Similarity ratings of target concept pairs

The third phase of the experiment consisted of rating the similarity of the word pairs on a different Apple Macintosh computer screen. The final experimental list containing the 144 pairs of words was presented to participants using the experimental psychology software PsyScope (Cohen et al., 1993). After signing the consent form, participants read the
instructions on the screen which informed them that a list of words presented in pairs would appear on the screen. Their task was to rate how similar the two words were on a 7-point Likert scale, where 1 denoted “not at all similar” and 7 denoted “very similar.” So, if participants thought that the two words in a pair were very similar, they pressed the “7” key. If they thought that the two words were not at all similar they pressed the “1” key. Participants were instructed to use the other numbers between 1 and 7 to indicate in between degrees of similarity. After the instructions, participants were asked to place their left index finger and the right index finger on the “3” and “5” keys respectively of the keyboard (Figure 20 below). This precaution ensured that participants would be most inclined to use the whole scale during the task. They pressed the number “4” key on the keyboard to launch the presentation of the first pair of words. In order to allow participants to become accustomed to the procedure, practice trials made up of six neutral abstract word-pairs preceded the 144 experimental trials, (see Appendix T for the practice list). None of the 6 neutral abstract word-pairs used for the practice trials appeared on the final experimental list.

Participants initiated the sequence of experimental trials by pressing the “4” key on the keyboard. After a 500-ms pause, a fixation point (+) appeared in the centre of a blank screen for 500 milliseconds. This fixation point appeared only at the beginning of the experimental trial. Then, the first pair of words appeared at the centre of the screen and stayed there until the participant rated it by pressing the key. This cycle continued until the last pair was rated. The experiment ended with the sentence “End of experiment. Thank you for your participation.” The intertrial interval depended on how long it took participants to start the next trial. Participants were told to take their time and rate all the pairs at their own rhythm and pace because their speed of response was not relevant. Each participant had a randomized version of the experimental list. This phase of the experiment took approximately 20 minutes. Their responses were recorded for analyses. Participants received instructions to “study attentively the two words that appeared in the middle of the screen and then rate on a scale of 1 to 7 your judgement of how similar they are to you.”

![Figure 20. Likert scale for rating concept pairs.](image-url)
20.4. Experimental conditions

The experimental conditions were identical to those of Experiment 2, except for the performing of the similarity task. In the baseline condition, participants did not read any situations, they only performed the similarity rating task. In the taxonomic situation condition, participants read the taxonomic situations and afterwards they performed the similarity rating task. Finally, concerning the new-thematic condition, participants read the new-thematic situations and performed the similarity rating task afterwards.

20.5. Experimental manipulation plan

The experimental plan was a 3 (Situations: baseline vs. new-thematic vs. taxonomic) by 2 (Target-Pairs: taxonomic vs. novel-thematic). Subject was a random factor. The dependent variable was the level of similarity ratings, corresponding to the measure of how similar participants rated the target pairs on the scale.

20.6. Predictions

Prediction 1 – baseline

Based on previous findings (e.g., Experiment 1 & 2), it was predicted that in the baseline condition, where there was no situational information preceding the ratings of the concept pairs, similarity ratings for taxonomically related target-pairs would be significantly higher than those for the novel-thematic target-pairs.

Prediction 2 – baseline vs. taxonomic situation

It was expected that after the target concepts were read and processed in taxonomic situations, categorical similarity relations between them would be reinforced by the situations. Thus, we predicted that first, the similarity ratings for taxonomic target-pairs processed in the taxonomic situation would be significantly higher than the ratings for the novel-thematic target-pairs. Second, comparing the taxonomic situation to baseline, the similarity ratings for taxonomic target-pairs in the taxonomic situation would be significantly higher than what would be observed at baseline.

Prediction 3 – baseline vs. new-thematic situation

If indeed situational information enables new thematic organizations to emerge between different abstract concepts that have no pre-existing relations, then we should expect the construction of integrational relations between the novel thematically constituted pairs of concepts when they are read in new-thematic situations. It was predicted therefore that, first, concerning the new-thematic situations, the similarity ratings for novel-thematic target-pairs would be significantly higher than those for taxonomic target-pairs. Second, comparing new-
thematic situations to baseline, we expected similarity ratings for the novel-thematic target-pairs to be significantly higher, whereas ratings for the taxonomic target-pairs would be significantly lower than what would be observed at baseline.

Prediction 4 – new-thematic vs. taxonomic situations

The prediction here was that when the target-pairs are read previously in new-thematic situations, the similarity ratings for the novel-thematic target-pairs would be significantly higher than the similarity ratings for the same pairs previously read in the taxonomic situations. At the same time, similarity ratings for the taxonomic target-pairs would be significantly lower when read previously in new-thematic situations than when previously read in taxonomic situations.

20.7. Data collection and analyses of Experiment 3

The procedure for the collection of data from the comprehension questions and the emotional valence judgements were identical to the ones described in Experiment 2. The final analyses of variances were carried out on the ratings of the critical target abstract concepts pairs for 57 participants because 3 from the latter gave wrong answers to some of their comprehension questions. The filler pairs were excluded from the analyses.

20.7.1. Computations of average ratings for novel-thematic and taxonomic target-pairs

The critical target concepts pairs were separated into novel-thematic pairs and taxonomic pairs for each participant. Concerning only the target novel-thematic pairs, the average ratings for all the 6 pairwise combinations for each cluster were computed. For example, the novel-thematic cluster \( (\text{history, terror, monarchy, treason}) \), which was processed in the same new-thematic situation yielded the following permutation pairs: \( (\text{history – terror; monarchy – history, treason – history, terror – monarchy, treason – monarchy, terror- treason}) \). Thence, the average for all the ratings given to each of these pairs was calculated for each participant. In doing this, 6 novel-thematic paired averages were obtained for each participant from the 6 situations read.

The same procedure was used to compute the average for the ratings given to each of the 6 target taxonomic clusters. For example, the taxonomic cluster \( (\text{catholicism, puritanism, protestantism, evangelism}) \) yielded the following taxonomic permutation pairs \( (\text{catholicism-puritanism, catholicism-protestantism, catholicism-evangelism, puritanism-protestantism, puritanism-evangelism, protestantism-evangelism}) \). Since participants rated each pair, the average for the 6 pairs was calculated for each participant’s taxonomic cluster. Just like above, 6 taxonomic paired averages were obtained for each participant from the 6 situations.
21.0. Results

The analyses of variance (ANOVA) were carried out on the average similarity ratings of the target concepts pairs produced by the 3 experimental groups. The dependent variable “level of similarity” was measured from the average ratings of the target abstract concepts pairs on the 7-point scale. The means and standard deviations are reported in Table 21. All post hoc comparisons were performed using the Tukey HSD test at an alpha level of .05.

21.1. Main effects

Situations

The ANOVA showed a main significant effect for the factor Situations, $F(2, 52) = 41.10$, $MSE = 5.07$, $p < .000$, partial $\eta^2 = .61$. Interestingly, as indicated in Table 21 and Figure 21, similarity ratings for the target-pairs were reliably higher when they were processed in new-thematic situations (Mean = 5.25) compared to when processed in taxonomic situations (Mean = 3.47) and at baseline (Mean = 3.64). Thus, reading the target-pairs in the new-thematic situations reliably influenced the similarity ratings of the target-pairs afterwards, much more than was observed in the other conditions (i.e., baseline and taxonomic).

Table 21. Average similarity ratings between target-pairs as a function of the 3 situations: baseline, taxonomic and new-thematic in Experiment 3. (Standard errors shown in parentheses. M denotes the global means for situations and target-pairs).

<table>
<thead>
<tr>
<th>Target-Pairs</th>
<th>Situations</th>
<th>M</th>
<th>T</th>
<th>N</th>
<th>M</th>
</tr>
</thead>
<tbody>
<tr>
<td>TAXONOMIC</td>
<td>Baseline</td>
<td>4.35 (0.16)</td>
<td>4.31 (0.17)</td>
<td>5.02 (0.17)</td>
<td>4.56 (0.95)</td>
</tr>
<tr>
<td>NOVEL-THEMATIC</td>
<td>Taxonomic</td>
<td>2.92 (0.17)</td>
<td>2.62 (0.18)</td>
<td>5.47 (0.18)</td>
<td>3.67 (0.10)</td>
</tr>
<tr>
<td>^M</td>
<td>New-thematic</td>
<td>3.64 (0.14)</td>
<td>3.47 (0.16)</td>
<td>5.25 (0.15)</td>
<td>-</td>
</tr>
</tbody>
</table>

Target-Pairs

The factor target-pairs also came out significantly, $F(1, 52) = 91.06$, $MSE = 1.42$, $p < .000$, partial $\eta^2 = .64$. Thus, the overall mean similarity ratings were significantly higher for the taxonomic target-pairs (Mean = 4.56) compared to the novel-thematic ones (Mean = 3.67).

Interaction effect

^ M denotes mean similarity ratings for the variables.
The interaction between Situations and Target-Pairs was also significant, \( F(2, 52) = 51.71, \text{ MSE} = 1.42, \ p < .000, \) partial \( \eta^2 = .67. \) This indicated that the similarity judgements for the two types of target-pairs differed reliably between the three situations as indicated in Figure 21 above.

![Effect of Situations on Similarity Ratings of Target Abstract Concept Pairs](image)

Figure 21. Average similarity ratings for target concept pairs, indicating the effect of situations on taxonomic and thematic relatedness. (* indicates significant differences).

In order to test the predictions, planned comparisons were carried out on the three situations with respect to the similarity ratings on target-pairs. Thus, comparing:

**New-thematic vs. taxonomic situations**

A significant interaction between them as a function of the similarity ratings for the target-pairs was observed: \( F(1, 52) = 83.99, \ p < .000. \) Analyses of contrasts showed that comparing the two groups, this interaction emerged as a function of reliable differences between the similarity ratings for the novel-thematic target-pairs: \( F(1, 52) = 120.80, \ p < .000, \) as well as for the taxonomic target-pairs: \( F(1, 52) = 8.95, \ p < .000. \) In other words, similarity ratings for the novel-thematic target-pairs were reliably higher when read in new-thematic situations (Mean = 5.47) than when read previously in taxonomic situations (Mean = 2.62). This indicated that the new-thematic situations significantly influenced the construction of novel thematic relations between the novel-thematic pairs, whereas in the taxonomic situation the similarity ratings for the novel-thematic target-pairs were lower.

However, contrary to expectations, when the target-pairs were read in the same new-
thematic situations, the similarity ratings for the taxonomic target-pairs were also reliably higher (Mean = 5.02) than ratings for the same pairs read previously in taxonomic situations (Mean = 4.31). This implied that the new-thematic situations reinforced the perception of similarity also for the taxonomic target pairs, more than the taxonomic situations did. Stated differently, the results suggest that after processing the target-pairs in new-thematic situation, the effect on the emergence of new thematic relatedness between the novel-thematic target-pairs and the effect on taxonomic relatedness between the taxonomic target-pairs were both reliably higher compared to the effects observed for the two types of target-pairs in the taxonomic situations condition (see Figure 21 above). Thus, the new-thematic situation significantly influenced all the target-pairs that were read in them (both novel-thematic and taxonomic). This was a very interesting observation that was not expected. Its interpretations will be discussed later.

