DOCTOR OF PHILOSOPHY

The representation and interpretation of abstract concepts : an LCCM theory approach

Al-Husain, Mohamed

Award date:
2014

Awarding institution:
Bangor University

The Representation and Interpretation of Abstract Concepts: An LCCM Theory Approach

By

Mohamed Abdul-Zahra Al-Husain

Supervisor: Professor Vyvyan Frederick Evans

A Dissertation submitted to the
School of Linguistics and English language in partial fulfilment of the
requirements for the Degree of Doctor of Philosophy in

Linguistics

College of Arts and Humanities
Bangor University

March 2014

Committee:

Chair

Dr Thora Tenbrink ....

External Examiner

Professor Chris Sinha ....

(*Internal Examiner*)

Dr Alan Wallington ....

Supervisor

Professor Vyvyan Frederick Evans ....

I. DEDICATION

First and Foremost, I dedicate this humble work to

Imam Al Zaman, the advent of whom we yearningly await:

To the memory of my father who worked hard to make me the man I am today. He always wanted me to measure up to this.

To my mother, who put up with me for all of the years before she passed away.

To Tahia who truly believes in me

To my brothers and sisters who have always been my biggest supporters in whatever I do

&

To my wife and children

II. Abstract

The human brain has evolved a unique capability of highly abstract thinking. Abstract concepts constitute a fundamental part of human cognition. In this dissertation, I address the nature of human abstract concepts and their content and structures. Second, I am interested in arriving at a plausible account of how people acquire, represent interpret and jointly share and negotiate the meaning of abstract concepts. Finally, it is important to define and expound the role of the linguistic content and structures in the referential and conceptual transparency of the meaning of abstract concepts.

First of all, unlike concrete concepts, abstract concepts seem to be very hard to investigate due to the non-physical nature of their referents. Their referents are not easy to track, or at least, not possible to bring to the lab. Past researches have either dealt with abstract concepts in terms of concrete concepts or perceived them as a homogenous category of concepts with ill-defined abstractness. The assumptions that this work promotes and empirically tests are as follows: the diversity of representational content, heterogeneous of knowledge-type, continuous and graded abstractness typology.

Secondly, most of those works seem to confuse concepts with words, building on an isomorphic perspective on human concepts. A plausible account of the nature of abstract concepts requires a systematic distinction between the representational content and format of both the linguistic and conceptual systems. Therefore, this work addresses the role that language plays in our acquisition and understanding of their content. The linguistic combination of two or more concepts, or compositionality, is assumed to facilitate the acquisition, representation and interpretation of abstract concepts. One lexical entity serves as a context for the other to achieve referential and conceptual transparency. For a psychologically plausible account of abstract concepts, a separation

(non-isomorphism) is needed to demarcate the linguistic and non-linguistic representational systems. This should solve the confusion between words and concepts. Evans' (2009) Lexical Concepts and Cognitive Model (LCCM) offers this opportunity by suggesting a principled interface between linguistic and non-linguistic representations. The version of compositionality principle suggested by this model could fit easily in the account of the role that language use plays in the representation and interpretation of abstract concepts

Thirdly, the assumption that abstract concepts derive most of their content and structure from language use does not embrace the intention to disassociate perceptual and embodied information from the content of abstract concepts. Rather, it is proposed here that such perceptual and embodied concepts are indirectly linked to their content. In other words, they play a facilitative function. There are several theoretical frameworks which sought to give a dominant status for the perceptual representations in the representation of abstract concepts. However, there is still ongoing debate on whether such approaches to cognition and abstract conceptual thoughts could fully specify this relationship. In this work, it has become empirically evident that human abstract concepts are highly relational. Their complex information potential qualifies for the level of abstractness as an emergent property of their representational contents and structures.

The present work developed a set of testable claims (heterogeneity, continuity, compositionality and the indirectness of perceptual and embodied representation to content and structure of abstract concepts). A number of experiments were instrumentally designed to test the validity of such assumptions. Four experiments were carried out to test a set of assumptions put forward by the present dissertation.

Taken together, these chapters show that abstract concepts could be placed on an approximate continuum of abstractness. Even the least abstract concepts which seem to have no perceptual properties originally inherent to their content and structure, they derive their content and structure in retrospectively via language use.

III. Content

IV. Figures

V. Tables

VI. Acknowledgments

I am pretty certain that I couldn't have made it this far on my own without the generous help and unflagging support of many people over the past 4 years. So, I would like to acknowledge the contribution of those people, however, I am not sure I can adequately express my profound gratitude to them.

First and foremost, I am largely indebted to my supervisor Professor Vyvyan Frederick Evans, a Professor of Linguistics at Bangor University UK, in the School of Linguistics & English Language, who deserves my special thanks. He has always been a source of interminable guidance and unwavering assistance. The most challenging academic exchanges of my life so far have begun with Professor Evans' question, "could you explain to me how..?" Upon the completion of this work, I fully acknowledge the invaluable insights, professional logic and constant guidance.

Most notably, I want to express my gratitude for having been so lucky to work with Professor Jenny Thomas who was my first supervisor before her retirement. Professor Thomas allowed me enough rope to make my own way at the first phase of researching my topic. I appreciate her patience in answering my many questions, the answers to which shaped my research experience.

Credit is also due to the academic and administrative staff in the School of Linguistics & English Language for their support. I remember my colleagues in the PhD programme at Bangor University, especially Mr Fariq for his comments and support upon my stay in Bangor city. I wish to make a special note of appreciation for all of the administrative staff in Iraq who allowed and participated in the experiments. Thanks also to the undergraduate and postgraduate students of the Iraqi universities who gave of their time to participate in this research.

Many thanks also to Dr. Sahib Al-Akashi and Eman Al-Khayat, who put a substantial amount of time and effort into the statistical analyses, and helped me to understand the mathematics involved in my work. I am also indebted to Sara Macleod, who provided her expertise in the proof-reading. She did an amazing job noticing and fixing my mistakes.

I'd also like to thank my family for all the unreserved sacrifices, unconditional love, patience and the continuous encouragement they have shown throughout my long journey towards a PhD.

This dissertation almost certainly contains much of the theoretical discussion about abstract thoughts, the responsibility for any errors or inadequacies in this work remains, of course, entirely my own.

VII. Declaration and Consent

Details of the Work

I hereby agree to deposit the following item in the digital repository maintained by Bangor University and/or in any other repository authorized for use by Bangor University.

Author Name: Mohamed Al Husain

Title: The representation and Interpretation of Abstract Concepts: An LCCM Theory Approach.

Supervisor/Department: Professor Vyvyan Frederick Evans /School of Linguistics and English Language.

Funding body (if any):

Qualification/Degree obtained: PhD. In Linguistics and English Language.

This item is a product of my own research endeavours and is covered by the agreement below in which the item is referred to as "the Work". It is identical in content to that deposited in the Library, subject to point 4 below.

Non-exclusive Rights

Rights granted to the digital repository through this agreement are entirely non-exclusive. I am free to publish the Work in its present version or future versions elsewhere.

I agree that Bangor University may electronically store, copy or translate the Work to any approved medium or format for the purpose of future preservation and accessibility. Bangor University is not under any obligation to reproduce or display the Work in the same formats or resolutions in which it was originally deposited.

Bangor University Digital Repository

I understand that work deposited in the digital repository will be accessible to a wide variety of people and institutions, including automated agents and search engines via the World Wide Web.

I understand that once the Work is deposited, the item and its metadata may be incorporated into public access catalogues or services, national databases of electronic theses and dissertations such as the British Library's EThOS or any service provided by the National Library of Wales.

I understand that the Work may be made available via the National Library of Wales Online Electronic Theses Service under the declared terms and conditions of use (http://www.llgc.org.uk/index.php?id=4676). I agree that as part of this service the National Library of Wales may electronically store, copy or convert the Work to any approved medium or format for the purpose of future preservation and accessibility.

The National Library of Wales is not under any obligation to reproduce or display the Work in the same formats or resolutions in which it was originally deposited.

Statement 1:

This work has not previously been accepted in substance for any degree and is not being concurrently submitted in candidature for any degree unless as agreed by the University for approved dual awards.

Signed ………………………………………….. (Candidate)

Date ……………………………………………..

Statement 2:

This thesis is the result of my own investigations, except where otherwise stated. Where correction services have been used, the extent and nature of the correction is clearly marked in a footnote(s).

All other sources are acknowledged by footnotes and/or a bibliography.

Signed …………………………………………. (Candidate)

Date …………………………………………….

Statement 3:

I hereby give consent for my thesis, if accepted, to be available for photocopying, for inter-library loan and for electronic storage (subject to any constraints as defined in statement 4), and for the title and summary to be made available to outside organisations.

Signed …………………………………………. (Candidate)

Date …………………………………………….

NB: Candidates on whose behalf a bar on access has been approved by the Academic Registry should use the following version of **Statement 3:**

Statement 3 (bar):

I hereby give consent for my thesis, if accepted, to be available for photocopying, for inter-library loans and for electronic storage (subject to any constraints as defined in statement 4), after expiry of a bar on access.

Signed ……………………………………………. Candidate)

Date ………………………………………………

Statement 4:

Choose **one** of the following options

a)	I agree to deposit an electronic copy of my thesis (the Work) in the Bangor University (BU) Institutional Digital Repository, the British Library ETHOS system, and/or in any other repository authorized for use by Bangor University and where necessary have gained the required permissions for the use of third party material.	
b)	I agree to deposit an electronic copy of my thesis (the Work) in the Bangor University (BU) Institutional Digital Repository, the British Library ETHOS system, and/or in any other repository authorized for use by Bangor University when the approved **bar on access** has been lifted.	
c)	I agree to submit my thesis (the Work) electronically via Bangor University's e-submission system, however I **opt-out** of the electronic deposit to the Bangor University (BU) Institutional Digital Repository, the British Library ETHOS system, and/or in any other repository authorized for use by Bangor University, due to lack of permissions for use of third party material.	

Options B should only be used if a bar on access has been approved by the University.

In addition to the above I also agree to the following:

1. That I am the author or have the authority of the author(s) to make this agreement and do hereby give Bangor University the right to make available the Work in the way described above.

2. That the electronic copy of the Work deposited in the digital repository and covered by this agreement, is identical in content to the paper copy of the Work deposited in the Bangor University Library, subject to point 4 below.

3. That I have exercised reasonable care to ensure that the Work is original and, to the best of my knowledge, does not breach any laws – including those relating to defamation, libel and copyright.

4. That I have, in instances where the intellectual property of other authors or copyright holders is included in the Work, and where appropriate, gained explicit permission for the inclusion of that material in the Work, and in the electronic form of the Work as accessed through the open access digital repository, or that I have identified and removed that material for which adequate and appropriate permission has not been obtained and which will be inaccessible via the digital repository.

5. That Bangor University does not hold any obligation to take legal action on behalf of the Depositor, or other rights holders, in the event of a breach of intellectual property rights, or any other right, in the material deposited.

6. That I will indemnify and keep indemnified Bangor University and the National Library of Wales from and against any loss, liability, claim or damage, including without limitation any related legal fees and court costs (on a full indemnity bases), related to any breach by myself of any term of this agreement.

Signature: ……………………………………………………… Date: …………………………………………..

PART I

Part I presents the theoretical background for the main themes of this dissertation. It starts with a statement of the general questions: (i) what is the nature of human abstract concepts? (ii) What characterizes the content and structures of such concepts (iii) how do we acquire, represent and interpret abstract concepts, and (iv) what is the nature of the role that language serve in acquiring, representing and interpreting abstract concepts.

More specifically, this part illuminates the inherent referential and compositional properties of language-use. It theoretically links language use to the facilitation of the meaning construction and sharing of abstract concepts. It shows how this linguistic property facilitates our capability to abstract, represent and interpret the knowledge associated with entities with or without physical properties. It critically reviews the theoretical models which have addressed directly or indirectly the understanding of abstract concepts.

This part has four chapters, each of which elaborates on one of the previously formulated questions and develops particular claims for part II to empirically verify. Chapter 1 is an introductory chapter where the main issues are briefly explained, the research questions are presented and the dissertation's structure is overviewed. Chapter 2 is focused on giving an adequate definition for this concept-type, reviewing the available literature and linking the contribution of language use to the acquisition, representation and interpretation of abstract concepts. Chapter 3 explores the compositional properties of language and its role in the representation and interpretation of abstract concepts. Chapter 4 presents the adopted theoretical framework, i.e., Lexical Concepts and Cognitive Models.

Chapter 1:
Introduction

1.1. Introduction

Not only do we have the capability to think and talk about things we can see, hear, taste, smell and touch, but also about a host of other entities for which we have little or no sensory impressions. The underlying mental structures for both types of experience are generally referred to as concepts. Such mental structures, or concepts, encapsulate complex knowledge-types about entities (physical, imagined or abstract), actions and events. Conventionally but not unequivocally, concepts are usually classified into concrete and abstract.