**New-thematic situation vs. baseline**

Analogously, planned comparisons revealed a significant interaction between new-thematic situation vs. baseline, $F(1, 52) = 71.17, p < .000$. Thus, the similarity ratings for the novel-thematic target-pairs that were previously read in new-thematic situations were reliably higher (Mean = 5.47) than similarity ratings for the novel-thematic pairs processed at baseline (Mean = 2.92), $F(1, 52) = 105.38, p < .000$. The effect of new-thematic situations on the emergence of thematic relatedness ratings for the novel-thematic target-pairs was higher than at baseline. Again, the similarity ratings for taxonomic pairs read in new-thematic situations were significantly higher (Mean = 5.02) compared to the ratings at baseline for the same pairs (Mean = 4.53), $F(1, 52) = 8.49, p < .000$. In other words, the effect on the taxonomic pairs was considerably greater when the latter were read in new-thematic situations than in the absence of situations (i.e., baseline).

Considering only the new-thematic situation, post-hoc analysis revealed that the difference observed between the similarity ratings for taxonomic (Mean = 5.02) and novel-thematic (Mean = 5.47) target-pairs was statistically marginal, ($p = 0.07$). Overall, processing the target concepts in new-thematic situations caused the perceived similarity for all the target-pairs to increase, whereas this effect was not observed in the taxonomic situations or at baseline.

**Taxonomic situation vs. baseline**

As expected, considering only the taxonomic situation, similarity ratings for the taxonomic pairs were reliably higher (Mean = 4.31) than similarity ratings for the novel-thematic target pairs (Mean = 2.62), $F(1, 52) = 101.41, p < .000$. The same observation was made between the two types of target pairs at baseline. That is, at baseline, similarity ratings for the taxonomic pairs were significantly higher (Mean = 4.45) than those for the novel-
thematic target pairs (Mean = 2.92), $F(1, 52) = 86.84, p < .000$. However, the interaction between baseline and taxonomic situations was not significant, $F(1, 52) < 1$, ns. Thus, participants in the taxonomic situations perceived the similarity between the two types of target pairs almost in the same manner as those at baseline. No other effects or interactions came out significantly.

22.0. Discussion

The main question was whether similarity ratings on target-pairs would differ reliably when read previously in new-thematic situations compared to baseline and taxonomic situations.

To form a cluster, we randomly brought together 4 abstract concepts each from a different taxonomic abstract category. These novel clusters, named novel-thematic were inserted into situations (i.e., the new-thematic situations condition) and it was postulated that if indeed situations and thematic organizations played a central role in the conceptual processing and semantic representations of abstract concepts, then as the novel-thematic clusters are instantiated and processed frequently in the same situation; meaningful relations and associations should be constructed and would emerge from them as a function of the mental simulation of the situational information. Consequently the novel-thematic clusters would be perceived as being similar. Thus, as participants read, simulate and comprehend the new-thematic situations, they would mentally build new thematic situated conceptualizations within which the novel-thematic clusters would interact and integrate together to form novel thematic clusters. Thematic, because the relations underlying their organization would be external and complementary, expressing the most “situated” meanings of the events and sequences described in the texts. Therefore, participants were expected to judge each pair of concepts derived from the permutations between all the four concepts forming the novel-thematic cluster as similar. That is, the effect of similarity ratings should be higher for the novel-thematic pairs that were previously processed in the new-thematic situations compared to baseline and taxonomic situations condition.

The results confirmed these predictions. The novel-thematic pairs processed in the new-thematic situations were rated as being highly similar than the ratings of pairs that were not processed in situations at all (i.e., at baseline). Thus, the situations facilitated the perception of the similarity between the novel-thematic pairs, whereas the absence of situations did not yield such an observation. Moreover, perceived similarity was significantly higher for the novel-thematic pairs after reading the new-thematic situations compared to reading the taxonomic situations. This indicated that the new-thematic situations reliably
influenced the novel-thematic pairs more than did the taxonomic situations. The main implication for these findings is that experiencing and processing situations containing abstract concepts from different taxonomic abstract categories provides the contextual background information, necessary for the thematic integration processes to emerge between the concepts. Thus, thematic reorganization influenced the conceptual representation of the target concepts, by virtue of their co-occurrences in relevant situations.

The results are consistent with findings from previous studies on concrete concepts that have shown that participants construct and elaborate thematic relations between concepts which belong to different taxonomic categories and consequently judge them as being similar (Wisniewski & Bassok, 1999). They are coherent with findings from Bassok and Medin (1997), who also showed that participants spontaneously generate novel thematic relations between sentences.

The current observations also cohere with findings from previous research on abstract concepts pairs that have shown that, abstract concept pairs are often judged as being similar through thematic relations, (Wiemer-Hastings & Xu, 2003). The particularity of the current study compared to those cited above is that it focused only on abstract concepts and the latter randomly co-occurred in situations a priori, and hence giving it a credible ecological validity. Indeed, Wiemer-Hastings and Xu, (2003) asked participants to write down their justifications for their similarity ratings a posteriori. Thus, participants came up with their own individual thematic scenarios to justify their thematic similarity ratings on individual pairs of concepts. The current study on the other hand, tested thematic reorganization with the target concepts co-occurring in situations. Thus, any thematic relations observed from the similarity ratings between the novel-thematic pairs could have mostly come from their processing in the new-thematic situations. To our knowledge, this study is one of the first that has directly shown that processing abstract concepts within meaningful situations, events or scenarios facilitate their perceived similarity. The results complement those from Wiemer-Hastings and Xu, (2003), and together they suggest that situations or scenarios play a significant role in the construction and emergence of thematic reorganizations between unrelated abstract concepts. Just as “strategy” and “battle” are perceived as similar through the justification that in order to win a battle one often needs a strategy (Wiemer-Hastings & Xu, 2003), so did the participants in the current studies judge “history and terror” to be similar through their co-occurrence and processing in the same situation.

Comparing baseline to taxonomic situations, the results did not indicate any reliable differences between them concerning taxonomic and novel-thematic relatedness. This finding was identical to the observations from Experiment 2. In that, baseline versus new-thematic
situations yielded reliable differences, but baseline versus taxonomic situations showed no differences at all. Taxonomic organizations persisted in these two groups, and hence, reflecting their original abstract taxonomic categories. This could be due to the fact that taxonomic organization of abstract concepts is already present in semantic knowledge such that taxonomic experiences or training has no reliable effect. It could also be due to the fact that taxonomic organization and categories are not sensitive enough to capture diverse representations of abstract concepts and so have less pertinence in their conceptual representations. The present results indicate that whether abstract concepts are processed in or out of situations, their taxonomic organization is not fundamentally affected.

Overall, the effect of situations on the thematic reorganization of abstract concepts observed in this study is consistent with the findings in Experiment 2. However, we expected that as similarity ratings for the novel-thematic pairs increased from their processing in the new-thematic situations, the ratings for the taxonomically related target pairs would be low. Thus, as the novel-thematic pairs are read in new-thematic situations, their thematic similarity ratings would reliably increase whereas at the same time, the ratings for the taxonomic pairs read in the same situation would be lowered (Prediction 4). However, this difference was statistically marginal. That is, similarity ratings for the novel-thematic pairs were marginally higher compared to those for taxonomic related pairs in the new-thematic situation. It seemed that the novel thematic relations facilitated taxonomic processing of target pairs in the new-thematic situations. It is unclear why we observed this effect. Nonetheless, several possible explanations come to mind.

First, several studies have reported facilitation influence of thematic relations on taxonomic similarity judgements (e.g., Gentner & Brem, 1999; Jones & Love, 2007; Wisniewski & Bassok, 1999). For example, Lin and Murphy (2001, Experiment 10) reported that thematic relations could influence decisions on taxonomic categorisation. In their study, Lin and Murphy used a categorization task in which participants first read a category (e.g., ANIMAL) followed by pairs of items that had either (dog – leash) or (dog – nest). Thus, the first item in the pair was taxonomically related to the category (e.g., dog). The second items were either thematically related to dog (e.g., leash) or unrelated to dog (e.g., nest). The task was to choose the item which was taxonomically related to the target category. Thus, participants were tested only on the taxonomic relations. They observed that thematic relations facilitated taxonomic categorization. In that, participants chose “dog” as belonging to the category ANIMAL more quickly in the pair (dog – leash) than in the pair (dog – nest). They concluded that as thematic relations become established in core conceptual knowledge, they have an automatic influence on people’s judgements of taxonomic category
memberships. The question worth pondering over therefore is: could the newly formed thematic relations have influenced similarity judgements for the extant taxonomically related word pairs, when the two were processed in the same new-thematic situation?

A second possible explanation of the results could be the nature of the task demanded from participants. That is, perhaps participants in the new-thematic group might for some reason have increased their overall average scale value of similarity as a result of the novel-thematic pairs that became highly similar from the influence of the situations. As a result, the taxonomic pairs also appeared more similar, by virtue of the fact that the overall similarity scale had been shifted up from the processing the new-thematic situations.

Indeed participants were asked to rate on a 7-point scale how similar all the target pairs were. As per our hypotheses, we expected the new-thematic situations to affect novel thematic relatedness. But one could imagine how difficult it was for participants in the new-thematic situation condition to consciously ignore the semantic similarity relations amongst the taxonomic pairs as well. That is, after processing a novel-thematic pair (history – monarchy) in the new-thematic situation condition, we expected that the two words would be thematically integrated and thus, perceived and rated as similar. However, participants could not consciously ignore the fact that “catholicism – evangelism” are also similar and related. So, although the taxonomic pairs did not seem as similar as the new-thematic pairs, participants may have thought that they should be comparably similar based on their feature overlap, semantic relatedness etc., and hence also rated them as being similar than they actually appeared to be.

Finally, the 7-point scale provided participants with a wider possibility for according higher points to the target pairs. That is, on a numerical level, participants in the new-thematic condition might have had metacognitive difficulties in according lower values on the 7-point scale to the taxonomic pairs compared to the novel-thematic ones. Even though introspectively perhaps, they may have felt that the novel-thematic pairs were more similar than the taxonomic pairs, they could not bring themselves into awarding lower values to the taxonomic pairs, resulting in the overall increase in values for all the target pairs processed in the novel-thematic situation.

In view of these questions and speculations, we decided to implement a fourth experiment with the aim of bringing further clarifications to the results. Using a speeded version of the similarity judgement task designed for Experiment 3, Experiment 4 explored the quick influence of thematic relations on people’s perception of similarity between taxonomic and novel-thematic related abstract concept pairs.
23.0. **Experiment 4**

23.1. **Introduction and objectives**

To recapitulate, the results of Experiment 3 showed significant increases in novel-thematic relatedness between abstract concept pairs as a function of new-thematic situations, relative to taxonomic situations. Unexpectedly, though, taxonomic relatedness increased as well, and differed marginally from novel-thematic relatedness in the new-thematic situation condition. One explanation was attributed to a facilitation influence of thematic relations on taxonomic similarity judgements (e.g., Gentner & Brem, 1999) and the nature of the task.

23.2. **Reasoning behind the methodology of Experiment 4**

In Experiment 4 therefore, we decided to replace the 7-point Likert scale with a speeded binary-decision similarity judgment task, which required a yes or no answer. We decided to use a speeded experimental task whereby participants had to respond as quickly as possible whether the target pairs were therefore related or not. To do this, the processing time for the target pairs was limited to 2000 ms, during which participants had to perform the similarity task. The reasoning was that under speeded conditions when time is limited, interference on taxonomic pairs from the novel-thematic pairs should increase (Gentner & Brem, 1999), and hence, performance on the novel-thematic pairs would improve. Consequently, we should observe a significant decrease in similarity judgements for the taxonomic pairs and a reliable increase in similarity judgements for the novel-thematic pairs within the new-thematic condition (i.e., after the novel-thematic clusters have been read in relevant situations), compared to the taxonomic situations condition and baseline. This assumption is based on previous studies that have shown that thematic relations intrude or interfere on taxonomic representations earlier on during processing and under speeded experimental conditions.