Abstract thoughts constitute a substantial part of human cognition and language. They, in fact, represent a fundamental characteristic of human existence. The question about abstract entities, e.g., democracy, feminism, inflation, happiness, justice, love, idea, doubt, freedom has attracted research interests in many domains such as philosophy, cognitive psychology and cognitive linguistics. Yet, there exists a number of questions which remain unanswered and many other confusions unresolved about the nature of the content and structures of abstract concepts: “what is in them”. This work is an attempt to address these questions theoretically and experimentally to arrive at plausible answers.

For most of the experimental works which were undertaken to characterize the lexical and semantic representation of concepts via tasks such as “lexical recognition, lexical decision, semantic priming and features list generation”, words were often confused with concepts. The concrete concepts were predominantly the main target because they were easy to study. However, we actually know unfortunately little about abstract concepts, even from the perspective of traditional cognitive theories (Barsalou, 2008: 634).Using words as stimuli, behavioural studies have demonstrated that concrete concepts are recognized faster in lexical decision tasks compared to abstract concepts, (Bleasdale, 1987; Whaley, 1978), remembered better in serial recall (Paivio, Yuille, & Smythe, 1966; Romani, McAlpine, & Martin, 2007), and read faster in naming tasks (de Groot, 1989).

It is commonplace fact that concepts are characteristically inaccessible by scientists without any direct point of contact. Language has an exceptional potential to offer an indirect but efficient point of contact. Consequently, cognitive linguists attempt to expound conceptualization by looking at how it explicitly manifests in language use (Langacker, 1987; Lakoff, 1987; Croft & Cruse, 2004; Cruse, 2000; Evans & Green 2006). This concludes that the conceptualization of the abstract concepts is not directly accessible without a reference that has to be made to language use. Cognitive linguistics perceives meanings as parts of the cognitive system which is directly linked to language use (Evans & Green 2006). Therefore, the need for a linguistic data is indispensable to maintain a systematic account of concepts, but without confusing the two:

> "[…] any conceptual approach to word meaning takes seriously the goal of explaining speakers' behavior, and so it attempts to define the knowledge (mental representation) that underlies the significance of words and sentences" (Murphy 2005: 269).

However, even though language itself is a mental phenomenon, it has a physical realisations which mediate its and others' systems content and structures. Therefore, it is fundamental for this work to make a number of distinctions such as form and meaning, words and concepts, the linguistic and conceptual representations.

Abstract concepts represent a highly complex topic as the debate on their representational format and semantic richness is still standing. Concepts like "pain", "happiness" or "sorrow" could be categorised as abstract concepts, yet there is a low consensus on rating them as abstract concepts, simply because they associate with some internal and bodily states which are closely related to our interoceptive senses (see Altarriba, Bauer & Benvenuto, 1999; Altarriba & Bauer 2004). For instance "pain" is correlated with some sort of physical discomfort; "anger" corresponds with facial expressions. On the other hand, "truth" and "time" do not seem to correlate with such causally related physiological and behavioural experience. This highlights the "heterogeneity" and "continuity" claims that this work makes on the nature and typology of abstract concepts. In a nutshell, abstract concepts do vary in their abstractness rating suggesting a continuum of abstractness (see chapters 5).

The common assumption among the research within cognitive linguistics is that the linguistic and conceptual systems are interrelated. The nature of this interrelation needs to be closely investigated. It is very apparent that we may have a concept but we don't have the word for it or may have more than one concept for one word or vice versa. Moreover, different conceptualizations may arise from the same linguistic forms in different contexts and at different points of time.

Conceptualization is predominantly context-dependant. The term "context" may refer to the internal or external context as well as the linguistic and situational contexts. For instance, the concept, "car", assumes a highly transparent conceptual structure (Conceptual Transparency)[1] and perceptually vivid content (Referential Transparency) in the mind of the perceivers, normally associated with the general category "CAR" even in the absence of a context. The concept "car", in "sport car", gives rise to subordinate members, BMW or Ferrari, where a car is a vehicle and BMW or Ferrari where all of them are categorised as VEHICLES or CARS. It does not require much reference to other categories to acquire a better conceptual transparency. One the other hand, without any context to delimit its content and structure, the meaning of the concept "doubt" does not maintain the adequate informational optimality for a minimum conceptual transparency. During processing, diverse and low resolution content and structure could be activated. However, when the concept "doubt" becomes part of a linguistic context or physical situation, higher resolution meaning could be licenced in

[1] The term "Conceptual Transparency" is coined in this work in juxtaposition to the term, "Referential Transparency," as (Hutchins, 1980) and (McGlone, 2001) proposed it-"what one sees with is seldom what one sees" (p. 8).

the mind of the individual, e.g., "wife doubts". In this example, it is very likely that the conceptualizer would think of "betrayal", "affair", "lies", etc. Again, "betrayal" is not synonymous with "doubts".

Several theoretical models on the content, conceptualization and lexicalization of abstract concepts are available with relative degrees of convergence and divergence. Still, with special reference to Evans' (2009) model, lexical concepts and cognitive models[2], the process of meaning construction of abstract concepts will be systematically contemplated (see Chapter 4). Its architecture is very relevant to our claim that language system has an unparalleled contribution to the representation and interpretation of abstract concepts. LCCM does place a significant emphasis on the contribution of the linguistic structures and language use to referential and conceptual transparency of the meaning of abstract concepts.

One significant thesis, that LCCM develops, is about a clear-cut distinction between symbolic, linguistic and non-linguistic, or conceptual knowledge. The symbolic component encodes the lexical content and makes a distinction between word and non-word symbolic units. The lexical concept has a pure linguistic content and gives access to non-linguistic, conceptual content (cognitive models). Meaning construction process lies at the interface between the linguistic and conceptual content. This distinction could serve well in addressing the heterogeneous content and structure of abstract concepts. Individuals may recognize the symbolic and linguistic content without actually knowing what it means (see Chapter 4 for details).

It is assumed here that the diversity of abstract concepts' content can be approached by the semantic compositionality principle as LCCM interprets it, "a process whereby the meaning of a complex unit is built up from the meanings of its parts – it serves to restrict the potential of the word in order to specify the semantic contribution it makes to the utterance" (p.218). Usage-based grammar and semantic compositionality stand at the heart of LCCM

[2] LCCM thereafter

Theory whose application manifest via a number of fundamental processes, e.g., selection, integration and fusion. The meanings of lexical entities do not emerge from their association with conceptual content as fixed chunks: rather, they provide access to a more dynamic and diverse body of conceptual knowledge, which Evans refers to as the cognitive models. Cognitive models comprise coherent sub-systems of knowledge, derived from experience; they are multi-modal in nature and extensively cross-referenced, ranging over individuals, types, events, and properties.

1.2. The Research Scope and Methodology

Against the backdrop of this introduction, the scope of the study will be delineated for clearer objectives and more systematic methodology.

1.2.1. Abstract Concepts

The distinction between the concrete and abstract human experience is very fundamental to human cognition and social interaction. As introduced previously, concepts are mental structures with restricted and indirect access. Human conceptual system can be seen as an abstraction system of ontological categories. Such abstraction meets the economy principle requirement for categorising the individuals' external and mental worlds. This system of ontological categories is mainly transferred and shared via language (Sambor, 2005). The categorised ontologies were perceived to fall into two distinct categories: concrete category (exists physically) and the abstract category (does not exist physically in the external world).

Concrete concepts are well known for having perceptually vivid psychological content and structure with high *referential transparency* (Hutchins, 1980; Keysar & Bly, 1995; McGlone, 2007). On the other end, with protean and fuzzy referential transparency, abstract concepts constitute a comparatively larger category than concrete concepts (Coltheart, 1981; Recchia & Jones; 2012).

Abstract concepts are associated with particular intangible and less transparent referent-type, such as democracy, recession, feminism, decision, inflation, algorithm, happiness, justice, love, tiredness, God, heaven, faith, advice, etc. Barsalou (1999) characterizes abstract concepts as the concepts for which people have no direct experience, for entities with no physical or spatio-temporal attributes. Similarly, Barsalou & Wiemer-Hastings (2005) defined abstract concepts as mental representations of *entities that are neither purely physical nor spatially constrained.* However, humans construct the meaning of abstract concepts and interpret them efficiently apart from their lack of referential transparency (directly accessible by their senses) (Barsalou, 1999, 2008; Boroditsky, 2000; Glenberg & Robertson, 2000; Lakoff & Johnson, 1980, 1999)[3]. These definitions are not unequivocal or without problems (Margolis and Laurence, 2007).

Concepts are not independent or discrete structures, simply because the organisation of human conceptual system mirrors and works out the "world's chaos" via a process of abstraction. So, the suggestion that abstract concepts are primarily understood by their relations to concrete concepts should be taken as an interrelation and a cognitive strategy for acquiring referential transparency rather than attribution of content and structure (for reviews, see Fischer & Zwaan, 2008; Meteyard & Vigliocco, 2008). The organisation of the conceptual system, in this sense, constitutes a grid of the representations of interrelated instances of complex experiences (Paivio, 1986, 2010; Plaut and Shallice, 1993). Therefore, attaching ourselves to the definition of abstract concepts in terms of concrete concepts leads us to exclude much of their nature. Abstract Concepts are, in fact, context-dependent mental structures which derive their meaning primarily from their associations with other concepts.

> "Their meaning consists in their position within the cognitive grid, at the same time determining the function of a semantic category in terms of its linguistic manifestations." (Zelinsky-Wibbelt,1993)

The assumption of non-homogenous and continuous nature of abstract concepts, a claim which the present work presents, necessitates methodologically plausible empirical tests to verify such claims.

---

[3] Human conceptualization system can be seen as a complex adaptive system, exhibiting the properties of any other complex systems such as interdependence, connectedness, adaptedness, emergence and so on.

Complex symbolic units (word combinations, utterances and discourse) represent the most explicit and conventionalised representations which could always be used and possibly reflected upon to explicate the underlying non-linguistic structures. However, the link between meaning and (form) the symbolic units is relatively stable yet not completely fixed. The meaning associated with such symbolic units often evokes multiple and distinct structures (linguistic and non-linguistic). We claim that this link involves some variation during the processing of verbal symbolic units, at the within-individuals and between-individuals levels. This variation reflects the differences in experiences, the diversity of contexts and the mode of processing at both the linguistic and conceptual levels.

In order to characterize the interface between concepts and the linguistic units, a number of lexico-semantic features can be considered and tested to derive the diverse and continuous nature of abstract concepts. The lexico-semantic variables, inclusively but not exclusively, are as follows:

i. Familiarity (the identification and the experience of being familiar),
ii. Imageability (the sensory-motor and imagistic structures invoked by the processing of a stimulus).
iii. Reference-Type (the nature of the referents the stimulus indexes) and
iv. Verbal-encoding (how easy/difficult to define or make a metalinguistic statement about the meaning of a stimulus),

The above lexico-semantic features will be utilized empirically to support the claim of heterogeneity, gradability and continuity of human concepts (Ch.5).

Metalinguistic statements about the meaning of a concept are an additional bottom-up validation of conceptual structures of the abstract concepts where the individuals consciously define the underlying knowledge-types of such concepts. These metalinguistic statements or verbal encoding (features generation and ranking) could make a hard-copy realization of the conceptual and linguistic organisation. It also derives the diagnostic features (defaultness) in the conceptual and linguistic structures and the hierarchy of their organisation

v. Diagnosticity (defaultness) reflects the salience of attributes and values in the conceptual and linguistic structures and the hierarchy of their organisation,

The intention and extension of the meaning of lexical symbolic unit involve all of the linguistic and pragmatic aspects of the symbolic unit. For instance, a concept such as "beautiful" in "beautiful woman", beautiful island", "beautiful speech", "beautiful lyrics", "beautiful dream", "beautiful beliefs", etc., varies in its activated associations to perceptual and non-perceptual information. The selective nature of such activation is facilitated by the context, the individuals' subjective experience and their knowledge of language use. Therefore, investigating the contribution of the relationships of a symbolic unit to other symbolic units under the general term "semantic compositionality" invests in gaining insights into "sound-grammar-meaning triples" or what is generally referred to as the mental lexicon[4]. The interfaces of the triples is governed and principled by the properties of the *mental lexicon*. It involves the intra-relationship within the lexical entities and concepts and the inter-relations among the lexical entities and conceptual entities. The investigation of the mental lexicon, then, involves characterizing the mental aspects of the linguistic-conceptual interface which becomes activated during the processing of language use. It includes looking at the "proliferation of distinct sense units associated with a given form" (Evans, 2009: x).

Finally, the idea that the semantic and grammatical rules guiding the co-activation of such mental entities is very crucial. Not only do their content and structures become schematically configured according to grammar but the activated conceptual structures become guided by such configuration. In a nutshell, compositionality does quantitatively and qualitatively determine the activated senses of concepts in particular linguistic contexts. More focus will be allocated to the correlation between compositionality and the representation and interpretation of this concept-type.

[4] A systematic organization of the sub-systems of forms, lexical structures, conceptual structures and relationships holding them according to experience and usage (see, Libben, 2013).

The appropriateness of such senses requires some rational top-down judgments in terms of their informational optimality as well as acceptability. It is widely accepted that semantic knowledge is built out of concepts. So, the co-activation of two or more concepts should meet the semantic conditions of informativeness and plausibility.

vi. Plausibility (match and mismatch of the meaning to the individual's beliefs systems) and
vii. Informativeness (how sufficient is the information to constitute an optimal interpretation)

The majority of explanations has emphasized the role of embodied and perceptual representation either in the form of image schema or simulations to content and structure of concepts (Boroditsky, 2000; Barsalou, 2008; Casasanto 2009; Lakoff & Johnson, 1980, 1999). This leaves limited or no room for other content types such as linguistic and introspective content (Casasanto & Dijkstra, 2010; Pecher, Boot, & Van Dantzig, 2011; Williams & Bargh, 2008).

Abstract concepts pose a critical challenge for grounded cognition theories. If cognition is grounded in the brain's modal-specific systems and embodied simulations, where are abstract concepts from? Such theories have a fundamental empirical problem: the need for a consistent account of the representation and interpretation of abstract concepts to determine the necessity, sufficiency and directness of embodied representations to the conceptual structures of abstract concepts. (See Experiment 4, Ch. 8).

1.2.2. Compositionality Principle

The compositionality principle implies that we always resort to the act of combining lexical entities to make extension, modification and modulation of the conceptual structures underlying the parts. How could the compositionality principle contribute to the process of meaning construction of abstract concepts? The aims of this section are twofold: first, to raise a question on the underlying contribution of language use to the conceptualizations of the abstract concepts. The second is to question the correlation between the compositional complexity of language use and the intended conceptual build-up of the abstract concepts.

The human semantic system is inherently constructive: complex propositions arise from putting together simpler ones. The compositionality principle implicates that “the meaning of an expression is a function of the meanings of its parts and the way they are syntactically combined” (Pylkkanen, 2008: 713). Here, Pylkkanen underlined one more element of compositionality, i.e., contribution of the syntax or grammar in a more general sense.

Looking at the traditional definitions of compositionality, one could easily conclude that it implicates fixed one-to-one equivalence between word-concepts. It also assumes that such units are in isolation and their meaning is context-free. A possible way to reconcile this position with the position of researches in cognitive linguistics, especially in their accounts of metaphor, polysemy, etc., is to consider the definition of Ward & Kolomyts, to compositionality as a process in which “previously separate ideas, concepts, or other forms are mentally merged” (2010: 101). However, this talks about purely mental structures.

The phenomenon of compositionality is very much relevant to thoughts and language productivity (see Clark and Hecht, 1982; Coulson, 2001). The combination of two lexical entities or more is a productive strategy used by individuals to delimit senses of a lexical entity, deliver new concepts and extend the meaning of language use, e.g., “fast car” versus “fast food”. In other cases, it extends the selected sense in favour of alternative senses. To illuminate this point, let’s take the conceptual combination “winter underwear” which triggers the meaning of a type of cloth with longer length and increased warmth, yet these meanings are not related in any way to the meaning of “winter” nor “underwear”. Similarly, the combination “natural selection” is taken to refer to biological evolution, a meaning which bears no relation to the meaning of “natural” or to “selection”. Therefore conceptual combination affords novel means for extending, modulating and generating new meanings from the meaning of the parts (Costello & Keane, 2001; Swinney, Love, Walenski & Smith 2007). Concept combination is a Gestalt-esque conception and a fundamental human creativity process where the "the whole is greater than the sum of its parts" (Hothersall, 2004). These aspects will be investigated in reference to abstract concepts.

The interest in conceptual combination has led to a number of models to explore the phenomenon (Chapter 3). Most of such models share the characteristic of assuming a fuzzy line between linguistic and conceptual systems. Most of them cannot make a discrete partition between concepts and words; rather they tend to confuse the two. They, in fact, propose a schematic representation of human concepts where concepts are conceived to retain slots with features or properties as fillers. The framework adopted here offers a different perspective, assuming that schematic structure may not be the only knowledge structure that could explain semantic potential of lexical entities.

1.2.3. Evans' Lexical concepts and cognitive models

LCCM could explain the representation and interpretation of abstract concepts by building on its unique perspective on the compositional property of language. Compositionality could facilitate the enunciation of the content and structure of abstract concepts. In other words, the integration and fusion of the lexical concepts enrich the conceptual content of abstract concepts.

The representation and interpretation of concepts necessitate activating the existing perceptual, linguistic and social information based on how they have been acquired, i.e., "Mode of Acquisition" (e.g., Wauters, Tellings, Van Bon & Van Haaften, 2003). The meaning of the individual concepts could be acquired from perceptual, linguistic or both experiences. This justifies the construal of the second construct within LCCM, i.e., cognitive models.

We have every reason to believe, in this work, that scrutinizing the distinct and less transparent senses associated with a given abstract concept relates directly to its relations to other concepts within the organisation of the mental lexicon and the cognitive models that the lexical concepts afford access to. The links to other lexical concepts are liable to be activated with diverse structures and variable salience: new links can be extended, old ones fade away in dynamic scenes of constant re-organisation of their content and structure (Martin, 2007).

This work will be more concerned with the linguistic context rather than the situational context, e.g., “beauty” as part of diverse linguistic contexts such as “beautiful woman” and beautiful island” and so on. The representation and interpretation of the meanings of “beautiful”, to a greater or lesser extent, rely heavily on its associations with the concepts, “woman” and “island” and the demand of mappings they impose on each other.

In a nutshell, the main objective is to figure out how compositionality allows abstract concepts to have unique specifications and particular content and structure at a time which could qualify individuals to comprehend their meaning. Evans underlines the role of the sentential context in enunciating and narrowing down the complex and diverse content and structure,

> “the sentential context, which is to say the other words in the sentence, which serve to direct the sort of encyclopaedic knowledge that *open* provides access to. That is, while open has a large body of knowledge, in the sense of a sophisticated range of scenarios and events it can be applied to, what I will refer to as its **semantic potential**, sentential context serves to guide and narrow the specific sorts of knowledge that a given instance of *open* actually relates to” (2009:11)

This assumption makes up one criterion in designing two experimental tasks (see e.g., Wisniewski, 1996), a task which addresses abstract concepts individually, out-of-context (see experiment 1 and 2) and a task which tests how the meaning of a concept emerges from its combination with others (Experiment 3 and 4).

Before wrapping up this introductory section, it is instrumental to introduce briefly the theory of Lexical Concepts and Cognitive Models (LCCM) whose terminological repertoire and system of theoretical assumptions will be utilized to dig deep into the content and structures of abstract concepts.

The lexical Concepts and Cognitive Models theory stands out among the most recent approaches in cognitive semantics, aiming to provide psychologically sound explanations of how meaning is constructed, accessed and interpreted. In Evans' terms, LCCM

> "…… is concerned with investigating the relationship between experience, the conceptual system and the semantic structure encoded by language. In specific terms, scholars working in cognitive semantics investigate knowledge representation (conceptual structure) and meaning-construction (conceptualization). Cognitive semanticists have employed language as the lens through which these cognitive phenomena can be investigated" (Evans and Green, 2006:48-49).

As a theory of lexical representation and semantic composition, LCCM adheres to the basic guiding principles of cognitive approaches to semantics and mental grammar.

The theory takes its name from the two central constructs which reside at the core of LCCM's architecture: lexical concepts and cognitive models. It makes a number of principled distinctions (words and concepts; words and lexical concepts; lexical concepts and cognitive models). The phonological forms (words) encode lexical concepts which are characterised by their highly schematic nature, being abstracted from frequency of use. Such lexical concepts provide access to a range of cognitive models, or "cognitive model profiles". Cognitive models, on the other hand, encode knowledge that relates to entities and states in the world including socially shared knowledge which is enriched with subjective experiences. A lexical concept could afford access to a set of "primary cognitive models" and 'secondary cognitive models' which constitute its "cognitive model profile".

This paradigm, in my view, adds a new and fundamental contribution to the enterprise of cognitive linguistics. It has a seminal perspective on the interface between linguistic knowledge and non-linguistic knowledge. Meaning arises from the selection of contextually appropriate lexical concepts and their fusion of the knowledge structures they give access to, to achieve informational characterization or interpretation. LCCM theory accounts for the “inherent variation of meaning” (Evans, 2009: xi).

LCCM assumes that language is encoded by three levels of representation: disembodied phonological symbols, embodied linguistic and conceptual contents. Its perspective on embodiment is attached to Barsalou’s account of “Perceptual Symbol System” (PSS) and his later account, “Language and Situated Simulation” (LASS) with some differences.

This thesis builds on the claim that LCCM could adequately explain how people conceptualize abstract concepts. This assumption will be tested by designing multiple tasks (Denzin and Lincoln 2003; Yin 2003) to collectively shed light on the interwoven factors which are involved in the meaning construction and conceptualization of abstract concepts. The multiple-task design addresses more than one condition for the same phenomenon, seeking to provide an in-depth examination of the multiple conditions at work during the process of conceptualization.

To expose the interaction between compositionality and the semantics of abstract concepts, the analysis of the findings from the lexical decision tasks, where abstract concepts are being presented within variable complexity of compositional structures, will be instrumental. The tasks were to instruct participants to judge the informational optimality and plausibility of the meaning of some underlined abstract concepts. The compositional structures were presented onscreen as part of a linguistic context (2-word, 4-word and 6-word utterances). The role of utterances is to foreground the semantic content of abstract concepts and explicate how the individuals make judgments during the representation and interpretation of abstract concepts.

Response time (RT) was predicted to give definite answers to the assumptions made in this work. Such tasks may give reasons to verify and refine the assumptions LCCM makes about the underlying processes of meaning construction in general and the meaning of abstract concepts in particular.

To sum up, one indirect objective for this work is to examine, test and verify the theoretical assumptions and constraining principles involved in the process of meaning construction as exposed by Evans (2009) LCCM.

1.3. Statement of the problem

Abstract concepts reside at the core of human cognition, organising a considerable part of our subjective and cultural cognition. However, how we represent and structure the content of abstract thoughts in the mind is still a bit of a mystery. Mostly, the distinction between the concrete and abstract concept-types is made in relation to the presence and absence of the imagistic and perceptual representations that they may invoke in the mind of the conceptualizer. Despite the available research on abstract concepts, their inherent conceptual content and structure remain highly controversial. Consequently, we believe that addressing the conceptual content and structure of abstract concepts constitutes a fundamental question for the present work. How efficient we are when we represent, interpret and negotiate their meaning is a good motivation for our theoretical and empirical quest to gain a better understanding of their nature.

This work seeks to advance the understanding of abstract conceptual thoughts in terms of answering a number of questions. If answered systematically and adequately, the questions constitute as a whole a novel and promising account of the nature of the psychological content, structure and behaviour of abstract concepts. The vast part of literature was centred on words with concrete reference, but enough is there on the representation and interpretation of words with abstract reference. According to scope of this work, the main focus will be on the abstract concepts and the contribution of the semantic compositional property of language to their referential and conceptual transparency. There is vast literature available on the role of language with relative degree of convergence and divergence, yet it is unclear, as to what contribution language makes to the enunciation of (referential and conceptual transparency) particularly the structure of abstract concepts in particular context. Conceptual combinations are taken here as a minimum verbal compositional units which offers a minimum context to facilitate their referential and conceptual transparency. The minimal complexity of compositional structure, “Conceptual Combinations” is the main unit of analysis. Units line discourse lies beyond the scope of this study. However, single word units are used to enhance the description.

The previous research on the linguistic phenomenon, “Conceptual Combination”, allocated more focus onto the process of combination irrespective of what is combined. Without a systematic distinction between words and concepts, the understanding of the underlying process of the conceptualization of meaning in a combination remains highly obscure. One more theoretical challenge is the choice of a model which makes a systematic distinction between words and concepts and has a balanced focus on the roles of the linguistic and non-linguistic structures.

To the best of my knowledge, no similar research has covered the constructed questions (outlined in section 1.4.). In addition, similar works were mainly focused on Indo-European languages, therefore the other contribution of this work that fills the gap, is presenting an account of how abstract concepts are represented and interpreted by speakers of a Semitic language, i.e., Arabic. This will inspire further research of a cross-linguistic and cross-cultural analysis of the understanding of abstract concepts. Section 1.4 formally presents the research problem in a form of a set of questions.