For example, Gentner and Brem (1999) observed that thematic relations interfered on taxonomic representations when participants had to make quick similarity decisions in a triad of words. This is because participants find it difficult to make a separation between comparison and thematic processes at an introspective level. Thus, during the quick processing of taxonomic word pairs in the presence of thematic ones, there is a stage of confusion that arises, whereby, participants experience a “lack of introspective awareness of
cognitive states” (Gentner & Brem, 1999). Perhaps, under time pressure, participants are less introspective, making it difficult for them to ignore thematic relations. In their study, Gentner and Brem asked participants to ignore thematic relations and select only the items that had taxonomic relations at two deadlines, either within 1000 ms or 2000 ms deadlines. For example, in a triad of words involving a standard target word (e.g., ROCKET), participants were asked to select an item that had a taxonomic relation to the target (e.g., missile), in the presence of an item that either had a thematic relation to the target (e.g., astronaut) or was unrelated to the target (e.g., belt). They observed that participants made more errors in identifying the taxonomic options in the presence of thematic distractors relative to unrelated distractors at 1000 ms deadline compared to the 2000 ms deadline. This indicates that under faster deadlines, there is higher response accuracy for thematic pairs (which means more errors on taxonomic pairs). In contrast, when participants are receive more time, accuracy on taxonomic pairs increases.

The empirical question worth considering at this point is whether novel-thematic relations recently constructed would be apprehended quickly enough during a similarity judgement task under speeded conditions, such that there would be a reliable interference on the processing of the taxonomic pairs, thereby inhibiting performances on the latter.

Predictions of Experiment 4 with respect to the general hypotheses

The general hypothesis stipulates that experiencing abstract concepts from different categories in the same situations allows diverse and new thematic relations to be formed amongst them, leading to the construction and emergence of novel thematic organizations. We predicted therefore that if under speeded conditions, there is higher response accuracy for thematic pairs (which means more errors on taxonomic pairs), then we should expect participants in the new-thematic situation condition to obtain higher affirmative responses for the novel-thematic pairs (implying that they would provide more negative responses for the taxonomic pairs in the same condition). In contrast, in the taxonomic situation condition we expected to observe higher affirmative responses for the taxonomic pairs, and participants should frequently respond “NO” to the novel-thematic pairs. The reason is that the target pairs embedded in the taxonomic situations have pre-existing taxonomic relations and moreover, they would be reinforced from their processing in the situations. Hence, the speeded conditions should not affect the performance on taxonomic pairs in the taxonomic situations.

Similarly, in the baseline condition, we expected to observe higher relatedness for the taxonomic target pairs relative to the novel-thematic ones, since the target pair concepts were originally selected from typical taxonomic categories and the novel-thematic pairs have not
been experienced at all in situations by the participants in this condition.

23.3. Method

23.3.1. Participants

From the Lumière University of Lyon, we recruited 60 undergraduate psychology students as participants, who received extra course credits in exchange for their participation in the experiment. Three experimental groups were constituted for the experiment, with each participant assigned randomly to each group. Participants took part in the experiment on an individual basis.

23.3.2. Materials

23.3.3. Situations and construction of target concept pairs

The situations and the lists of target concept pairs used here were identical to those used in Experiment 3 except for the following minor modifications. First, the 7-point Likert scale was replaced by a forced binary response choice of “yes” or “no” with respect to the similarity decision task on all the concept pairs. The Psycscope (Cohen et al., 1993) experimental computer program presented the word pairs on the screen. We decided to use the deadline of 2000 ms for the following reasons:

First, Gentner and Brem, (1999) used two deadlines in milliseconds, ms (1000 ms vs. 2000 ms) and showed that within 1000 ms of presentation, pre-existing thematic relations interfered on taxonomic processing. We decided to use the 2000 ms deadline based on the justification that since the novel-thematic pairs were new and relatively recent, 1000 ms might not be sufficient to apprehend the newly formed thematic organizations amongst them during processing. Moreover, interference effects on the taxonomic pairs from the novel-thematic ones might not be significant within a 1000 ms deadline. Since we could not determine a priori exactly which deadline would be the most suitable, we reasoned that 2000 ms deadline would be reasonable for participants to make an accurate response to all target concept pairs across all conditions.

Therefore, if within the 2000 ms deadline we do not observe significant similarity judgements between the novel-thematic target pairs relative to the other conditions, then it could possibly mean that no novel thematic reorganizations emerged. Or, maybe our deadline was not accurate. However, were we to observe the opposite, then our hypothesis would be supported.
23.3.4. Procedure

The procedure of Experiment 4 had 3 phases, and the schematic protocol was identical to the one described in Experiment 3, except that in phase 3, participants performed a speeded similarity decision task on the target word pairs.

23.3.5. Phases 1 & 2: Situation reading procedure

Participants were first told that they were going to participate in two very different experiments. The first experiment, which was about reading texts, would be performed in two phases and the second experiment was going to be about rapid similarity decisions on word pairs. The procedure and instructions for the reading phases were identical to the ones used in Experiment 3.

23.3.6. Phase 3: Similarity ratings of target concept pairs

The third phase of the experiment was presented on a different Apple Macintosh computer. Written instructions informed participants that a list of words presented in pairs would appear on the screen. They were instructed to decide “yes” or “no” as quickly and accurately as possible if the two words forming the pair were similar. If a participant thought a pair of words was very similar, they pressed the “YES” key, represented by the /s/ key on the keyboard. If they thought they were not similar at all they pressed the “NO” key, represented by the /k/ key on the keyboard. An experimental trial began with participants placing the left index finger and the right index finger on the “yes” and “no” keys respectively on the keyboard. They pressed the space bar with their thumb to launch the presentation of the first pair of words. The pair remained on the screen for a duration of 2000 ms, in which time participants had to effectuate their response. Once participants made their choice, the next item was presented after a 1000 ms delay. Participants were told that their speed was an essential part of the experiment, and that if they did not make a response quickly enough, the pairs would automatically disappear from the screen, accompanied by a beep sound.

To allow participants to become accustomed to the procedure and to the 2000 ms deadline, they saw 24 practice neutral abstract pairs of words at the beginning of the experiment (please refer to Appendix U for the list used in the practice trial). This practice session trained participants in responding within the deadline of 2000 ms. They received feedback as to the accuracy of their responses during practice, but not during the experimental trials. This phase of the experiment took approximately 25 minutes to complete.

23.4. Experimental conditions

The experimental conditions and design were identical to that of Experiment 3, except that participants performed the speeded similarity decision task on the target-pairs after
reading the situations. The dependent variable was the percentage of affirmative similarity responses for the target-pairs.

24. Results

24.1. Data collection

The procedure for the collection of data from the situations was identical to the one described in Experiment 3. The final analyses of variances were carried out on the responses of the similarity decisions made for the critical target abstract concept pairs only. All responses that exceeded the 2000 ms deadline were considered to be too long and therefore excluded from the main analyses. Four participants produced responses that largely exceeded the 2000 ms deadline, and thus were excluded from the final analyses.

The novel-thematic target concepts pairs were separated from the taxonomic pairs for each participant, and then the percentage of affirmative (i.e., yes) similarity responses for the two types of pairs was calculated. Afterwards, all the proportions were transformed into arcsine values and the analyses of variance (ANOVA) were performed on the arcsine transformed proportions from the three experimental groups at an alpha level of .05. The ANOVA was done with the statistical software Statistica following the experimental plan identical to the one used in Experiment 3. The means and standard errors are reported in percentages and presented in Table 22. All post hoc comparisons were performed using Tukey HSD test at an alpha level of .05.

Table 22. Average similarity responses in percentages of target-pairs as a function of the 3 situations: baseline, taxonomic and new-thematic. (Standard errors shown in parentheses).

<table>
<thead>
<tr>
<th>Target-Pairs</th>
<th>Situations</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Baseline</td>
</tr>
<tr>
<td>TAXONOMIC</td>
<td>60.58 (0.24)</td>
</tr>
<tr>
<td>NOVEL-THEMATIC</td>
<td>30.89 (0.17)</td>
</tr>
<tr>
<td>M</td>
<td>45.53 (0.16)</td>
</tr>
</tbody>
</table>

24.2. Main effects

Situations

A significant effect for the factor Situations was observed, $F (2, 55) = 3.23$, MSE = 0.06, $p < .04$, partial $\eta^2 = .11$. Interestingly, the percentage of similarity for the target-pairs was reliably higher when they were processed in new-thematic situations (Mean = 59.78)
compared to when processed in taxonomic situations (Mean = 49.91) and at baseline (Mean = 45.53). This pattern of effect was identical to observations made in Experiment 3.

Figure 22. Percentage of similarity responses for target-pairs with respect to the experimental situations: Baseline, Taxonomic and New-thematic. (* indicates significant differences).

Target-Pairs

The factor Target-Pairs also came out significantly, $F(1, 55) = 48.43$, MSE = 0.02, $p < .000$, partial $\eta^2 = .47$. Generally, the percentage of similarity was significantly higher for the taxonomic target-pairs ($M = 60.27$) compared to the novel-thematic ones ($M = 43.19$).

Interaction effect

The interaction between Situations and Target-Pairs was also significant, $F(2, 55) = 41.28$, MSE = 0.02, $p < .000$, partial $\eta^2 = .60$. The percentage of similarity for the two types of target-pairs differed significantly between the three situations as indicated in Figure 22 above. In order to test the predictions, planned comparisons were performed on the situations as a function of the similarity of the target pairs. Thus, considering:

New-thematic vs. taxonomic situations

Planned comparisons revealed a significant difference between taxonomic and new-thematic situations as a function of percentage similarity responses for the two types of target pairs: $F(1, 55) = 68.21$, MSE = .02, $p < .0000$. Details from contrast analyses showed that
this difference was reliable between the percentages of similarity for taxonomic target-pairs: \( F(1, 55) = 4.54, \text{MSE} = .05, p < .03 \) and also for the novel-themed target-pairs: \( F(1, 55) = 34.80, \text{MSE} = .03, p < .00 \).

As expected, when the target-pairs were read in new-themed situations, the percentage of similarity among the novel-themed target-pairs was reliably higher (Mean = 63.19) than for the same pairs read previously in taxonomic situations (Mean = 33.19). In other words, in the new-themed situations, similarity for the novel-themed pairs increased by 30% compared to taxonomic situations. This indicated that the new-themed situations enabled the integration and the construction of new thematic relations between the novel-themed pairs and hence they were perceived as similar within 2000 ms deadline. Whereas this observation was not made for the novel-themed pairs in the taxonomic situation.

Interestingly and as expected, the percentage similarity for the taxonomic target-pairs in new-themed situations was reliably smaller (Mean = 51.81) than the percentage similarity for the taxonomic target-pairs previously read in the taxonomic situations (Mean = 65.79). That is, in the new-themed situations, the perception of similarity for the taxonomic target-pairs dropped significantly by about 14%, (see Figure 20 above), indicating that within the deadline of 2000 ms duration, the new-themed situations significantly interfered in the processing of the taxonomic target-pairs, contrary to observations in Experiment 3.