1.4. Research Questions

Typically, abstract concepts are defined as those which are not concrete. One general intuitive thought is that abstract concepts, (e.g., dignity, conspiracy, dream, freedom, love, beliefs, God, etc.) differ from concrete concepts (e.g., chair, apple, tree, screen, body, etc.). It is worthwhile to ask, how could we represent, interpret and agree almost with little difficulty on the meaning of concepts under such variable referentiality and conceptual transparency? For concepts with referents that we can easily capture with our senses, the challenge does not seem to be significantly critical, but it seems very daunting if we consider abstract concepts. To unveil this matter, it becomes necessary to answer the questions:

1. What is the psychological content and structure of abstract concepts?
2. What makes abstract concepts in any way different from concrete concepts?

The aforementioned questions, then, focus on what constitutes the core conceptual content and structure of abstract concepts such as “honesty”, “recession”, “dehydration”, etc., and how do we represent in our minds. No doubt, the core content and conceptual structure of concepts such as “fish”, “car”, “bird”, etc., is perceptually-derived mainly due to the physical nature of their referents. Their referents have vivid imprints of their physical properties in our memory. They are easy to think of, represent and interpret. Similarly, some concepts like fear, pain, and disgust have some perceptual representations associated with them but with proportionally variable scale (Chapman, Kim, Susskind, & Anderson, 2009; Schnall, Haidt, Clore, & Jordan, 2008). Still, such concepts are categorised as abstract, similar to concepts such as “values”, “logic”, “honesty”, “recession”, “dehydration”, etc. A fine-grain distinction is needed to resolve such confusion by offering an answer to

3. Can abstract concepts be conceived as a unified and homogeneous category?

One intuitive observation about question 3 is that abstract concepts cannot be considered as a unified concept-type. Rather, we claim a heterogeneous, continuous and gradable membership typology: abstract concepts could be envisaged to constitute an approximate continuum with different degrees of abstractness. This pending claim necessitates a plausible definition of “*abstractness*” and some systematic experimental evidence to support the *heterogeneity, continuity and gradability* of concepts.

One ubiquitous means of explicating the psychological content and structures of human conceptual system is language use. One characteristic of any language is that its lexical items have the potential to combine (compositionality) into higher complexity units, e.g., phrases, utterances and discourses. This property helps licencing particular senses and "effectively delimiting which part of the encyclopaedic knowledge—the semantic potential—available to any given word is activated in any given utterance" (Evans 2009:23). The other question which can be added to the previous questions is:

4. How does language contribute to delimit the diversity and heterogeneity of the content and structure of abstract concepts?

Variation is a characteristic property of words' meaning. This variation is evidently manifested in language use. One possible explanation is that the meaning arises in the mind as a result of constructing coherent simulations, based on the interaction of our body with the external. According to (Barsalou, 1999; 2003 and Lakoff & Johnson, 1980, 1999) views on the representation of concepts, the conceptual processing is embodied and perceptual in nature (Barsalou's account will be discussed in detail in Ch. 2). Applying the theoretical assumptions of grounding and embodiment to the simulations of concrete concepts such as "car", the assumption seems very plausible simply because we keep high-resolution images or other perceptual knowledge-types for the referents in the memory. The retrieval of such mental images and knowledge-types proved to be faster.

However, the application of this assumption to concepts such as "values, logic, honesty, recession, dehydration, etc." seems very problematic because the process of tracking their referents is very complex at least for some of them. For the imagistic and perceptual representations which accompany a group of abstract concepts, e.g., "fear" it is still unknown whether they represent a constitutive part of their inherent content, or not. Do embodied and perceptual representations constitute a sufficient input for their referential and conceptual transparency during the processes of reference-tracking and meaning construction (see necessity and directness conditions in Meteyard & Vigliocco, 2008)?

So, abstract concepts pose a serious challenge to this view. Barsalou attempts to extend his explanation of the abstract concept "truth" to other abstract concepts. However, Barsalou's attempt to associate perceptual representations with abstract concepts such as "truth" did not make clear whether the perceptual content associated with "truth" could be construed in the same way the mental images of the physical entity, "car", could be involuntarily invoked upon thinking of the concept, "car". In other words, is it possible that we imagine some perceptual content for "truth" that we could perceive as its own?

To what extent, however, could abstract conceptual thought be grounded in bodily and sensory-motor information is an important theoretical question.

5. Are embodied and sensory-motor representations a constitutive part of the content of abstract concepts? Or do they only serve a facilitation function for abstract concepts' meaning construction and interpretation?

This work shares with Evans (2009) the argument that abstract concepts emerge as a function of compositions of different types of information: experiential information (sensorimotor, introspective and affective) as well as linguistic information. Evans strongly argues for a non-isomorphic stance on the content and structure of human concepts. Although the proposal of Vigliocco, Meteyard, Andrews & Kousta (2009) argues strongly for a fundamental contribution served by the linguistic content in the representation and interpretation of human concepts; yet, it does not say much about the underlying mechanisms and principles which guide this contribution. Evans bypass this gap by offering principled mechanisms for such contribution.

The above gives us plenty of reasons to believe that to address human abstract concepts; a selection of an adequate theoretical model which is capable of answering the outlined questions should be purposefully made. One necessity is to fill the theoretical gap in Vigliocco, Meteyard, Andrews & Kousta (2009) by offering some experimentally valid normative principles which guide the role of language system in the representation and interpretation of meaning. LCCM opens a wider window onto how linguistic and conceptual knowledge interact in a systematic and principled fashion. It makes available a repertoire of concepts, terms and tools derived from the most recent accounts in cognitive science that could be useful for addressing the above questions.

The last questions are mainly concerned with the adequacy and plausibility of Evans (2009) LCCM in accounting for human abstract concepts.

6. How theoretically adequate and psychologically plausible is LCCM theory in its account of abstract concepts in the same way it addresses concrete concepts?
7. What kind of role does LCCM attributes to language use in the representation and interpretation of abstract concepts?
8. How does LCCM perspective on referentiality and compositionality fit to the account of abstract concepts?
9. How does LCCM explain the difference between plausible and implausible abstract concepts?

To empirically address the content and structure of abstract concepts, a number of experiments were designed to derive answers for the aforementioned research questions.

1.5. Preview of the current dissertation chapters

This work falls into two parts, Part I and Part II, and nine chapters. Part I focuses on the theoretical background and the discussion of the main theoretical issues which allow the investigation and understanding of the abstract concepts. It is composed of four chapters. Chapter 1 introduces the main research themes, offering very brief and straightforward introductory remarks on the core themes of this research. It outlines the research questions, makes a statement of the problem and closes up with a brief preview of the chapters.

Chapter 2 discusses the main target “abstract concepts” in the light of a short review of the previous works and models. It seeks to come up with an adequate definition. A range of previous definitions will be critically reviewed. It develops a theoretical discussion on the possible route for the understanding of the nature of abstract concepts.

Chapter 3 puts together a background for the relationship between the meaning construction and interpretation of abstract concepts and language use. In this chapter, the minimal linguistic context, namely “conceptual combinations”, is placed under focus, “e.g. pet fish”. It reviews the literature which has addressed conceptual combinations and outlined a number of testable lexico-semantic features which can be utilized in the practical part of this dissertation.

Chapter 4 justifies the selection of the theoretical framework, LCCM, together with a detailed and critical review of its main theoretical assumptions. Chapter 4 raises some issues that need to be incorporated into the adopted model to adequately address the main questions outlined in Chapter 1.

Part II represents the empirical contribution of this work to the understanding of the abstract concepts. It falls into four chapters and a conclusion chapter. The four chapters address the claims that this work makes in part I. In chapter 5, four tasks were designed to address the heterogeneity and continuity of concepts based on a questionnaire designed for this purpose.

Chapter 6 attacks the conceptual structures and knowledge-type associated with the abstract concepts. The verbal encoding tasks (features listing and ranking) are useful means in this direction. Chapter 7 investigates the correlation between linguistic compositionality and the plausibility and informativeness of interpretations. Chapter 8 investigates the necessity of the embodied representations to the representation and interpretation of the abstract concepts. Each experiment ends with a summary of the statistical results and a general discussion. Finally, Chapter 9 is a general discussion and conclusion which builds on the statistical and analytical underpinnings.

Chapter 2
Abstract concepts

2.1. Introduction

This chapter expands the introductory exposition of chapter 1, exploring in-depth the unique nature of abstract concepts and their semantic richness. It highlights the relational nature of abstract concepts and the indispensable role of the linguistic and situational context in enunciating their content and structure. A wide array of literature on the understanding of abstract concepts will be reviewed to identify the theoretical and methodological gaps. This chapter develops a number of claims that serve as foundations for chapter 3 and 4.

One claim is that abstract concepts are characterized by coarse-grained content due to their diverse links (associations) to other concepts. Such associations have evolved over time at the individual and cultural level to achieve referential and conceptual transparency. Based on such semantic richness of the content and structures of abstract concepts (Recchia & Jones, 2012), it becomes systematically clear that abstract concepts should be addressed as a heterogeneous rather than a unified homogeneous category: "*Heterogeneity Claim*". They can only be accounted for in terms of graded continuum to incorporate their rich content and dynamic structures. This claim is referred to as "*Continuity Claim*"

The second claim is that, for their lack of well-defined referents in the external world (lack of referential transparency), their conceptual structures cannot become relatively clear without the help of the more stable representational structures. The abstract concepts have an inherent and ubiquitous need for a representational system which delimits, modulates and extends their conceptual structure to achieve the required conceptual transparency. Language referential and compositional properties allow this to happen.

It follows from this that the complexity of the compositional structure of language use could correlate significantly with conceptual transparency of abstract concepts. So, the claim is that a minimal linguistic context or a smallest complex compositional structure is required for such conceptual transparency to be experienced. This is referred to as the "compositionality claim". This compositionality issue could make a good case for making explicit a range of the linguistic processes underlying the enunciation and licencing a particular content and structure for abstract concepts in that context.

This chapter ends up by establishing that the selection of LCCM is crucial for describing the nature of the content, structure and behaviour of abstract concepts during meaning construction and interpretation.

2.2. Abstract Concepts: Nature and Typology

In this section, we seek to approach abstract concepts by finding a more comprehensive definition and plausible typology. In other words, it is my objective first to decide what makes concepts "abstract". The departure point for this mission starts with the conventional definitions discussed before (see section 1.2.1.). One common shortcut is simply to define abstract concepts as those which are typically not concrete. This requires two prerequisite requirements: the first requirement suggests that we need to know, (what is a "concept"?) in the first place and the second is that we also need to know (what makes a concept concrete?).

First of all, to the requirement of this chapter, I am inclined to deny any implication which may associate my perspective on concepts with a "*Fregean*" view which treats concepts themselves as abstract (see e.g. Glock, 2009). I fully attach myself to the Experientialists' stand. This view reads that concepts are perceived as mental particulars of subjective experience and a key constituent of the propositional knowledge[5] such as beliefs (see Margolis and

[5] The term "propositional" is not equivalent to the sense used widely in amodal theories of knowledge, but similar to the sense used in embodied theories (Barsalou, Yeh, Luka, Olseth, Mix, K. & Wu, 1993).

Laurence 2007). A clear definition of concept is required here to bring forth the second requirement.

Arising from the dualism of mind and body, concepts are mental representations which the mind develops via a process of abstraction. A system of concepts emerges as an outcome of this process. The system also involves the underlying classification and interrelations of such concepts. It can be envisaged as a network of individual concepts and assemblies of concepts. Concepts are organised in a hierarchical distribution to override the dynamic and redundant nature of the world (Frawley, 2005). The network of the acquired concepts makes up our knowledge-base of the world which we use to make sense of our interactions with the world. This also involves the interaction of the concepts with each other.

The other requirement relates to the understanding of what makes concepts concrete or otherwise abstract. A qualitative difference between concrete and abstract concepts has recently been proposed based on the nature of their content and structure (e.g. Crutch, 2006; Crutch, Connell, & Warrington, 2009; Crutch, Ridha, & Warrington, 2006; Crutch & Warrington, 2005; 2007; 2010). Rosen [6], quotes the American philosopher Paul Benacerraf, in highlighting this difference

> "The abstract/concrete distinction matters because abstract objects as a class appear to present certain general problems in epistemology and the philosophy of language. It is supposed to be unclear how we come by our knowledge of abstract objects in a sense in which it is not unclear how we come by our knowledge of concrete. It is supposed to be unclear how we manage to refer determinately to abstract entities in a sense in which it is not unclear how we manage to refer determinately to other things" (Benacerraf, 1973).