**New-themed situation vs. baseline**

Analogously to the above, planned comparison showed a significant interaction between baseline and new-themed situation: \( F(1, 55) = 55.48, \text{MSE} = .02, p < .0000 \). Details from contrast analyses indicated that this significant interaction emerged as a function of reliable difference between the mean percentages of similarities for the novel-themed target-pairs in the two groups: \( F(1, 55) = 39.09, \text{MSE} = 0.03, p < .0000 \). But the difference between their mean percentages of similarities as far as the taxonomic target pairs were concerned was not reliable: \( F(1, 55) = 1.31, \text{MSE} = 0.05, p = .26 \).

In other words, the percentage of similarity between the novel-themed target-pairs that were previously read in new-themed situations was reliably higher (Mean = 63.19) than for the same pairs at baseline (Mean = 31.94). Thus, the effect of new-themed situations on percentage similarity for the novel-themed target-pairs increased reliably by 31% compared to baseline. However, the percentage of taxonomic target-pairs read in new-themed situations that were perceived to be similar was lower (Mean = 51.81) compared to the one at baseline for the same target-pairs (Mean = 59.58), but this difference was not significant.

Considering only the new-themed situation condition, the differences observed in percentages of similarity between taxonomic organization (i.e., taxonomic target-pairs, Mean
= 51.81) and novel-thematic reorganization (i.e., novel-thematic target-pairs, Mean = 63.19) were significant, $F(1, 55) = 11.39$, MSE = 0.02, $p < .00$. This effect was confirmed by Post-hoc analysis as well ($p < 0.02$), as shown in Figure 22.

**Taxonomic situation vs. baseline**

As predicted, considering only the taxonomic situations, percentage of similarity for the taxonomic target-pairs that were previously read in them was reliably higher (Mean = 65.79) than for the novel-thematic target pairs (Mean = 33.19), $F(1, 55) = 68.59$, MSE = 0.02, $p < .000$. The same observation was made between the two types of target-pairs at baseline. That is, at baseline, percentage of similarity for the taxonomic target-pairs was significantly higher (Mean = 59.58) than for the novel-thematic target-pairs (Mean = 31.94), $F(1, 55) = 51.95$, MSE = 0.02, $p < .000$. However, the interaction between baseline and taxonomic situations was not significant, $F(1, 55) < 1$, ns. Thus, the effect of taxonomic situations on percentage of similarity decisions made on both types of target-pairs was identical to the one observed at baseline as indicated in Figure 22. No other effects or interactions came out significantly.

### 25.0. Discussion

The main question of Experiment 4 was whether under speeded conditions the novel-thematic target pairs would inhibit or interfere in the processing of the taxonomic target pairs in the new-thematic situation. In other words, would the similarity judgments for the novel-thematic pairs compared to those of the taxonomic pairs increase significantly in the new-thematic situation, relative to taxonomic situation and baseline? The answer is yes.

Relatedness based on similarity judgements for the novel-thematic pairs increased significantly and that for the taxonomic pairs decreased reliably when the concepts pairs were read in the new-thematic situations. This was not the case in Experiment 3, suggesting that the task of judging similarity on a 7-point Likert scale with no time pressure enabled participants to use ‘deliberate’ strategies in processing the concepts. Moreover longer duration meant that there were limited interferences from the novel-thematic pairs on the processing of taxonomic pairs. That could explain some of the results in Experiment 3.

However, under speeded performance in Experiment 4, when participants were under time pressure, similarity judgments on the novel-thematic pairs increased significantly relative to taxonomic pairs in the new-thematic situations. It seemed as though participants used automatic strategies to apprehend the novel-thematic target-pairs within 2000 ms of processing deadline, thereby, increasing significantly their interference effects on the taxonomic pairs. The observation of interferences effects by virtue of the fact that taxonomic
relatedness decreased significantly in the new-thematic situation condition indicates that indeed, new thematic reorganizations were constructed among the novel-thematic clusters.

These results have two main implications. First, they suggest that not only do situations enable the construction of new thematic relations among clusters of abstract concepts, which have no pre-existing thematic relations, but also, these “novel” and recent thematic relations once created under speeded conditions inhibit the processing of the taxonomic pairs. As a consequence, similarity judgements for the taxonomic pairs decrease significantly. However, given longer time, participants are able to make deliberative judgements on taxonomic relations such that the perception of similarity between the taxonomic concept pairs is reinforced, just as we observed in Experiment 3.

The results are consistent with the findings of Gentner and Brem (1999). In other words, when participants are given enough time to make judgements, there is less confusion at a metacognitive level, and hence, less intrusions from thematic relations on taxonomic processes. In contrast under time pressure, participants lack introspective awareness, and hence are unable to inhibit thematic relations. As a consequence, there is an enhancement in the performance of similarity judgements on thematic relations relative to taxonomic processing, as shown by our results in Experiment 4. At baseline, the similarity judgement on taxonomic target pairs was observed to be significantly higher than for the novel-thematic ones. This suggests that the taxonomic relations were already established in memory, since the target pairs were all pre-selected from established taxonomic categories, whereas the novel-thematic were new to participants in this condition.

In conclusion, Experiment 4 has confirmed the robustness of the effects observed, namely, that thematic reorganization and situational information play a significant role in the conceptual processing and representation of abstract concepts. The interpretations of overall results together with their implications are dissertated in the General Discussion.
Chapter V

GENERAL DISCUSSION

26.0. Introduction

The purpose of the studies presented in the current thesis was to investigate the role of situational information and thematic reorganization in the processing and representation of abstract concepts. The general discussion will commence with a brief summary of the main hypotheses. The results will then be discussed within a number of different theoretical frameworks. What are considered to be the most promising mechanisms and interpretations for our overall findings, along with some of their implications, will be outlined. Finally, discussions on the limitations of our work and how future research could improve and apply our findings in different domains of research will follow.

The primary hypotheses for these studies were that (a) situational information could play a significant role in the conceptual processing and representation of abstract concepts and (b) thematic organization could be the principal framework in which abstract concepts are structured. In that, situations provide a dynamic contextual structural background that supports the emergence of novel and pertinent thematic reorganization amongst different abstract concepts. We assumed therefore that if the processing and representation of abstract concepts were structured within a thematic organizational framework, then when clusters of abstract concepts are instantiated and experienced within relevant situations, new thematic relations should emerge as a function of the type of situation being experienced. As a consequence, traces of the novel-thematic relations could be captured as evidence from the cognitive tasks demanded from participants.

26.1. Recapitulation of global results

The general discussion at this point will continue with a brief recapitulation of the overall results, followed by their interpretations and implications within a larger theoretical setting.

In Experiment 1, participants in the taxonomic and new-thematic groups processed situations that had either taxonomic or novel-thematic target abstract concepts inserted into them respectively. Afterwards, they were asked to sort the target concepts presented together into clusters after the processing of situations, compared to a baseline group. The results showed marginal differences, indicating that despite the type of situations within which the target concepts were previously instantiated and processed, the three experimental groups
were all equally likely to sort the target items taxonomically. This implied that taxonomic organization persisted, making it impossible to determine whether abstract concepts could be reorganized thematically. Moreover, the effects of situations on the sorting of the target concepts were undetermined.

In the presence of such inconclusive observations with respect to our predictions that participants would thematically reorganize concepts when processing situations, Experiment 2 was undertaken. The purpose of the latter was to use an improved version of the methodology and experimental protocol of Experiment 1 to address the original hypotheses and predictions. The results in Experiment 2 showed that participants who read the new-thematic situations produced significant amounts of novel-thematic organization compared to baseline and taxonomic situation. These results suggested that whilst reading the situations, the new-thematic group constructed novel conceptual thematic organizations of the target concepts encountered whilst reading the story-situations. However, because the magnitude of the effects observed in the new-thematic group of Experiment 2 was proportionally smaller compared to that of the taxonomic and baseline groups, it was speculated that other factors such as the experimental task used, individual differences in sorting and potential intrusions from underlying taxonomic relations on thematic processing, might have all contributed to influencing and rendering taxonomic sorting more salient and more accessible compared to novel-thematic relations. Consequently, Experiment 3 was implemented to investigate these issues.

A different experimental task - a similarity judgement on concept pairs was utilized. Taxonomic and novel-thematic target concepts pairs were created, upon which participants had to perform a similarity judgement task using a 7-point Likert scale after processing the situations. The primary objective of Experiment 3 was to determine whether novel thematic organization of abstract concepts in situations affected perceived similarity between concept pairs. The underlying reasoning being that if indeed situations facilitated thematic reorganization and the latter in turn facilitated perceived similarity, it would imply that novel thematic reorganization of abstract concepts is pertinent to and significantly supports important high level conceptual processes, since similarity is considered to be an important characteristic for cognition (Jones & Love, 2007; Medin, Goldstone & Gentner, 1990; Wisniewski & Bassok, 1999; Golonka & Estes, 2009). Thus, similarity seemed to be a good test-bed for determining the extent to which situations and thematic reorganization could influence the conceptual representations of abstract concepts.

The results of Experiment 3 revealed that, overall, participants in the new-thematic group judged the novel-thematic pairs as being significantly similar compared to the
taxonomic group and baseline. The new-thematic situations facilitated perceived similarity between the novel-thematic pairs whereas the absence of situations did not. Contrary to our expectations however, participants in the new-thematic group also produced significantly higher similarity ratings for the taxonomic pairs. Thus, processing novel thematic relatedness also facilitated the processing of the taxonomically related pairs within the same situations. Thereby causing the global increase in similarity judgements for both pairs in the same new-thematic group. In addition, we speculated that strategic processing which took time might have influenced perceived similarity, and that perhaps the 7-point Likert scale used in conjunction with the untimed nature of the task could have contributed to the twofold increase observed for taxonomic and novel-thematic pairs in the new-thematic group.

Experiment 4 implemented a speeded version of the similarity judgement task designed for Experiment 3. Consequently, Experiment 4 imposed a 2000 ms deadline within which similarity judgement had to be performed on all target concept pairs, using a binary-decision task. The results from Experiment 4 showed that indeed, comparing the new-thematic group to taxonomic and baseline, there were significant percentage increases in similarity ratings for the novel-thematic pairs than for taxonomic pairs. In other words, within a processing deadline of 2000ms after reading the new-thematic situations, participants were able to apprehend newly formed novel thematic relations that emerged from the co-occurrence of the novel-thematic clusters in the new-thematic situations. Consequently, a reliably higher percentage of the novel-thematic pairs were judged as being similar compared to taxonomic pairs.

Taken together, the global results showed that the new-thematic situations significantly influenced the categorization and similarity judgements of the target abstract concepts that have no pre-existing thematic relations. Our findings extend those of previous studies such as Wisniewski and Bassok, (1999), Gentner and Brem (1999) as well as those of Lin and Murphy, (2001). Indeed, these researchers used pre-established thematic relations in their studies. Our studies went a step further and used unrelated concepts to show that new thematic relations could be constructed between abstract concepts pairs that have no pre-existing thematic relations, and the latter could be apprehended relatively quickly.

One might ask that what is the purpose of abstract concepts reorganizing themselves thematically, if the reorganization does not serve any relevant cognitive purposes? Barsalou, (1999) argued that concepts organize themselves for situated action and cognition, in order to achieve goals and support behaviour. The overall results indicate that, not only is thematic organization relevant to conceptual processing, but also, where abstract concepts are concerned, situations play a significant role in allowing new and situated thematic integration.
to be established and emerge from different abstract concepts for the purpose of situated conceptualisations. Thus, concerning categorisation, the target concepts were clustered according to the situation in which they co-occurred. Regarding similarity, pairs of concepts were perceived to be similar when processed in situations compared to the absence of situations.

26.2. Interpretations of overall results

Previous studies on abstract concepts have emphasized how they depend on situations for their semantic processing. For example, Schwanenflugel and her colleagues have shown that abstract concepts are harder to process than concrete concepts when background contexts are absent. However, this effect known as the ‘concreteness effect’ is annulled when background situations are present (e.g., Schwanenflugel 1991; Schwanenflugel et al. 1988; Schwanenflugel & Shoben 1983; Wattenmaker & Shoben 1987). Barsalou (1999) proposed that the representation of abstract concepts is dependent on identifying the background event sequences which frame them.

Despite the establishment of this fundamental nature of abstract concepts in conjunction with situations, few theories or studies to our knowledge have explained how situations enable abstract concepts to be semantically organized and represented in the conceptual system. Several empirical questions come to mind at this point. For example, when a person goes to a party, how do abstract concepts conceptually enable this person to represent his/her experience of being at the party? During the conceptual processing and representation of an experience (e.g., the party), how do abstract concepts process the introspective experiences lived? How do they come together to enable the person to use language to represent and express their experiences? After all, a concept, be it abstract or concrete is meant to help humans express their experiences in the form of language, thought, decision-making, memorization and other cognitive processes (Barsalou, 1999; Hampton & Dubois, 1993; Murphy, 2002). In the literature on abstract concepts, it has often been evoked that most abstract concepts are relational concepts which express and extend relations among other entities that occur in the same or in different situations (e.g., Gentner, 1981). As evoked in the theoretical background on the nature of abstract concepts (Ch. I, Section 4.0.), abstract concepts also represent social situations and events, introspective and mental states and they often rely upon other abstract concepts to express their meanings (e.g., Barsalou & Wiemer-Hastings, 2005).

For example, the concept domination may include notions such as rights, authority, power, injustice, etc., which are themselves abstract. So in trying to mentally represent a
target abstract word, one automatically processes related words that are also as abstract as the target word. In fact, Wiemer-Hastings and Xu (2005) reported that the features of most abstract concepts are mostly abstract features which include experiential and situational properties. As a consequence, most complex abstract concepts could be described and represented by using other “simpler” but supportive abstract concepts. Therefore, the question worth considering is what happens with the group of abstract concepts that come together to represent the meaning of specific target abstract concepts. For example, Wiemer-Hastings and Xu (2005) proposed that a concept such as *emancipation* could be represented as a transitional process from one social state (oppression) to another (liberation) with respect to a specific social situation (dictatorship government). The question therefore is how do *oppression*, *liberation* and other abstract concepts interact and integrate together in a “dictatorship government” situation to be able to capture the meaning of “*emancipation*?” Moreover, if we assume that there is a reciprocal and mutual effect between situations on the one hand and the abstract concepts instantiated into them on the other, then an important question is do the abstract concepts occurring in the situations influence the global processing and comprehension of the entire situation itself? If so, how?

To our knowledge, the current overall studies are one of the very few that have gone a step further and shown that as the sequence of events evolve and modify within a given situation, abstract concepts thematically “mutate” themselves continuously into new thematic clusters that adapt continuously to the inferences that individuals generate from a given situation with respect to their background knowledge. In so doing, people are able to simulate and infer diverse and subtle variations in meanings of abstract concepts relative to contextual changes. This observation is in perfect harmony with findings reported by Jones and Love (2007) and also by Wisniewski and Bassok (1999), who also observed an effect of thematic integration on similarity for concrete concepts.

Interestingly, when abstract concepts have pre-established thematic relations among them, participants usually organize them thematically and their similarity judgements are constructed from these pre-established thematic relations. When abstract concepts have pre-established taxonomic relations among them, participants usually organize them taxonomically and their similarity judgements are constructed from these pre-established taxonomic relations. However, and more interestingly, when a group of abstract concepts have no pre-established taxonomic or thematic relations among them, participants usually tend to thematically integrate and reorganize them using newly derived thematic relations constructed from made-up situations, events or scenarios (Wiemer-Hastings & Xu, 2003). We provided support for this phenomenon and demonstrated that new thematic relations could be
constructed between abstract concepts which have no pre-established thematic relations. Veritably, if thematic organizing principles and situational information did not influence the processing and representation of abstract concepts, then the novel-thematic clusters after being instantiated in the new-thematic situations would have “reverted” back into taxonomic category structures. Thus, we would have consistently observed taxonomic organization in both the categorization and similarity judgement tasks across all the experiments implemented.

The current studies show the flexible nature of abstract concepts. The categorization and similarity judgement tasks enabled us to observe the conceptual representations of the novel-thematic clusters recently experienced in situations. Using naturally co-occurring abstract concepts in situations provided strong evidence supporting the malleability in the underlying networks that support situated and simulated conceptual representations (Barsalou, 1999). Clearly, the present results are more consistent with accounts which suggest that the human conceptual system is an ever-changing storehouse of knowledge that readily incorporates new thematic relations of previously unrelated abstract concepts, and points to the flexible and dynamic nature of semantic knowledge, (Barsalou, 1999; Pecher & Raaijmakers, 1999). The findings from the current studies also sit harmoniously with previous studies that have proposed that abstract concepts have a qualitatively different representational framework from concrete ones and that such a framework could be associative and/or thematic rather than taxonomic (e.g., Crutch & Warrington, 2005; Dunabeitia et al., 2009).

It is becoming a well-established fact within the psychology and cognitive science research literature that situations play a vital role in the conceptual processing of abstract concepts. For example, Barsalou and Wiemer-Hastings, (2005) reported that not only do abstract concepts focus on the social aspects of situations as well as introspective states, but also without situations, it would be quite difficult to comprehend most abstract concepts. Wiemer-Hastings and Xu (2003) observed that situational properties are elicited frequently during property production tasks involving abstract concepts. Ghio and Tettamanti (2010) reported that processing abstract sentences activates left-hemisphere languages regions as well as the retrosplenial cortex, known for its role in processing contextual information and introspective states. Thus, the evidence supporting the view that situations are essential to the processing of abstract concepts is solid. However, most studies sharing this view have rarely inserted abstract concepts within the situations assessed.

Classically, most studies assess abstract concepts in isolation or together with concrete concepts and observe the type of information and cognitive process that they evoke. The
current set of experiments used a reverse paradigm in examining the effect of situations on abstract concept organization and processing. In our view, this manner of approaching the problem has a credible ecological validity, since naturally people use abstract concepts together with other concepts within linguistic contexts. An interesting point of interrogation is whether the thematic reorganization process of bringing together the most pertinent and optimal abstract concepts within a situational background, simultaneously facilitates the global comprehension of the entire situation itself? The direct answer to this question is beyond the scope of the current thesis, since we did not assess text comprehension directly as a function of the effect of thematic organization of abstract concepts. However, our results permit us to speculate that this might actually be the case. We propose a plausible account of how the comprehension of situational experiences could be facilitated through the thematic reorganization of the most optimal abstract concepts processed within them. We speculate here that the two might have a reciprocal processing effect on each other. Situations need the reorganization of abstract concepts to be semantically comprehended; in parallel, abstract concepts require situational background in order to obtain the necessary contextual elements, temporal sequences and constraints for them to be meaningfully simulated and conceptually processed (Barsalou, 1999, Wiemer-Hastings et al., 2001).

For example, the abstract concept “kindness” may be experienced and described within the following situation: “you are at a till paying for your groceries that cost five euros. You look into your wallet and you retrieve four euros and ninety cents. You feel quite embarrassed and worried that you might have to abandon your groceries for the lack of ten cents. A stranger waiting behind you offers you the ten cents, enabling you to leave with your groceries.” In this situation example, the concept “kindness” is experienced in conjunction with other peripheral abstract concepts such as embarrassment, calculation, relief, appreciation, lack and other introspective and meta-cognitive states. So the situation provides an organizational frame that constrains the peripheral concepts enabling them to help represent the concept of “kindness” semantically. Simultaneously, the complementary roles and thematic integration processes taking place amongst the peripheral concepts (that may include certain concrete concepts) also enable a mental simulation (Barsalou, 1999) to be constructed, thereby facilitating the global and profound comprehension of the situation itself. This is the principle of “situated thematic framing and comprehension reciprocity” between abstract concepts and situations. Naturally, much further research in the future aimed at addressing this particular account is necessary.

The results also show an important phenomenon concerning the effects of situations on pre-existing taxonomic organization of abstract concepts. We observed systematically, that
situational information did not seem to reliably reinforce the taxonomic organization of abstract concepts as they did for thematic organization. In other words, whether abstract concepts are experienced in or out of situations, their taxonomic relations are not fundamentally enhanced and therefore contextual structures in situations do not enhance the taxonomic organization between abstract concepts. Why might this be so? Several ideas come to mind.

First, the qualitatively different organizational principles underlying taxonomic and thematic relations (e.g., Crutch & Warrington, 2005) propose that taxonomic relations are principally organized around the semantic and featural similarities between concepts (Ch. I, section 3.1). Thus, taxonomic organization of concepts is mainly based on the strict internal relations between the intrinsic physical properties and commonalities of concepts. Consequently, taxonomic relations do not implicate external situational elements directly within their organizing principles. Conversely, thematic relations are principally organized around the integral and complementary roles that different concepts play in the same scenario (e.g., Lin & Murphy, 2001; Golonka & Estes, 2009). Hence, it is based on the external relations and associations between the extrinsic characteristics of concepts. This indicates logically that thematic relations are more “situationally” or contextually sensitive than taxonomic relations.

Second, the nature of abstract concepts is such that they have a relatively weaker internal graded structure in their categories (e.g., Wiemer-Hastings & Xu, 2005, Hampton, 1981), they mostly represent subjective and introspective experiences, (e.g., Wiemer-Hastings & Xu, 2005; Barsalou & Wiemer-Hastings, 2005) and they are more dependent on temporal co-occurrences in events and scenarios (e.g., Hampton, 1981). Consequently, abstract concepts tend to be more anchored in situations.

Logically therefore, looking at the organizational principles governing thematic relations of concepts in general and the basic nature of abstract concepts, one begins to understand why thematic organizations could be the most natural, instinctive and intuitive conceptual framework, suitable for the conceptual organization of abstract concepts, as evidenced in the current thesis as well as by most researchers in the past (e.g., Crutch & Warrington, 2005; Wiemer-Hastings & Xu, 2003; Dunabeitia et al., 2009; Wiemer-Hastings & Xu, 2005). The reasoning pattern above implies that there seems to be a higher compatibility between abstract concepts and thematic organizations than between abstract concepts and taxonomic organizations. This could explain why taxonomic organizations between the target abstract concepts remained stable as a function of the presence or absence of background situational information across all the experiments.
26.3. Interpretation of overall findings from the perspective of different theoretical frameworks.

23.3.1. Perceptual Symbols Simulation and language comprehension

Situations played a significant role in the experimental material used in our studies, hence, it was considered to be necessary to look at how language processing, most specifically the constructing of situation models could have played a role in the interpretation of our findings. Here, we discuss what we see as the most encouraging explanations along with their implications for future research.

Could the findings be partly interpreted within the theoretical perspective of the perceptual simulation (Barsalou, 1999) as a basis for the comprehension of texts containing abstract words? What is represented in situation models when reading situations with abstract concepts embedded into them? We argue that Perceptual Symbol Systems (PSS) provide a powerful framework for representing the situations upon which the meanings of abstract concepts depend on. If abstract concepts require situations or contexts to represent their meanings, then grounding a situation will be an implicit way of grounding the abstract concepts that are represented in it. Indeed, it would seem likely that abstract concepts expressed in situational texts could be grounded through situational simulations.