[6] Rosen, Gideon, "Abstract Objects", The Stanford Encyclopedia of Philosophy (Spring 2012 Edition), Edward N. Zalta (ed.), URL = <http://plato.stanford.edu/archives/spr2012/entries/abstract-objects/>.

Intuitively, the raw typology of concept-type commences primarily on the basis of referentiality. Without any doubt, the distinction between abstract and concrete poses challenging problems for the theories in philosophy of language and traditional linguistics – for instance, the conditional requirement of truth-conditions. However, such a requirement cannot be taken as a satisfactory touchstone for making a plausible distinction between the two. It does not give an adequate definition of the notion of "*abstractness*".

The problem with the distinction between concrete and abstract concepts takes different forms; however, the presence/lack of the spatio-temporal realisations often comes first (Liggins 2010: 67). Concrete concepts seem to be tightly linked to their referents in the external world or at least internally to the mental images in the memory. The conceptual structure of a concrete concept like "car" is very likely to be less variable for the vivid perceptual properties associated with its referent. According to Barsalou & Wiemer-Hastings, (2005), concrete entities are purely physical and spatially constrained. Consequently, this makes abstract concepts encode "entities that are neither purely physical nor spatially constrained". However, Wiemer-Hastings and Xu claim that taking "physicality as the distinguishing factor" between abstract and concrete is unsatisfactory simply because it fails to

> "account for graded differences in concreteness. For example, most people perceive scientist to be more abstract than milk bottle, but both are perceivable physical entities. Likewise, most people perceive notion as more abstract than ambiance, but neither is a perceivable physical entity" (Wiemer-Hastings and Xu 2005: 720)

Concrete concepts are abstracted from the modality-specific information (visual, haptic, gustatory, etc.) which we capture by our senses. They assemble, at least partly, around their psychological similarity (family resemblance). Members of the same assembly share minimum perceptual features. In her seminal work on categories, using tasks such as rating and property listing, Eleanor Rosch (1978), established valid evidences for prototype structures which she found to have a measurable effect on semantic processing as well[7].

Building on the assumption that referents of abstract concepts lack the physical properties and are "spatially or temporally unconstrained" remains problematic. There is a class of concepts which seems to occupy the middle space between concrete concepts and the highly abstract concepts. Their representation and interpretation are mediated by records of perceptual and internal states. Despite the fact that such records which arise during the experience of "fear" and "panic" are the same, yet their conceptual content is not the same, based on the different uses and co-occurrences with other concepts. It is implausible apparently to propose that the processed conceptual content of "fear" is all the same in dissimilar contexts, e.g., seeing a cobra, stopped by a policeman for not having insurance policy, hearing a sound in a dark haunted house. The perceivable states which co-occur with the experience of "love" such as being sweaty or nervous, heart racing, or feeling of satisfaction and comfort in the presence of a loved partner are not the same as love but come as causal states of its experience (Damasio 1994; 2000; Prinz 2004). This gave a good reason for Altarriba, Bauer & Benvenuto, (1999) and Altarriba & Bauer (2004) to claim that concepts expressing internal states, e.g., fear and sorrow make up a subcategory in the middle between concrete and abstract concepts.

The conceptualization of this class of concepts is shaped by the individuals' subjective experience. A seminal research by Dunabeitia, Avilés, Afonso, Scheepers & Carreiras, (2009) revealed that the concepts such as "smell" or the "scent", have been found to be categorised as abstract, yet cooks particularly have shown high level of agreement on rating "smell" as concrete.

[7] The theoretical basis of my experimental work is that if this basic set of task can be replicated for abstract concepts to bring about evidence that they do constitute a special case in many ways. Abstract and concrete concepts are selected from established norms in which people rate them on a scale from one to seven, moving from abstract to concrete respectively (Paivio, 1986).

Verbs such as “to write” may assume high concreteness scores because this action concept explicitly involves our motor system, holding a pen or pressing buttons on a keyboard. The matching nouns “writings” or “composition” pose a big deal of convergence. In the same way, the concepts “team”, “nation”, “system”, “race”, “government” should be considered as concrete, primarily for the high imageability of their referents: we can easily see as well as imagine, the causal effect of their presence, hear the noise they cause, see their grouping, etc. still however, not every group of individuals necessarily constitute a team/ government/nation/ etc.

It is worth to underline that the conceptual structure of “love” in “God’s love for mankind” and “pet’s love for owner”, tends to be partially or wholly culturally configured. Sinha, (2009) rightfully argues that the conceptualizations of abstract concepts representing psychological states, social values and norms, e.g., “fear”, “love”, “pride”, “generosity”, etc., seem to be governed partially or wholly by bio-culturally evolved models and mediated by language.

Concepts like “ghosts”, “elf”, “angels”, “God”, “Hell”, “paradise”, “atoms”, “Santa Claus”, etc., were rated as abstract concepts, yet seem to involve an array of perceptual, imagistic representations, or spatio-temporal configurations. Such concepts are characterized by having a range of perceptual records, nevertheless assume high abstractness scores (Paivio Yuille & Madigan, 1968: 3). Cultural models (Holland & Quinn, 1987) seem to frame most of the content of such concepts. Cultural models are composed of cultural knowledge which is accumulated over time on diverse cultural domains like marriage, politeness, religion, moral values, etc., via the numerous experiences shared by the members of that culture. A cross-cultural effect is also possible.

Finally, Hastings and Xu (2005: 731) observed that a range of concepts (e.g., idea, theory, meaning, temptation, right, mood, possibility, curse, etc.) seems to be associated with no images of any sort for “a few participants had extreme difficulty generating properties” for them. In conceptualizing such abstract concepts, the individuals seem to move back and forth between the stimulus (lexical items) and their previously acquired knowledge, and end up relying heavily on the linguistic system. Extending associations to other lexical items serves to frame the meaning of concepts, particularly when the conceptualizer fails to fetch enough perceptual features for their referential and conceptual transparency (Iyengar, 2010). Highly abstract concepts evolve more association-based content over time, mostly with the help of language use. In such instances, the conceptual content associated with a given abstract concept is not inherent to the concept itself but part of its co-occurrences with other lexical items (Kintsch, 1998; Scheufele & Scheufele, 2010).

The above examples give us every reason to conclude that the sensory-motor information, captured by our senses, is critically insufficient for making clear-cut distinctions. This also illuminates how indeterminate the boundary is between concrete and abstract concepts. Third, it provides evidences for the claim we make on concepts' continuity.

The scene becomes even more intricate when we go beyond the context of single concepts into a higher complexity of symbolic units compositionality, where concepts are fused with the help of the compositional property of language to make up complex meanings. In an utterance like "to reach a knob", the action of "reaching" has both a motor element (actual muscular movements of reaching) as well as different perceptual constituents (what the knob looks like, how far it is, the direction of movement, what is the reachable part of it, and so on), therefore it is likely to be perceived as concrete. Yet, "reach" can turn out to be completely abstract expressing fictive motions, as in "to reach a deal" where it does not involve any motor actions at all (Talmy, 1988; 2000; see also "time is running out"). It is even more confusing to rate the abstractness of conventionally lexicalised idioms like, "kick the bucket", "kicking off the year", or "spill the beans" (Aziz-Zadeh, Wilson, Rizzolatti & Iacoboni, 2006).

The above discussions necessitates that a systematic typology of abstract concepts by identifying some criteria for fine-grained classification for them (see Section 2.2.1).

2.2.1. Typology

In this section a number of dimensions needs to be identified to come up with a possible classification for abstract concepts. Such dimensions are based on the inherent characteristics of the conceptual content of this concept-type.

i. Concepts Individuation

The individuation of concepts is a rational process which results in assimilating newly encountered concepts with the previously acquired beliefs. The assimilation requires sanctioning the shared features and their relations to construct coherent wholes. Belief-systems constrain the process of individuating newly abstracted concepts or new content. According to Edwards (2010), the role that the belief-systems play in the representation of abstract concepts constitutes a benchmark for the typology of concepts. Individuation arises from the following underlying processes:

a) Reflection

People often engage in reflective reasoning which is a form of critical thinking. Halpern (1996) describes the underlying embedded processes and strategies in reflective reasoning:

> "... the use of those cognitive skills or strategies that increase the probability of a desirable outcome...thinking that is purposeful, reasoned and goal directed - the kind of thinking involved in solving problems, formulating inferences, calculating likelihoods, and making decisions when the thinker is using skills that are thoughtful and effective for the particular context and type of thinking task. Critical thinking is sometimes called directed thinking because it focuses on a desired outcome."

The outcome of this reasoning is accumulative as it builds on something, rather from scratch. Reflective reasoning pays careful consideration to previously acquired belief or knowledge. By doing so, the individuals make sense of newly encountered information. It also allows supporting, extending, modifying or possibly refuting the existing knowledge. This leads the individuals to become aware of and actively control their knowledge – judge what they know, foresee what they need to know, what is missing and how they bridge that gap – during knowledge acquisition situations.

Language use lies at the core of the reflective mode of reasoning. The individuals may acquire the conceptual structure of an entity in the external and mental worlds to which no direct accessibility has been achieved. Even though, reflective conceptual content is inferentially grounded in the previously acquired encyclopaedic knowledge and belief- systems, “a reflective concept, however, may or may not involve an endorsement of the content” (Horsey 2006: 170), for a mismatch is always possible. The content of the concept “recession” mostly originates from someone (for instance, a newspaper column writer or economic analyst on TV, etc.). The content of “recession” is accessible to the conceptualizer only indirectly, i.e., through language use and other illustrative visual aids. All that the conceptualizer knows is what the writer or analyst linguistically represents about the global recession. Rational inferences and language use mediate the content of the reflective abstract concepts by metaphorically extending the abstract content to the physical process, for instance, by relating (“bubble”, “declined growth” and “recovery”, etc.) to “recession”. Science concepts can be reasonably perceived as reflective due to the fact that they evolved via theoretical inference and coaching: e.g., atom, “inflation”, oxidation, vitamin, mirror neuron, cognitive models, which entertain deference to expertise “deference to experts involves endorsing whatever the content of the expert’s concept is (Ibid). In this way our encyclopaedic knowledge and belief-systems evolve.

b) Imagination

Here, I would add another conceptual correlate that is “imagination”. This sub-class of abstract concepts implicates active involvement of our imagination. It can be an irrational process which makes it different from reflection-based outcomes. The structure the hybrid blend of the conceptual content of this sub-class is organized schematically and the bigger part of it originates in the external world, but the referent hardly exists. Originally, the entities and people like Superman, Hamlet, Kung Fu Panda, Sinbad, the Pokemon characters, etc., do not exist except in the head of those who created them. I refer to those as the "*fictive abstract concepts*"[8].

In this way, it becomes possible to fit in the imagined entities which (Evans, 2009) included within the denotational reference. Language referentiality has the capability of indexing physical and imagined entities. In this way, the imagined referential sub-class should detached from denotational reference.

ii. *Intuition*

Intuitive concepts are "innately pre-formed, unanalysed abstract concepts" (Sperber, 1996; 89). This makes them need no testimony or attribution. Intuitive concepts, "love", "anger", "pride", "fear", "respect", "pain", etc., evolve out of internal states and subjective beliefs. The line between such an array of concepts and highly reflective concepts is not clear.

The perceptual records and internal states are predominantly characteristic of the representation and interpretation of intuitive concepts. Gygax, Garnham & Oakhill (2003) proved that readers of texts with intuitive concepts usually activate perceptual records similar to those they actually show during the actual experience of psychological states without the need to process the deep, complex conceptual representation. Bio-culturally evolved belief-systems plays a guiding body of configuring the structure of such concepts.

iii. *Deference*

Deference is another criterion for abstract concepts classification. Here, the possession of the conceptual structure of this class of abstract concept can be ascribed to the conceptual systems of others by virtue of deference. Fodor (2008b: 88) explains that "deference to 'experts' [...] belongs neither to

[8] The term is used analogously to Talmy's concept of "fictivity".

semantics nor to (cognitive) psychology, but to the pragmatics of linguistic communication". Individuals may possess knowledge of an abstract concept, e.g., "Venus", "love goddess", "genie", "resurrection" or "unicorns", etc., and believe in them as a form of deference for people who believed in them in the past. The rationality and plausibility of the content of such of concepts is based on attributing it to other's beliefs (the perceiver may or may not share such belief). Moral concepts can be reasonably perceived as deferential due to the fact that they evolved via cultural transfer.

iv. Linguistic Associations

The last criterion relates to the compositional property of lexical entities in enriching the content of highly abstract concepts. For this class of concepts (e.g., idea, theory, meaning, temptation, right, mood, possibility, curse, etc.) the linguistic content seems to be the main source of content, for they have no images associated with them. In conceptualizing such abstract concepts, the individuals seem to move back and forth between the stimulus (lexical items) and their previously acquired knowledge, and ended up relying heavily on the linguistic system. Evidently, the trajectory of their acquisition is a lexical entity we heard for the first time when we were children. The more uses in which they occur, the richer their content becomes. Extending associations to other lexical items serves to frame their meanings.