In as much as embodied views and grounded cognition theories have been very effective in explaining the representation and processing of concrete words and texts, it is far more of a challenge to show how an embodied account could be used to explain the processing of abstract concepts. We argue that if situations constrain and frame the representations of abstract concepts, and if thematic reorganization plays a vital role in the processing of abstract concept in situations, then, situations and thematic clusters could also bring together the most appropriate combination of both concrete and abstract concepts forming a ‘thematic cluster situation model,’ which could process the meaning of and ground the abstract concepts described in texts. Thus, perceptual symbols framework could play a role in the construction of a grounded thematic situation simulation of abstract concepts using malleable perceptual symbols within modality-specific brain regions.

Naturally, concepts are neither processed in vacuum nor in isolation. Moreover, most situational experiences involve the presence of some concrete concepts. We argue that the perceptual simulations of abstract concepts in situations rely partly on the concrete concepts that form part of the situation being read or experienced. In reality, there is rarely anything like a “purely” abstract text or situation. Most abstract sentences or texts map onto situational
referents that have concrete concepts instantiated into them. A look at some of the so-called ‘abstract sentences’ stimuli used in previous empirical studies show that such abstract sentences implicitly evoke concrete situational elements and referents. For example, Schwanenflugel and Shoben (1983) used abstract sentences such as “The group’s success was achieved through persistence” or “even adverse comments were included in the review.” In these two examples, one could infer and mentally simulate concrete situational frames such as “a football team’s group effort to win a match” for the first sentence and “a scientific article being evaluated by a reviewer” for the second sentence respectively.” In these two situation examples, thematic reorganization of the different abstract and concrete concepts could enable a perceptual simulation of the situation models constructed after reading them. Indeed, Barsalou, Santos, Simmons and Wilson (2008) have argued that the representation of abstract concepts may include the mental simulation of entire situations including some pertinent concrete elements. Concerning the current results therefore, we assume that the situations could have been mentally simulated perceptually, enabling the novel thematic reorganization of the abstract concepts to emerge.

Let us consider for a moment the case for individual concepts. For example, when the concept religion becomes active, it is not represented in seclusion, rather it is processed, imagined or remembered in a meaningful background situation (e.g., Barsalou, 2003, Barsalou, Niedenthal, Barbey, & Ruppert, 2003). Consequently, religion might be represented with other concepts like, faith, heaven, God, congregation, church or mosque, holy books, alter, sins, forgiveness etc. Many empirical studies demonstrate the presence of situational information as people represent and use all concepts (e.g., Barsalou & Wiemer-Hastings, 2005; Chaigneau, Barsalou, & Zamani, 2009; Wu & Barsalou, 2009; for a detailed review, see Yeh & Barsalou, 2006). Wilson Mendenhall et al. (2011) proposed that since most abstract concepts represent entire situations, the process of situated conceptualizations enable the representation of all the background information associated with a given concept.

The results from the current thesis in conjunction with the situated conceptualization model (Barsalou, 2005) support the assumption that, a mental simulation of a situation may involve the thematic integration and reorganization of the various abstract and concrete concepts available in the situation itself. Thus, simulating an entire situation implies constructing a situated thematic conceptualization of the most pertinent abstract and concrete concepts required to situate and render meaningful the situation itself as well as the specific concepts of interest. As Barsalou and Wiemer-Hastings (2005) pointed out, situations are equally important for the representation of both concrete and abstract concepts but in varying degrees. Thus, a situated conceptualization of the concept “religion” may involve simulating a
worshipping situation within which the thematic clustering of other concepts such as faith, forgiveness, redemption, alter, priests etc., would emerge. By reciprocity, as the worshipping situation is being processed and understood, so would the main concept, religion. Thus, both become semantically processed and understood in parallel.

To extend our assumption even further, let us consider the following analogy using the concrete concept “table”. According to PSS and other embodied theories, the mental simulation of a table would involve a perceptual representation of its four legs, flat top and its function such as writing on it, as well as the introspective states associated with using a table in a specific situation. All these features are assumed to be perceptually simulated within their corresponding modality specific brain regions. However, one must remember that the features of the table (i.e., top, legs, writing on it, being made of wood etc.) enable the conceptual processing and representation of the table, by the same token, they could also render meaningful, all situations representing our experiences of using tables, like in a stressful examination situation for example. The fact that abstract concepts such as liberalism or monarchy do not possess direct perceptual characteristics and do not evoke direct sensorimotor experiences does not mean that embodied theories such as PSS cannot be used to explain their representation through sensorimotor processing.

In line with our findings and in accordance with embodied views for situation models proposed by Zwaan (2004), we assume that participants constructed a grounded situation model when reading the situations within which the target abstract concepts were embedded. In doing so, thematic integration amongst the concepts were simulated together with other conceptual elements presented in the story, thus making the situation and the target abstract concepts meaningful.

It is true that abstract concepts like determination or sincerity cannot be smelled, tasted, held, heard nor even seen. However, within common human experiences, such concepts do make sense. So, how do concepts that cannot be seen nor heard, in other words which cannot be perceptually construed still continue to be used and to make sense to people? One particular perceptual modality upon which Barsalou (1999) insisted in his various perceptual and simulation theories is introspection. Most researchers on cognition do not emphasize enough how important introspection is to the human conceptual system and even more so to our understanding of abstract concepts. We have indicated earlier on that most abstract concepts stand for subjective experiences, introspective states and the relations between them. One way in which humans share their introspective and subjective experiences is through or from situations. For example, concepts like sincerity, liberalism, determination or opinion cannot be shared with another entity (person, animal, or objects) without specific
situations. Reiterating our previous example on “kindness” evoked earlier on, without the “grocery store” situation, it could be very difficult to experience, describe and express the concept of “kindness”. So though “kindness” does not have a specific smell nor taste and neither can it be seen, it can be grounded through a situation. Logically then, without situations and our introspective sense, a concept like “kindness” will be meaningless and hence might not even exist as a human experience.

The question that cognitive researchers should ask therefore should not be whether perceptual symbols systems or embodied theories of cognition could represent abstract concepts. Rather the question should be how does the cognitive system simulate or ground situations through which introspective, social and other related internal states are expressed and perceived? If this question were answered, we would automatically answer the question as to how Perceptual Symbol Systems represent abstract concepts. Thus, as the conceptual system simulates different introspective states and experiences within a situation, it draws on new thematic reorganization of the most pertinent and optimal abstract concepts to support the process. In doing so, new thematic clusters mutate and evolve continuously as and when the situation modifies and becomes meaningful, thus grounding the abstract concepts within the situational experience. Indeed, further empirical research is required to support this account on the embodied representations of abstract concepts.

23.3.2. Similarity between abstract concepts through thematic integration

The cognitive process of similarity is central to cognitive science because it plays a significant role in psychological and computational models used to explain important cognitive processes such as categorization (Rosch, 1973), problem solving (Ross, 1989) and recall (Conrad, 1964). Traditionally, perceived similarity between concepts is considered to be a function of their distance in mental space and it is determined by direct comparison between features. Thus, similarity was thought to be a comparison between overlaps of perceptual properties (Tversky, 1977) or alignment in structure (Gentner & Markman, 1997). However, contemporary theories on similarity have argued that thematic relations also affect similarity, by virtue of the items interacting or occurring in the same scenario. Does that mean that traditional models oversimplified the cognitive process of similarity? How could these models explain similarity processes between abstract concepts?

One interesting observation from the current studies was the perceived similarity between different abstract concepts experienced and processed in the same situation. Indeed, participants judged the pairs of abstract concepts read in the same situation as being similar even though the two words forming the pair were semantically different and had no pre-
existing thematic relations. Therefore, one domain in which our results have particular significance is in theories on perceived similarity between concepts. The findings from Experiment 3 and 4 clearly indicated that processing different abstract concepts in similar situations increases their perceived similarity. Novel-thematic relations recently constructed amongst abstract concepts by virtue of them being experienced in relevant situations facilitated the perception of similarity relations between them.

Future research could further investigate whether all types of situations influence perceived similarity between abstract concepts. Do all situations facilitate the thematic integration between abstract concepts? If we had asked the participants in the baseline condition to justify their similarity ratings, would that have facilitated the perception of the similarity between the novel-thematic abstract concepts pairs compared to the taxonomic pairs? Only future studies could provide credible answers to these questions of reflection.

24.0. Implications of findings for other areas of research

The rest of the discussion that follows will look at the implications of our global findings as far as other areas of research on cognition are concerned.

24.1. Categorization and conceptual organization

What type of conceptual organizational structure underlies the representation of abstract concepts within the cognitive system? Probably, one of the most important implications of the findings presented in this thesis is related to concept organization and categorization. Traditional theories of categorization and concept organization such as the Prototype models (e.g., Smith & Minda, 2002), Exemplar models (e.g., Medin & Schaffer, 1978) or the Spreading Activation models (e.g., Collins & Quillian, 1969) assume that entities and categories are represented mainly by their internal perceptual features, with little consideration for either the thematic relations and associations between concepts which possess completely different features or the position that abstract concepts could occupy in such models. Concerning concrete concepts, tremendous research on conceptual organization has shown that they are mostly organized by a hierarchical organization of taxonomic relations binding them together (e.g., Collins & Quillian, 1969).

However, categories of concrete concepts are only a fraction of human knowledge. People also have conceptual representations of abstract and complex concepts such as mental states, cognitive processes, emotions, introspection and subjective experiences. Thus, abstract concepts represent a considerable part of every human experience. But, very little is known about categories of abstract concepts and the conceptual structure used to represent it. Very
few attempts if any, have been made to generalize and incorporate abstract concepts and categories into semantic memory models, resulting in almost non-existent knowledge about their real organizational structure.

Considering the characteristics of abstract concept categories and taking into account the organizational principles governing taxonomic structures evoked earlier on in previous sections, it is very clear that taxonomic organization made up of superordinate and subordinate representations may not be able to capture the entire content and structure of the representations of abstract concepts. Moreover, neuropsychological evidence seems to support this assumption. Crutch and Warrington (2005), argued that there is a Qualitatively Different Representational Framework (QDRF) for abstract concepts relative to concrete ones. The QDRF model proposes that abstract concepts are presented in associative neural networks whereas concrete concepts have a semantic similarity organization. That is, “irrespective of the type of information which constitutes abstract and concrete concepts, a much more fundamental difference exists in the actual architecture of those representations” (Crutch & Warrington, 2005, p. 623).

The implications from the overall findings presented in the current thesis are complementary to this view. We argue for a dynamic and flexible thematic reorganizational structure underlying the conceptual representation of abstract concepts. Our findings suggest that at least on a functional level, when abstract concepts are used to achieve high-level cognitive processes such as categorization/sorting or similarity judgements, thematic organizations play an important role. Indeed, to our knowledge, no studies or theories have proven empirically that concepts are generally stored as individualized “atoms” floating within the conceptual system. Instead they may become organized with other concepts only during conceptual or perceptual processes in order to support actions, behaviour or some other goal (i.e., computational processes based on functional demands). Neither has it been empirically shown that concepts are stored in pre-established organizational structures, be it taxonomic or thematic. In fact, the claims made by almost all studies about organizations of concepts (be it taxonomic, thematic or other types of organization) have been suggested from and deduced through experimental cognitive tasks subjected to participants.