2.3. Previous Models of Human concepts

There are a number of models which have been proposed mainly to account for the ways in which humans represent, conceptualize, and make sense of concepts. Two main lines of thinking exist on the content and structure of human concepts. The two lines disagree on the representational content and format of abstract concepts[9]. The first line proposes the existence of purely symbolic (amodal) while the other assumes a richer perceptual (modality-

[9] Sandra (1998) proposes a distinction between 'representational content' (i.e. what is represented in the mind) and 'representational format' (how this content is represented mentally or even physically).

specific) representations which arise from the interaction of the body with the external world

Traditional models on human knowledge representation claim that knowledge is stored as amodal symbols and the semantic representations are disembodied and modality-independent. In other words, “the representational format of a concept is qualitatively different from the sensory experiences which concepts relate to.”(Evans, 2012). Amodal perspective is inspired by the predispositions of the analytic tradition of philosophy of language where human concepts are analysed via disembodied, non-experiential, and formal models. Concepts were conceived as mental entities which are made up of arbitrary symbolic representations (Fodor, 1975, 1987). Referentiality, accordingly, is achieved by the correspondence between the system of abstract symbols and the entities (the objects and events in the world) (Fodor, 1975; Pylyshyn, 1984; Jackendoff, 2002). In this section, the amodal perspective on human concepts will not be taken further, simply because the interest of this work is mainly in the modal-specific experiential perspective only (see section 2.3.2). Two lines of research will be discussed

2.3.1. Behavioural models

Biased by the thrilling interest in making an empirical contribution to the understanding of abstract concepts (see Part II), the behavioural research on abstract concepts will be introduced first in this work section. The initial perspective of this work, on abstract concepts, was shaped by two cognitive linguistic models, namely, Cognitive Metaphor Theory (Lakoff & Johnson, 1980, 1999) and Perceptual Simulations System (Barsalou, 1999). The main discussions will consider these two accounts the most. Other models will be quoted, in the meantime, to seek evidences of behavioural and neural patterns for the nature of abstract concepts.

2.3.1.1. Dual Code Theory

Paivio's "Dual Code Theory" was originally a general accounts on human cognition and memory, but its applicability was extended to explain the representational content of abstract concepts (Paivio, 1971, 1986, 1991; Paivio, Yuille, & Madigan, 1986). Research under the tenet of Dual Coding Theory mainly used words as stimuli: the subjects were given a list of words which they have to read/think about and then rate them in terms of a scale of "imageability" and "concreteness". This is a good reason to conclude that their findings would be better understood as models of memory than meaning construction.

One fundamental notion of the architecture of Dual Coding Theory is the "concreteness effect". It was primarily focused on putting concrete concepts as its point of departure for the understanding of abstract concepts. The "concreteness effect" is taken to signify the role of sensory-motor (imagistic) representations in the distinction between the processing of concrete and abstract words (Connell & Lynott, 2012). This theory underlined the finding that concrete concepts are processed faster than abstract concepts in a lexical decision task (Kounios & Holcomb, 1994; Kroll & Merves, 1986; Schwanenflugel & Shoben 1983) and recalled better in free recall tasks (Nittono, 2002; Paivio, 1986).

This theory proposes that there are two independent systems underlying the cognitive processing; verbal and imagistic systems. Therefore, Paivio, (1986, 2007) states that the reason why the processing of abstract concepts differs from that of concrete is because they recruit two distinct representational brain systems. The concreteness effect of concrete words arises from an extensive activation of sensory-motor representations. The knowledge-types encoded by concrete concepts are primarily derived from the modality-specific information (visual, haptic, gustatory, etc.). The verbal system assumes a secondary function. On the other hand, the processing of abstract words is heavily reliant on verbal representations mainly which are associated with activations of the language-dominant left hemisphere (Paivio, 1986;

Pulvermüller, 1999). The content and structure of abstract concepts are derived solely from the verbal system (Kounios, 2007; Prinz, 2002).

The basic units of the imagistic system are referred to as "*imagens*". Imagens are characterized by parallel and distributed activation of imagistic representations. The units of the verbal system, which underlie our use of the word, are referred to as "*logogens*". They are characterized by sequential activation of linguistic representations. The representational codes of one system may outweigh the codes of the other system; but, yet the two codes often overlap in the processing of information.

Their paradigm design was based on presenting the subjects with stimuli to rate according to a number of lexico-semantic features, e.g., concreteness, familiarity and imageability ratings, where the response time RT was computed. The subjects' responses were found to take longer RT when the stimuli are verbal than when the task is pictures-based. The difference in response time signals the existence of two distinct but interconnected systems (Paivio, 1986). Concreteness rating, using a Likert scale, relates to whether the referents associated with the stimuli are perceived as concrete or abstract. Familiarity is to derive judgments on how easy it is for the respondents to recognize the stimuli. Imageability is defined as the ease with which a word gives rise to a sensory mental image (Paivio, Yuille & Madigan 1968).

Abstract concepts, as this model proposes, are processed and retrieved in terms of associative networks of words. Accordingly, abstract concepts are more difficult to process and take a longer response time. Our understanding of some abstract concepts, so far, does implicate that they are represented mainly with the help of language use but not at the expense of sensory-motor representations. Our question is whether the latter type of representation is inherent or simply non-constitutive (facilitative).

Dual Code Theory has received considerable support from ERP and fMRI neuroimaging findings. Based on the patterns of neural activation during processing of the stimuli, the conclusion was in favour of the existence of dual systems rather than a unified system (Adorni & Proverbio, 2012; Binder et al 2005). Yet, on the other end, there remain an array of results which make it hard to incorporate this account (Kousta et al. 2011; Pexman et al. 2007).

Not much was said about the “logogens” and how they give rise to meaning. However, the most interesting proposal we credit Paivio’s model for is its acknowledgment of the linguistic dimension of the content of abstract concepts. However, the deployed empirical tasks were inadequate to characterize the nature of the contribution of the linguistic content. Furthermore, the conceptual content of a lexical item like “truth” cannot be sufficiently measured simply by rating it according to familiarity, concreteness and imageability. The information that such rating tasks explicate is essential but remains very crude.

One interesting finding of the rating tasks, I should quote, is that “Ghost” scored relatively as high as (5.37) on a seven point scale of imageability, but had a concreteness rating of 2.97 (also on a seven point scale). This shows that words can be highly imageable without being concrete (Paivio, 1968: 3). The cases of “shadow”, “phantom” and “ghost” and many others constitute one sub-category of abstract concepts which violates the assumption that abstract concepts lack the perceptual information and contradicts the claim of Paivio’s original theory.

Crutch, Connell, and Warrington (2009) claim that for a profound understanding of the meaning construction of abstract concepts, the tasks should invest more in exploring their associative relations. Response time (RT) may seem a valid and efficient technique to underline the existence of the two systems; however, such tasks alone seem to be insufficient to make conclusive claims on the duality of systems.

In this work, RT is also incorporated as a measure of the associative relations and structural hierarchy of the content and conceptualization of abstract concepts. Features listing and ranking task should measure the role of language system in the representation and interpretation of abstract concepts.

The meaning of single concepts remains impoverished without a context which relates them to other concepts, i.e., the co-occurrence and co-activation (Shah, Kwak, Schmierbach, & Zubric, 2004). The role of language in making available a richer context is crucial for concepts' conceptualization at the informational level. It allows concepts to extend more relational associations to incorporate more information to activate the necessary content for the referential and conceptual transparency (Wilson-Mendenhall, Barrett, Simmons & Barsalou, 2011). Recently, the work of Wilson-Mendenhall, Barrett, Simmons & Barsalou (2011) addressed the abstract concept "observe" as part of physical and social context of threat scenarios. Their work has neurological implications. They investigated the patterns of activation associated with the concept "observe" within physical and social scenarios of threat. The concept has elicited different activation profiles under different linguistic contexts (physical and social in this case). Their conclusion was that in different situational contexts, the same abstract concept is processed differently. Similarly, based on their dynamic causal modelling, action-related sentences (e.g., "Now I push the button.") or abstract sentences (e.g., "Now I appreciate the loyalty"), Ghio & Tettamanti (2010) were convinced that the situational knowledge is central to the way individuals assign conceptual content to abstract concepts. Eventually, this and many other evidences give us a reason to fundamentally believe that the semantics of a given abstract concept can be constrained by its involvement in language use.

2.3.1.2. Context-Availability Model

The Context-Availability Modal is another behavioural model which came as an alternative model for cognition and memory. As it has been stated in section (2.3.1.1), dual-coding theory demanded that the processing of concrete concepts assumes both verbal and imagistic representations, while abstract concepts are only coded in by one system, i.e., the verbal system. This necessitates that concrete and abstract concepts should have different activation patterns at the cognitive and neural levels being at work simultaneously (Zhang et al., 2006). On the other hand, the context-availability hypothesis (Schwanenflugel, Harnishfeger & Stowe., 1988) proposes that both concrete and abstract words should have access to the same neuronal structures.

Then Context-Availability Model suggests the existence of single “semantic system” (see Kieras, 1978). This implicates that the information from the linguistic and situational context during the comprehension of concepts must be accessed and processed by a unified semantic system. The main difference between the abstract and concrete concepts arises from the tendency of abstract concepts to build a multitude of semantic associations with other concepts. To put it differently, the comprehension of abstract concepts requires high availability of contextual information to acquire more associations to the sensory-motor knowledge structures of other concepts, stored in semantic memory.

The context availability is a good predictor of the familiarity and concreteness effects (Wiemer-Hastings, Krug and Xu, 2001). Results from the rating tasks have shown that the more contextual information is available for the concepts during processing, the higher imageability rating such concepts score. A familiarity effect in these experiments is defined as a subject's ability to respond more rapidly to a familiar stimulus than to an unfamiliar stimulus (Ambler & Proctor, 1976). The “concreteness effect” is taken to signify the role of sensory-motor representations (imagistic) in the distinction between the processing of concrete and abstract words (Connell & Lynott, 2012). What interests this work most is the main theme of this model, i.e., the source of the contextual availability. Contextual availability can be a function of the physical world (being physically in direct contact and having a good exposure to the situation) or a function of the linguistic context in making available the informational availability. We are more interested in the compositional property of language which serves the comprehension of abstract concepts by making available the required contextual information.

Despite the explanatory power of Schwanenflugel & Shoben's context-availability model, it offers insufficient explanation why concrete words assume greater inherent contextual availability whereas abstract words demand it from other linguistic and situational contexts. It hardly explains the nature of the mechanisms of context generation during processing. More focus could have been allocated to language use. Most importantly, words and concepts have been used interchangeably with no systematic distinction between the two. Both Dual Coding model and Context-Availability fail to resolve a major debate in the psychology of language and meaning; namely, whether concreteness effect arises due to the ways in which words are used in language or whether they reflect qualitative differences in their semantic content. To be fair to this model, Context-Availability model could be taken as one step forward in the way for the emergence of the grounded cognition models of human concepts.

2.3.2. Experiential models

The Experientialists perspective, on the other hand, maintains that human conceptual knowledge is modal-specific in nature, in the sense that our conceptual representations are derived from the interaction of our perceptual system with the external world. The mental representations of abstract concepts, therefore, assume modality-specific format (e.g., Barsalou, 1999; Gallese & Lakoff, 2005; Glenberg & Kaschak, 2002; Zwaan, 2004).

The departure of this perspective is that our sensory-motor, affective and introspective experiences serve and determine the way people think about concepts. Our conceptual knowledge is grounded in our bodies' interaction with the external world. Sensorimotor information is deposited in visual, auditory, and motor memory centres of the brain and becomes activated during the conceptualization of concepts. Mutual agreement on the concept "water" arises from our collective perceptual experience of "water": we can taste it, see its colour, feel its wetness by touching it by our hands, drink it, etc. It can be easily simulated simply by activating such perceptual features.

For concepts like “pain” or “sorrow”, the individuals retain some perceptual records and experience particular internal states, yet they are classified as abstract concepts for there are hardly any possible referents available to their exteroceptive senses. The perceptual records and internal states attributed to intuitive concepts such as “love” are not enough to conclude that they are inherent to their conceptual structure. This is simply because the same perceptual records and internal states are shared by distinct abstract concepts. For instance, increased heart beats, sweats, facial patterns can accompany both fear, love, anxiety, etc.

Other class of abstract concepts have no such perceptual records. Peculiarly though, a relatively similar agreement does exist on the meaning of the abstract concepts, “idea, rights, rules, secrete, anniversary, variable, majesty, intelligence, etc.”, despite the fact that we have no direct perceptual experience whatsoever or any clear referents in the external world. So, how could the experiential models explain such subclass in the light of the interaction between the body and the world?

Utterances such as “to reach a deal”, “time is running out”, “kick the bucket”, or “spill the beans” are conceived as vehicles for abstract concepts, due to the intuition that their meanings are not constructed via the literal sense of the words, i.e., they are metaphorical (Lakoff & Johnson, 1980). Metaphoricity is motivated by the need to achieve the necessary concreteness (grounding) effect for the target concept. On the other end, the source concept affords a number of attributes to be mapped according to the target concept’s demands. In this way, the source concept serves as context for the target concept through associations which can be subjectively as well as culturally determined.

Conceptual metaphor theory represents an elegantly designed model which could explain the concreteness effect, the representation of abstract concepts by proposing a number of image schemas as a grounding structure for their content. Despite their descriptive power, image schemas are also limited (section 2.3.3.1).

The other class of models which accommodate the sensory-motor representational content and structure suggest that abstract concepts can be represented in the form of simulations of situations or events (Barsalou, 2008; Barsalou & Wiemer- Hastings, 2005; Glenberg & Robertson, 2000). To create the optimal concreteness effect, simulation seems a more plausible and comprehensive alternative for conceptual metaphor. One reason for such an assumption is that the simulation process offers more global and continuous context as well as extends diverse semantic relations for a given concept. Such grid of connections takes the form of an interrelated and coherent network of cognitive models, frames, constellations of features and concepts clusters (Scheufele & Scheufele, 2010; Shah, Boyle, Schmierbach, Keum, & Armstrong, 2010; Tewksbury & Scheufele, 2009; Ruigrok & van Atteveldt 2007). For instance, in "to kick the ball", the meaning of "kicking" primarily arises from its integration with information from "the" and "ball" and secondarily from other elements, such as the one embedded in the thematic roles "players", etc.,. The information about the spatio-temporal configurations constitutes a global network (context) to provide a coherent interpretative backdrop for comprehension (Matthes & Kohring, 2008). The more links which extend from a given concept in a semantic network, the higher referential and conceptual transparent its meaning is (Shah, Boyle, Schmierbach, Keum, & Armstrong, 2010). The nature of such semantic network, for "kick the ball" differs significantly from, for instance, that in an utterances such as "kick the habit" or "calculate chance elements".

Based on predictions from research in linguistics (Lakoff, 1987; Langacker, 1987; Talmy, 1983), especially from research on grounded cognition (Barsalou, 1999; Glenberg & Robertson, 2000), the abstract conceptual contents and structures associated with words were expected to be automatically activated during language processing (Richardson, Spivey, Barsalou, and McRae, 2003). Conceptual metaphor models and simulations models made seminal attempts to explain human abstract concepts; however, they couldn't offer a conclusive account of whether such perceptual structures are inherent to the content of abstract concepts or not. The diversity of their content and complexity of their conceptual structures rendered the task of fitting them in the account of such obviously very hard.

The above discussions illustrate how abstract concepts pose a serious challenge to the assumptions and empirical results associated with grounded approaches to cognition. This leads us to question the nature of the contribution of the sensory-motor, embodied, introspective and affective representations and how they serve the meaning construction of abstract concepts. To put the question differently, are sensory-motor, embodied, introspective and affective representations integral and constitutive parts of the content and structure of abstract concepts or just a part of the simulation which facilitates the enunciation of their meaning? In section (2.3.3.1) and (2.3.3.2), the two models, conceptual metaphor theory and simulation theory will be addressed in detail.

2.3.2.1. Conceptual Metaphor Theory

The goal of this section is to understand the contribution of conceptual metaphors to the understanding and grounding of abstract concepts. Conceptual metaphor theory claims that metaphors are fundamental to the structuring of our thought and language. Lakoff and Johnson (1980: 3) argued that "our ordinary conceptual system, in terms of how we both think and act, is fundamentally metaphorical in nature". Lakoff also argued that, "[m]etaphor is the main mechanism, through which we comprehend abstract concepts and perform abstract reasoning." (1993:203).This means that metaphorical construction is a dominant cognitive tool for the conceptualization of human abstract concepts to compensate their lack of sensory-motor or perceptual properties (Boroditsky, 2000; Lakoff & Johnson, 1980, 1999).

Metaphorical structure is a fundamental strategy which comes to mediate the meaning of abstract concepts' by structuring our conceptualization in terms of "a conceptual mapping from one semantic source domain [perceptually rich: war] to another semantic target domain [abstract: argument]" (Santa

Ana, 1999:194) where “we borrow the embodied conceptual structure of the familiar domain to make sense of the target domains” (Santa Ana, 1999, p. 194). Ungerer and Schmid (2006) read the process of metaphorical mapping in the following way,

> “the metaphorical mappings are derived from more general classes of objects, living organism and human beings into which we divide the entities in the world when we look at them. We understand abstract categories in terms of these general classes, because the specific way in which we interact with instances of the three classes is extremely familiar to us, and this interaction provides the source for the metaphorical mappings” (p. 126-127).

The mapping of the abstract conceptual domain (target) being mapped onto a more concrete conceptual domain (source) is often reflected in some kind of representational system, e.g., language use, body postures and facial gestures. However, they wrote that “[t]he locus of metaphor is not in language at all, but in the way we conceptualize one mental domain in terms of another” (Lakoff, 1993: 203). Acknowledging the fact that linguistic system is in many ways active in promoting embodied thinking to maximize the informational optimality for the representation and interpretation of abstract thinking.

The point of departure of the assumptions of conceptual metaphor is the existence of two categories of conceptual domains: concrete and abstract. The distinction between the two is schematic.

1. Concrete domains, those conceptual schemas which derive directly from our embodied interaction with the physical and social world
2. Abstract domains, those schemas which associate with no such perceptual experiences.

Embodiment lies at the core of the theoretical architecture of the conceptual metaphor theory. The perspective of Embodied cognition assumes that our conceptual system is grounded in our bodily states, body-based simulations, and situated action (Barsalou, 1999; Barsalou, Simmons, Barbey, & Wilson, 2003; Decety & Grezes, 2006; Glenberg & Robertson, 2000; Gibbs, 2006; Fogassi, Rizzolatti, Casile, Giese, & Their, 2012; Zwaan, 2004). Embodiment renders into image schemas as a form of organizing structures which are imposed on thought and language (Fauconnier, 1994; Gallese & Lakoff, 2005; Johnson, 1987; Lakoff, 1987; Langacker, 1987; Mandler, 2004). The embodiment hypothesis also contends that these structures inhere vivid spatial relationships (directionality, organisation or orientation) into metaphoric representations. As a result we come to understand much of what appear to be abstract via metaphoric structures and relationships:

> "…there is directionality in metaphor, that is, we understand one concept only in terms of another. Specifically, we tend to structure the less concrete and inherently vaguer concepts (like those for emotions) in terms of more concrete concepts, which are more clearly delineated in our experience." (Lakoff and Johnson, 1980: 112)

Metaphorical structures are deeply woven in our thinking which makes them almost non-discernable. In his original words, Lakoff argues that "metaphor allows us to understand a relatively abstract or *inherently unstructured* subject matter in terms of a more concrete or at least a *more highly structured* subject matter." (1993: 244; italics added). This relates to the assumption that image schemas guide and facilitate the structuring the content of abstract concepts via metaphor (Johnson, 1987; Lakoff, 1990). It emphasizes that to understand inherently unstructured abstract concepts, such as "argument", some cognitive structures must be ascribed to it by more highly structured experience such as "war", "building" "container" and "journey" (see 2.1).

2.1.

a. In the end, he won the argument.
b. It was a well-constructed defensive argument.
c. In their argument, they chose to attack below the belt. The argument had no foundation.
d. He is madly in love.

e. Love had wings, it flew so quickly.

A number of mechanisms are suggested to link the two bodies of conceptual knowledge such as conceptualization, mapping, categorisation and inference. However, it is unclear how conceptualizer makes the choices, i.e., how they decide which one is informationally more optimal than others. As we can see, the number of concrete concepts – FIGHT, JOURNEY, BUILDING, VICTORY – were used to structure our understanding of the abstract concept "ARGUMENT". This makes the scene more challenging. Here, more than one coherent scenario is possible for the concept, "ARGUMENT". Metaphorical structures could offer a number of different organizing structures for the very same abstract concept. Mundane expressions, such as

(2.2.)

a)	She can't live without LOVE	(LOVE IS A NUTRIENT)
b)	this is the first station for their LOVE	(LOVE IS A JOURNEY)
c)	LOVERS are one soul alive in different bodies	(LOVE IS A UNITY OF PARTS)
d)	He is madly in LOVE	(LOVE IS A CONTAINER)
e)	LOVE burned his heart	(LOVE IS FIRE)
f)	LOVE drives me crazy	(LOVE IS MADNESS)
g)	LOVE is to give more than to take	(LOVE IS A BUSINESS EXCHANGE)
h)	Their LOVE dragged them astray	(LOVE IS A NATURAL FORCE)
i)	LOVE is either bitter or sweet	(LOVE HAS A TASTE)

Looking at the examples in 2.2, we have many reasons to believe that the concept "LOVE" can be envisaged to be structured by diverse structures of concrete conceptual structures due to the multiple metaphorical organisations it can accept. For example, saying to my partner something like, "This is our first station of LOVE"; I must have (LOVE as a JOURNEY) in mind. To highlight how important "LOVE" is, "I can't live without LOVE" and how it tastes for some people "LOVE is either bitter or sweet". The metaphorical structure (LOVE is a NUTRIENT) and (LOVE HAS A TASTE) are used respectively to structure the same unstructured conceptual content of "LOVE". I might say "I am madly in LOVE" and "She drives me crazy" to ascribe the intensity of the state of LOVE, using (LOVE is a FLUID in a CONTAINER) and (LOVE is MADNESS) respectively. To specify the ideal perspective on how

LOVE should be, one might say "LOVE is to give more than to take", its nature is mapped onto a more concrete schema (LOVE is a BUSINESS EXCHANGE). The expressions "war" and "fire" are used to bring about something about when LOVE goes wrong (for an overview, see Kövecses, 2010). Too many distinct metaphorical structures are available for the same concept.

As we stated previously, all of such metaphorical structures involve schematic organisation which incorporates notions of object, space, motion, and force. Such schematic structures are mapped onto the coarse-grained structures of abstract concepts.

Murphy (1996) proposes that metaphoric structuring has one of two interpretations: *strong* and *weak*. The strong interpretation implicates that abstract concepts have no conceptual structure at all; rather, they can only be understood via reference to a source domain conceptual structures. The concept of "Love" is understood by reference to "fire", "head" and "madness". This entails that the individuals become much more occupied with searching their knowledge of "heat" than to think about "love" itself (p. 177). This could lead to one of the following two conclusions: the concept "Love" either shares the conceptual content of "fire", or has no or little conceptual content of its own. If they share the same conceptual content, this makes them synonyms. The abstract concept, "love", in itself becomes a problem as the conceptualizer needs "at least a minimal independent representational theory" to prevent "*referential intransparency*" where the individual would be "conceptually incapable of distinguishing between them" (McGlone & Manfredi 2001: 94; see also Keysar & Bly, 1995). In more extreme cases, the source domain itself is abstract to some degree, e.g., in the case of (LOVE IS MADNESS), the use of the metaphorical reference, "madness", complicates the scene as "madness" itself needs another organizing structure to be conceptualised. This may leave us with *serial* metaphorical structuring.

The weak interpretation suggests that abstract concepts have some conceptual content, then we need to identify and define it. The weak interpretation, as Murphy (1996) proposes, suggests that there are distinct bodies of knowledge representations associated with abstract concepts: one for abstract concepts themselves and another for representations which arise from the metaphorical mapping (p. 176-177). This means that the structure of “love” can be defined partly in its own terms rather than wholly in terms of the metaphorical transfer from “heat”. This is a conclusion which Lakoff and Johnson do not admit easily. Finally, if they have no conceptual content at all, how come we assume that they exist at all?

For Lakoff and Johnson, the principle source of our metaphorical mind is our bodies and our interactions with the external world (Lakoff and Johnson, 1980: 119): the meaning emerges out of blending multiple domains and multiple experiences. Image schema lies at the core of this idea.

2.3.2.1.1. Image schema

Lakoff & Johnson (1980) suggested that individuals develop a set of basic coherent structures called “image schemas” which the individuals use to provide an organising structure for both concrete and abstract concepts. Grounded in our sensorimotor experiences, image schemas, however, remain abstract compared to proper modal of sensorimotor experience.