The current thesis support the assumption that irrespective of the way in which abstract concepts are stored within the conceptual system, at a functional level, abstract concepts continuously reorganize themselves into novel thematic clusters such that these thematic reorganizations affect the categorization and similarity judgements performed upon them.

Theories and models of conceptual organization need to be extended to account for the
impact of thematic reorganizations of abstract concepts on categorization and learning. Thus, the cognitive representational structure made up of situations rather than individual concepts could be the most adaptable conceptual representational framework for abstract concepts, whereby the “nodes” linking the structure denote situations rather than individual words. This could be an interesting goal for future research on abstract concepts.

24.2. Latent Semantic Analysis models - LSA

One domain in which implications from findings in the current thesis have particular significance concerns models of linguistic processing that extract meanings and similarity from co-occurrence statistics, such as Latent Semantic Analysis (LSA, Landauer & Dumais, 1997). In an interesting study, Simmons and Estes (2006) examined whether LSA could adequately differentiate taxonomic versus thematic similarity relations between concrete word pairs in the same way as human participants. Using a similarity rating task, Simmons and Estes presented participants with a list of taxonomically and thematically related word pairs, and participants had to decide whether the words were similar. Simultaneously, LSA cosines were obtained for the same taxonomic and thematic lists. The results from LSA were then compared with those of the participants using linear regression analysis. Their overall observation was that participants were reliably able to differentiate thematic relations from taxonomic ones, but LSA did not. That is, LSA did not show any significant difference between the similarity scores attributed to thematic and taxonomic word pairs. Thus, LSA did not seem to be able to capture subtle similarity differences between thematic and taxonomic relations, whereas such semantic differences are important to human cognitive processes. However, it is worth emphasizing here that the stimuli used in the study of Simmons and Estes (2006) consisted of only concrete concepts and their sample size was very small, whereas LSA is known to be more “reliable” when applied to large corpora (Landauer & Dumais, 1997).

Based on what we know about the nature of abstract concepts, we could speculate that LSA might perform better in distinguishing the differences in similarities between thematic and taxonomic abstract concepts compared to concrete ones, since the latter are less dependent on contexts compared to the former. Indeed, our findings suggest that the co-occurrence of different abstract concepts in similar contexts affects their perceived similarity. This is coherent with some of the principles upon which LSA operates. Thus, if LSA uses contextual information to determine the similarity between words by virtue of the logic that as the contexts of two words become similar so do their meanings or semantic similarity, then it might be possible for LSA to distinguish between thematic and taxonomic similarity of
abstract words in the same way that people do. An interesting direction for future research could be to replicate our studies using LSA, based on the prediction that LSA would show a significant differential sensitivity in similarity judgements between taxonomic versus novel-thematic abstract words pairs as a function of contextual elements.

24.3. Cultural effects on categorization styles

Could Westerners be “induced” to manifest novel thematic organizational thinking patterns during the conceptual processing of abstract concepts? According to the current studies, the answer is yes. Cross-cultural studies have proposed that people from Western cultures tend to engage in context-independent and analytic perceptual processes by focusing on salient entities independently from the context in which they are embedded. Conversely, people from East-Asian cultures tend to engage in context-dependent and holistic perceptual processes by attending to the relationship between entities and the context in which they are experienced (e.g., Nisbett et al., 2001; Unsworth, Sears & Pexman, 2005; Chiu, 1972). The overall results presented in the current studies support the situated and dynamic constructivist approach to culture and its effects on cognitive processes (e.g., Oyserman & Lee, 2008). We observed that globally, participants (with western background) were able to construct novel thematic relations between semantically different abstract concepts through situational information processing. Thus, as participants read the situations containing the concepts, they were able to disengage the concepts from their taxonomic structures and reorganize them into new thematic clusters with respect to the context and meanings described in the text being read or processed. This shows that their conceptual structure for abstract concepts is not rigid, but rather malleable and flexible, capable of capturing different relations expressed in texts.

What is not certain at this point is whether the same pattern of results would be observed had the present studies used concrete concepts. Recent social cognition studies have advocated the view that culture could be “primed” so as to instigate the emergence of context-dependent or context-independent categorization styles, despite the “original” cultural background of an individual. For example, Oyserman and Lee, (2007) argued that culture is situated and the environment within which the individual is immersed into influences it. In other words, as far as individualism versus collectivism, holistic versus analytic, taxonomic versus thematic are concerned, these cognitive differences with respect to culture are far from being static or rigid. Rather, cultural differences and its effect on cognitive processes such as categorization are dynamic and dependent on the environment within which an individual is expected to function or perform a specific action.

Oyserman and Lee (2008) suggested that either individualism or collectivism, in other
words, taxonomic or thematic thinking can be primed by the environment so that it becomes salient for the support of the situated action being achieved. Thus, independent of cultural factors, taxonomic or thematic organization could be made to become accessible enough, such that East-Asian can be primed to categorize taxonomically and Westerners could also be primed to categorize thematically. The current results are coherent with this socially-situated cognition model, where people generally live, think and hence effectuate most of their cognitive processes within relevant social contexts. Indeed, most of the studies from cross-cultural psychology on categorization styles are based on concrete stimuli, so the interpretations being made here are speculative at best, and only future research could shed more light on these interesting phenomena, especially for abstract concepts and culture.

24.4. What about episodic priming?

Could the findings be explained by episodic priming? Extant models of episodic priming could hardly explain the results, especially from Experiments 3 and 4. This is based on the fact that, first, the novel-thematic target-pairs were unassociated (i.e., according to standard association norms) and taxonomically dissimilar, therefore the observed similarity judgements cannot be attributed to semantic similarity or to associative strengths. Thus, any model that attributes episodic priming to associations, featural similarity or compound-cue familiarity could not account for the emergence of new thematic relatedness between the novel-themed pairs. Second, studies on episodic priming for newly associated word pairs are inconclusive as to the exact experimental and conceptual conditions that support it.

The studies presented in the current thesis differed fundamentally from classic episodic priming paradigms in concrete ways. First and foremost, our experimental work was not on assessing memory systems and its functions. The primary interest was investigating the influence of situations and thematic reorganization on the conceptual representations of abstract concepts. So, even though memory was expected to play a role, as it does in most cognitive tasks, it was however not part of our objectives.

Second, the target pairs were distributed randomly in each story. The participants read all six stories with four paragraphs in each story, before performing similarity judgements or categorization tasks on concepts pairs. Thus, the words in each pair co-occurred with other words in the texts, so the learning conditions in the current experiments differed from those in standard episodic priming experiments.

Third, we used a similarity judgement task after processing the target pairs in situations in Experiment 3 and 4. This task is different from standard tasks usually used to assess priming effects (e.g., lexical decision, naming, picture-recognition etc.) and the
experimental protocol differed from standard priming paradigms. In fact, Ratcliff and McKoon, (1988) tested the range of priming in texts. In their study, Ratcliff and McKoon asked participants to read two stories: a main story followed immediately by a filler story. After reading the two stories successively, they were presented with four test sentences, three served as prime sentences and one was a target sentence from the main story. Thus, the target sentence from the main story was primed by either a prime sentence that was nearer to the target sentence in the main story, a prime sentence that appeared mid-way from the target sentence or a prime sentence that was from the filler story. Participants had to respond “true” or “false to the test sentences. Each of the primes sentences was followed by the target sentence and the response times to target sentences were recorded. They observed faster priming responses for the near prime sentences compared to the far and middle, with no reliable difference between the middle and the filler prime sentences relative to the target. They concluded that the range of priming in texts, i.e. the distance between prime and target sentences in a text determines priming effects. That is, priming items must be as close to the targets as possible with as few as possible intervening items between them in texts in order to produce facilitation effects. Thus, the closer the prime and target are in the textual contexts, the more likely they are to form a compound-cue necessary for retrieval during priming.

The current studies differ from the above in several ways, first, the abstract word clusters randomly co-occurred in the stories, thus providing ecological validity as to how people normally read and comprehend situations involving different abstract concepts. Second, the results cannot be explained by spreading activation models of episodic priming since these models are sensitive to time lapse of activation that could lead to decay of priming (Anderson, 1983; Collins & Loftus, 1975).

What about integrative priming? In that, since abstract concepts are easily integrated into various relations that instantiate dissimilar abstract concepts co-occurring in relevant events, situations and scenarios, one could perhaps imagine that participants created simple integrational relations amongst the novel-thematic pairs. But, even integrative priming effects could not be solely responsible for the robust effects observed across the four studies. This is because as explained in sections on integrative priming (Ch. II section 7.6.2.), the latter occurs when the word-pairs could be combined to form a new unitary semantic representation with a different meaning from each of the words forming the pair. That is, a relational integration is constructed between two words such that the two words form a noun-compound with a distinct meaning. For example, the pair “animal-hospital” could be integrated to form the compound “animal hospital” that signifies “a hospital for curing animals” (Estes & Jones, 2009). So, animal will prime hospital in an integrative priming condition, where “animal-
“hospital” have been studied together. More importantly, for integrative relation priming to occur, the direction of the compound is very pertinent, in that, it is important that “animal” precedes “hospital” in the pair “animal-hospital”. Because, the reverse direction of the pair, “hospital-animal” does not convey the same meaning and in some cases might be nonsensical. Hence, it will not instigate any reliable integrative priming effects.

A close look at the novel-thematic target pairs used in the current studies shows that sensible integrative relations cannot be established between all of them (e.g., “aristocracy – archaeology,” “history – treason,” “liberalism – languages,” “psychology - sadness” etc.). Thus, standard integrative priming could not reliably explain the overall results. The current studies focused on the co-occurrences of unrelated words in naturalistic situations that gave rise to relatedness effects similar to the acquisition and organization of semantic knowledge through our experience with language. The only relations that could be established between the novel-thematic target pairs are new thematic relations constructed as a function of the instantiation, experiencing and processing of the target pairs in relevant situations, as evidenced from the overall findings. We assume that as abstract concepts occur in similar contexts, they become thematically reorganized and their conceptual representations also become similar as a result.

25.0. Limitations in the current studies that could be addressed in future studies

Of course there are several limitations to the current set of studies that deserve to be recognized and hopefully addressed in future studies. Foremost among these is the valence of the target abstract concepts used in the experiments. One is cognizant of the fact that valence could have influenced the types of conceptual organizations observed from the new-thematic and taxonomic groups. Indeed, previous studies on representations of abstract concepts (e.g., Kousta, Vigliocco, Vinson, Andrews & Del Campo, 2011) have indicated that valence is a factor that plays a significant role in the processing of abstract concepts. Hence, there exists a possibility that some of the target abstract concepts which had positive or negative valences might have influenced or instigated participants to sort concepts using affective associations or relations. As such, it might be argued that the thematic reorganization or the effects on similarity judgements observed could have been influenced (partly) by the emotional valence of some of the stimuli rather than to the situational information in which they were read. The choice of abstract concepts samples used in the current studies was limited and constrained by the general difficulty associated with obtaining distinct exemplars for the taxonomic abstract categories. This issue could however be addressed in future studies by counterbalancing the emotional valence of the abstract concept stimuli across the taxonomic and novel-thematic
lists. Such a measure would control the possible effects of emotional valence on new-thematic reorganization of the concepts. It is reckoned though that the extent to which emotional valence might have impacted on the results remains to be ascertained in future replication studies.

Second, concerning norming Study 3, the 9 out of the 24 abstract words were normed for concreteness and familiarity using MRC psycholinguistic norms. The remaining 15 were normed according to the procedure described in norming Study 3. In hindsight, it would have been interesting to norm all the 24 abstract word stimuli using the same method in order to minimize possible inconsistencies in ratings for concreteness and familiarity. Though we do not believe that this protocol significantly impacted on the findings, future studies could consider using the same method to norm all the 24 abstract stimuli in order to determine whether there would be significant differences in the results compared those presented in the current thesis.

Third, studies on abstract concepts (e.g., King & McRae, 2012; Wilson Mendenhall et al., 2011; Barret et al., 2006; Sett & Caramelli, 2005) have proposed that abstract concepts could be divided into different domains or categories, and such sub-categories could affect their conceptual processing and representation. For example, King and McRae, (2012) argued that abstract concepts can be separated into relational concepts (e.g., ignore) and internal states (e.g., relief) and that situational information activates these two types of concepts differently. In other words, using a lexical-decision priming paradigm, they observed that when preceded by situations, relational abstract concepts were processed reliably faster, whereas internal states abstract concepts were not affected by situational information priming. Indeed, the abstract concepts used in the current thesis were not separated into different categories, and thus they included concepts representing both relational and internal states. It is possible that some types of abstract concepts might yield significant novel-thematic organizations than others. It is hoped that future studies could control this factor in order to determine whether differences in types of abstract concepts (e.g., relational versus internal states) would influence the emergence of novel thematic organizations after situation processing compared to taxonomic situation and baseline.

Fourth, concerning the experimental protocol of Experiment 4, a deadline of 2000 ms within which the target-pairs had to be processed was used. It might be argued that this deadline was too long, or not accurate enough and hence, might not represent an early enough activation and/or processing duration for new thematic relations to emerge. The reason for selecting this deadline was explained under Experiment 4 (Ch. IV, section 18.3). At present, we are unsure about the most optimum deadline necessary for the processing of target abstract
concepts embedded into situations. Future studies could replicate Experiment 4 and manipulate different deadlines in order to determine whether similar effects would be observed as a function of situational information.

Fifth, in retrospect, it would have been interesting to analyse statistically the similarity ratings for the taxonomic and novel-thematic fillers used in Experiments 3 and 4. Since the fillers were not inserted into the situational texts, it is suspected strongly that their conceptual organization would have resembled the ones which were observed at baseline. Nonetheless, their analyses might have provided further insights into the type of reorganization produced by participants as a function of the situations.

Sixth, it was observed in Experiment 2 that certain participants in the new-thematic situation condition did not create taxonomic clusters, neither did they create the novel-thematic organizations which resembled the original novel-thematic clusters. This implies that certain participants demonstrated another type of thematic association, based on their personal manner of thematically integrating different concepts to obtain some meaning. In hindsight, though these “individualized” clusters lacked consistency and coherency, we could have analysed what these individualized clusters represented. As they were certainly not taxonomic, they could have represented participants’ subjective manner of processing the concepts. It is hoped that future replication studies could analyse these “individualized” clusters in order to decipher the conceptual meanings associated to them as a function of the type of situation in which they were previously instantiated.

26. Future directions – Practical applications of the findings in the context of other research domains

Although fundamental research on abstract concepts has been useful for understanding the properties, structure, content, conceptual organization and representation of abstract concepts in general, suggestions for its practical applications in other domains remain limited in current literature. We believe that significant findings and observations from previous research as well as from the current thesis provide useful information and sufficient understanding of abstract concepts, such that we could begin to envisage the practical implementation of some of these findings in different domains. Here, we propose possible applications of the influence of situations and thematic reorganization on abstract concepts in just two domains, Social behaviour and Autism, in the hope that future research would follow suit and venture into other practical applications.

26.1. Teaching social behaviour in children
Thematic relations and abstract concepts are central to social interactions and communication. Most social interactions are thematic in nature because they are complementary (i.e., they engage two or more entities, each playing a facilitating role to achieve a common goal). Social interactions frequently take place in situations and they instantiate and incorporate several abstract concepts. Thus, social thematic situations involve the processing, representation and organization of many abstract concepts. One can therefore suppose that the development of adaptive social behaviour and communication, especially in children could be dependent on how efficient the thematic reorganization and representation of the abstract concepts experienced in situations would be.

Indeed, the quality and understanding of social relations affects behaviour, attitudes and interactions towards members of other social or cultural groups (e.g., Allport, 1954; Pettigrew, 1998). Understanding important abstract concepts in social situations could reduce group hostility and prejudice. In this sense, antisocial behaviour in children such as bullying and conduct disorders could be addressed by using situations to explain abstract concepts that describe good social conduct such as kindness, respect, consideration, empathy etc. Future research could use specific social situations to assess how social behaviours are moderated by the thematic representation of abstract concepts that represent good social conducts.

26.2. Autism

Asperger Syndrome is a sub-group of the Autism spectrum disorder (DSM-IV, American Psychiatric Association, 1994). Social interaction deficits of individuals with Asperger syndrome are well documented (e.g., Gillberg & Gillberg, 1989; Nordin & Gillberg, 1998; American Psychiatric Association, 1994). Although people with Asperger syndrome (AS) or High-Functioning Autism (HFA) are usually credited with normal IQ levels, they are usually defined by specific deficits including marked impairments in social skills such as: socially and emotionally unadapted behaviours, inability to recognize social cues, difficulty to interact with peers or develop peer relationships and an impairment in the ability to use non-verbal gestures to regulate social interactions (e.g., Sztefai, Bremner & Nagy, 1989). They are also known to have difficulties in recognizing and understanding language that represents emotional and mental states in themselves as well as in others (Tantam, 1988; Kerbeshian, Burd & Fisher, 1990). Though the causes of Autism are currently unknown, extensive research advances the Theory of Mind (ToM) hypothesis, which is an implicit cognitive ability to understand the existence of introspective states and then using it to explain, predict, and adjust one’s behaviour with respect to other people’s. Thus, people with Autism are said

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to have deficits in the ToM, leading to problems in pretend play, imaginative activities and empathy (e.g., Baron-Cohen, 1988; Leslie, 1987). However, recent researches on teaching ToM skills to AS or HFA people with normal IQs have revealed to have marginal impact on their patterns of social interactions, despite their high scores on ToM tasks. Thus, despite improvement in their performance on experimental ToM tasks in research laboratories, there is little impact in their subsequent social adaptive skills in naturalistic environments (e.g., Ozonoff & Miller, 1995). Other studies on Autism have proposed that people with AS or HFA rely on physical and perceptual cues rather than on social cues in order to perform social tasks. In other words, a concept that is processed in a physical situation is more meaningful to them than concepts which are processed in social situations. We propose that if social situations are the main contexts which are a challenge to the learning of social skills for AS people, and if based on previous studies (e.g., Wilson-Mendenhall et al., 2011; Barsalou & Wiemer-Hastings, 2005) abstract concepts mostly contain social elements and they capture meanings and introspective states expressed in social situations, then an empirical question worth addressing is: Are AS or HFA people capable of mentally simulating and attributing specific abstract concepts to relevant situations? Are they able to create the most optimal thematic abstract clusters made up of relevant abstract concepts and use them for the representation of a specific internal state or to achieve a specific goal with respect to relevant social situations? Neuroimaging studies carried out by Wilson-Mendenhall and colleagues (2011), indicated that emotional concepts such as fear or anger are processed differently when associated with a situation describing a physical threat compared to a situation describing a social threat. This means that different types of situations affect the cognitive representations of specific abstract concepts differently.

If AS or HFA people have limitations in carrying out such cognitive processes involving abstract concepts, then it could be interesting and promising to use situations and thematic reorganization of abstract concepts to teach AS or HFA people to understand meanings of abstract concepts relative to specific social situations. Indeed, using social attribution tests (SAT) with AS and HFA participants, Klin (2000) showed that not only do AS participants use significantly less cognitive and affective abstract words to describe social situations and personality traits of persons involved in social interactions, but also and more importantly, most of the abstract words used are not pertinent to the social situation described. That is, Klin (2000) observed that AS participants, compared to controls frequently made mistakes in matching pertinent abstract concepts to their corresponding social situations despite their understanding of the semantic meaning of the abstract concepts individually. The findings from the current thesis could be used to enhance social skills training programmes.
The latter could focus on creating thematic social situations with different abstract concepts that describe social cues, attributes, behaviour, personality traits and emotions inserted into them. Frequent processing of such situations by AS people could enable them to mentally simulate the concepts within relevant and meaningful social situations, thereby enhancing their “practical” and thematically situated understanding of the abstract concepts. That is, they could be “trained” to identify the optimal cluster of abstract concepts that could be combined together to represent a theme, an emotion or mental states within an appropriate social context. We sincerely believe this to be a very fertile area for applied social research in Autism.

27.0. Conclusion

Abstract concepts are overwhelming to study and it takes a lot of courage to approach them in experimental research. In trying to understand them, it seems as though one ends up with more questions than answers, such as, *have we gained more insights into the understanding of how abstract concepts are conceptually processed? Are we closer in demystifying the complex semantics involved in processing and mentally representing abstract concepts?* The answers to queries like these are “abstract” in themselves. Simply because they are dependent on the introspective and metacognitive perspectives of the individual who reflects over them. And then there are the questions: *have the studies presented in the current thesis answered the experimental questions and objectives set out at the beginning? Have the overall findings brought us closer to grasping any idea about how abstract concepts could be conceptually or semantically represented and understood?* The response to these could be summarized by the following concluding remarks:

Abstract concepts constitute a large chunk of the human conceptual system. They are as important to the human cognitive system as concrete concepts. They represent most aspects of human experiences that cannot be touched, seen or heard. It is almost as though the more one studies them the more abstract and intangible they become, especially as far as their practical applications are concerned. Consequently, most researchers in psychology and cognitive science have steered themselves away from including them in their research objectives. However, as cognitive research strives more and more to unravel the mystery of mental processes, it seems improbable that abstract concepts can be avoided for that much longer.

The current thesis has focused on evaluating a few of the factors that affect or influence semantic representation, processing and organization of abstract concepts in the conceptual system. We focused on two main aspects: thematic organization and situational
information and assessed whether they influenced or played a significant role in the conceptual processing of abstract concepts. Our overall findings suggest at the most, that situational information and thematic reorganization are part and parcel of the cognitive processes that are engaged in when abstract concepts are encountered. In spite of all the potential concerns, shortcomings and criticism which could be imagined with regards to our work, the integral results from the four studies demonstrate at the least, that situational information and thematic reorganization cannot be totally ignored when investigating the conceptual processing and representation of abstract concepts. One thing of which we are certain though is that the studies presented here could serve as a platform that could lead future research in extending our findings relating to the representation of abstract concepts. As far as we know, no studies have demonstrated that abstract concepts belonging to different taxonomic abstract categories and which have no pre-existing thematic relations could be thematically integrated and reorganized when instantiated and experienced in situations. Even though abstract concepts are indeed, “abstract” we believe that they do have some important concrete and practical applications in wider research domains as described earlier.

In closing, the current thesis has attempted to answer pertinent research questions with the intention of highlighting some of the complexities that come with studying abstract concepts in general. We have shown that abstract concepts rely on two very important dimensions for their processing: thematic organization and situations. Overall, the results can be accounted for and are coherent with theories which assume that situational information is fundamental to semantic representations of abstract concepts. However, it is clear that a great deal more needs to be done in order to arrive at a full empirical account of the processing of abstract concepts. We emphasize that thematic organization of abstract concepts complements taxonomic representations and together they provide a more complete, cohesive and coherent understanding of the human conceptual system.
References