The perceptual representation of abstract concepts might be essential for the way children learn concepts (e.g., Smith, 2005). Children acquire image schemas related to space first as spatial configurations are directly acquired from their visual and proprioceptive windows on the world (Mandler 2004; 2012). The movement and spatial orientation that the children observe are reliable grounded informational sources; it makes up the basis for later conceptual development. Mandler (2004) writes:

> “Needless to say, infants in the first year of life have not yet used their conceptions of space to understand highly abstract domains such as marriage or comprehension. In principle, however, they already have the means at their disposal to do as adults do when constructing

> abstract concepts, namely to use spatial analogies to understand abstract realms…"(p. 89)

The image schemas will gradually become complex top-down sensory-motor structures which the children will apply to understand future experiences. The spatial experiences of verticality, for instance, is constituted by visual, tactile and/or motoric information. Up schema as a complex structure could be applied as a top-down structure on "RESPECT".

Images schemas are responsible for the development of a considerable part of thought and language. They help to represent a range of children's abstract thoughts (For a more comprehensive list of image schemas, see Hampe & Grady, 2005). Still, image schemas and the mappings of image of schemas pose a serious gap in the theory of conceptual metaphor. Still, image schemas are characterised by the lack of the perceptual specificity of the sensorimotor experience. It has been used to mean different things. For instance, if the UP-DOWN schema can be mapped on several concepts like *quality, divinity and valence* (Pecher, Zeelenberg & Barsalou, 2011), this makes it very necessary to have extra guidelines to make a principled distinction among these concepts. This also makes it even harder to imagine how the mechanism related to metaphorical mappings could be extended to make such predictive distinctions. In short, image schemas are not sufficient for giving a fully consistent description of the content and structures of abstract concepts.

Even though conceptual metaphor is assumed to be primarily conceptual, this does not make language a secondary component of the larger system of the mind. In fact, it plays a leading role in facilitating metaphorical construal. The linguistic mode of acquisition contributes to the way the content of abstracts are structured. The sense making of the abstract conceptual domain is influenced by their language expressions and lexicalizations. Lexicalization is a process worth considering in investigating the semantics of abstract concepts in relation to cultural models. Lexicalised meanings are more salient than the non-lexicalized ones. One day we might discover, for instance, that LOVE is or could be lexicalized and conceptualized in relation to schemas like

(LOVE IS A COMET) or (LOVE IS COCA COLA, GLOBAL RECESSION, etc.,) according to particular social or cultural models, who knows! There is always an utterance which could be produced for the first time, converging from what has been said before.

Cognitive Metaphor Theory does not say much on the interface between conceptual, linguistic and intentional components of meaning and how it guides the selectional and fusional mechanisms during the mapping processes. It does not specify which and when a given element becomes highly dominant and on what priority order that the transfer follows (Steen, 2007). The selection and alignment mechanisms are crucially important for constraining how the metaphorical mappings between two conceptual structures should operate at what Lakoff and Johnson call "domains", "Back-stage Cognition" (Evans 2009) or "mental spaces" (Fauconnier and Turner, 1998, 2002, 2008). How the two conceptual structures are aligned and fused in a way to facilitate successful interpretation needs to be regulated by a set of principles. Other principles are necessary for integrating linguistic entities in metaphorical expressions which remain unclear as well in this approach (discussed in Ch. 4).

Steen's argument is consistent with the argument that the present work makes about the contribution of the contexts. Language compositionality configures the combinations of higher order knowledge structures to subserve the coherence of the resulting simulations. Schemas combine to inform higher order and more complex knowledge structures, frames and cognitive models.

2.3.2.2. The Simulation Models: Perceptual Symbolic System

The simulation-based view of meaning-construction proposes that simulations are embedded in the biology of the organism, the function of language and the act of communication. It suggests that the core of making meaning involves the reactivation of perceptual, motor, affective and social knowledge. The process necessitates that the individuals may have experienced directly or indirectly the same experience. This enables them to re-enact these experiences in response to verbal and non-verbal stimuli (e.g., Barsalou, Simmons, Barbey & Wilson, 2003; Bergen & wheeler, 2010; Pecher, Zeelenberg & Barsalou, 2003; Van Dantzig, Pecher, Zeelenberg & Barsalou, 2008).

Simulation is a basic brain computational mechanism which involves partial reactivation of neural states from the modalities (perception, motor action, and introspection; touch, taste, smell, audition, vision, etc.). It involves the recreation of entity sensory features (Stanfield & Zwaan, 2001; Zwaan, Stanfield, & Yaxley, 2002; Zwaan, Madden & Yaxley, 2004), motion directions and dynamics (Glenberg & Kaschak, 2002; Kaschak et al., 2005; Setti, Borghi, & Tessari, 2009) and intrinsic spatial configurations (Bergen, Lindsay, Matlock, & Narayanan, 2007; Estes, Verges, & Barsalou, 2008; Meier, Robinson, Friesen & Schjeldahl, 2007).Evans (2010) assumes that this process involves a number of cognitive processes:

> The conceptual content encoded as cognitive models can become re-activated during a process referred to as a simulation. Simulation is a general purpose computation performed by the brain in order to implement the range of activities that subserve a fully functional conceptual system. Such activities include conceptualization, inferencing, choice, categorisation and the formation of ad hoc categories (p. 612).

The simulations of actions and perception seem to be coupled into a kind of internal mental model "to replace the stimulus inputs from the world with inputs from our model of the world" (Rumelhart, Smolensky, McClelland & Hinton 1986: 42) via processes of inferring, choice and categorisation (Evans, 2010). This implicates that simulations could in part be guided by the existing belief-systems.

Simulations are embodied where the embodiment concept encapsulates a clearly definable and pivotal role of human body in the semantic representation. What it actually means for human cognition to be embodied can be taken in the literal sense of the word. This literal sense entails that human cognitive system is "constrained by the physics of the body" and the semantic representations should be taken as "the output arising from the body interacting with an environment". To a much stronger version of the embodied simulations, a living body is a constitutive prerequisite for (embodied) cognition (cf. e.g. Wilson, 2002; Ziemke, 2003).

It seems that some kind of symbolic representations is necessary even for theories and models of embodied simulation in the absence of the stimuli (e.g. Barsalou 1999, Clark & Grush, 1999; Grush, 2003) where simulation processes function as off-line representations. There is no intention to propose distinct types of simulation process but to propose different conditions for simulations: "Off-line" and "On-line" (cf. Wheeler, 2005). The absence or the presence of the stimuli is a condition for characterizing the difference between the two. Off-line representation seems to require more imagistic representations than the on-line representation. The difference in time-constraints is very fundamental for this distinction. Thinking about a well-known goal, David Beckham's goal against Greece in 2001, requires an off-line simulation, which is mainly based on retrieved imagistic representations of the goal. On-line simulation is stimulus-driven representation being based on a direct perceptual input, e.g., I respond instantly to a ball after making a simulation of the temporal and locomotion configurations of a ball after being passed to me by another player in a game.

The online/offline distinction is quite relevant to the simulation of most abstract concepts due to their lack of the perceptual input associated with the designated referents. Concepts like "recession", as assumed here, require the simulation of some other concepts in an off-line manner to undertake an on-line simulation for the word as a direct perceptual stimulus.

One important prototype of the simulation models is the Perceptual Simulations System (PSS) (Barsalou, 1999, 2003, and 2008). Barsalou advanced a model of human cognition which is genuinely founded on the most recent findings on human neural states. The two main pillars of this model are *simulators* and *simulations*. Simulators serve as a concept or type in the traditional sense (Barsalou 2003). They are distributed multi-modal systems which fit in information across the instances of a category. For instance, a simulator for "car" evolves from the experiences of different instances of the category, "CAR". It involves perceptual information of how cars look, their engine sound, the opening of the bonnet, the affective experience of owning a car, etc. New information will be meshed in that simulator.

Simulations are specific conceptualizations of small subsets of simulators on particular occasions. The contextual factors determine the content of a given simulation. A "car" in a race is simulated differently from the simulation of a car in a safari park. All of the experienced instances of the category, "CAR", reside implicitly in the car simulator where different activated structures are specific to different contexts. The level of the referential and conceptual transparency of the simulated instance is inherently variable. Certainly, the same instance is never simulated exactly the same twice. However, a large number of simulators can have simultaneous accessibility for the same physical entities, actions, introspections, properties and relations. That is, if we repeatedly attend to and selects a particular element of experience or physical entities (e.g., "car", actions "drive", introspections "love", properties "fast", relations "transport"), a simulator for that specific element is formed in the long-term memory.

Simulation necessitates the existence of other cognitive mechanisms such as abstraction, selection, predictions, pattern completion and inference (Barsalou 2009). The term abstraction means the abilities to abstract a category for adjacent members or concepts or to generate interpretations and explanatory constructs (Barsalou 2003).

> Abstraction is simply a skill that supports goal achievement in particular situations. It does not construct summary representations that fix category membership.... no such underlying abstraction exists. Instead, participants construct a holistic simulation of the target category (for example a particular chair), and then interpret this

> simulation using property and relation simulators (for example, property simulators for seat, back, and legs).... Because of the dynamical nature of feature listing, considerable variability arises both between and within individual people in the features they produce. (Ibid: 1184)

Simulation theory, as Barsalou perceives it, involves the potential of sense-making mechanism which seeks to fetch coherent multimodal experience from partial reinstatements (perceptual symbols) via a process of bindings, prediction and pattern completion.

Interpretations are necessary to ascribe meaning to experience rather than mere recordings of meaningless images. In this sense, "a representation of a [SOFA] is not a holistic recording of it, but a set of propositions that interpret it" (Barsalou, 2003: 1178). The notion of interpretation, though, could bear more (emergent) representation for a given concept than mere sensory input fetched for it by the individual at a given context.

Barsalou's perceptual symbol system is a fully functional conceptual system. They are the building blocks of our mental representation. A perceptual symbol, according to him,

> "[R]epresents both types and tokens, produces categorical inferences, combines symbols productively to produce limitless conceptual structures, produces propositions by binding types to tokens, and represents abstract concepts." (1999b: 581).

A perceptual symbol can be conceived as a node in a superimposed representation of an artificial neural network. It serves the representation of diverse concepts and contributes to the representation of a host of contexts. In other words, it "simply implements a recording system that partially reproduces experienced states" (Barsalou, Simmons, Barbey, & Wilson, 2003: 88). It is important though that the perceptual symbols have some representational format, i.e., an undifferentiated bitmap, and make up minimum realizations of the function of a conceptual system, (Ibid).

Perceptual symbols, as Barsalou (1999) explicitly pointed out, are not symbols in the same way amodal symbols stand for something in the world. In the same way, Barsalou has repeatedly declined any chances for the interpretation of his model in a way that equates the perceptual symbols with the pictorial representations; rather, they are perceptually coded information (see section 2.3.2.3). They are neural states being imprinted by bodily and across-modal experiences. During visual perception, for instance, objects, actions and events are recorded in terms of neutrally distributed activation in the brain regions to represent what is currently being perceived. The resulting multimodal representations are construed specifically to serve a mechanism called a simulator. Barsalou's words read that "[t]he structure of a perceptual symbol corresponds, at least somewhat, to the perceptual state that produced it" (1999: 578), however, he does not claim one-to-one isomorphic correspondence between the two, i.e., "[t]his is not a claim about correspondence between perceptual symbols and the physical world" (Ibid: 608).

Situations are intrinsic in perception and action. At any particular moment in perception, individuals recognize the immediate space around them, i.e., agents, objects and events involved. As we can understand Barsalou's claim, it is obvious that he does not adopt the same argument as Hesslow (2002) who perceives simulations as whole reactivations of perception and action. It is more accurate for us to believe that Barsalou has in mind partial reactivations in the sense that their profile is constrained by a given situation.

> Consider a situated conceptualization for interacting with a purring house cat. This conceptualization is likely to simulate how the cat might appear perceptually. When cats are purring, their bodies take particular shapes, they execute certain actions, and they make distinctive sounds. All these perceptual aspects can be represented as modal simulations in the situated conceptualization. Rather than amodal redescriptions representing these perceptions, simulations represent them in the relevant modality-specific systems. (Barsalou, 2005b: 626-627)

Accordingly, for instance, a simulator encapsulates a mechanism which enables the cognitive system to experience a “snowman”, whether it is encountered by a documentary in a National Geographic programme, a cartoon episode (stimulus driven or bottom up) or actual experience when children make one during winter in the backyard of the house (memory driven or top-down).

The explanation which Perceptual Simulations System (PSS) offers for the content, structure and behaviour of abstract concepts differs from the theory of Conceptual Metaphor, in that abstract concepts do not extend directly from a single sensory dimension (Barsalou, 1999, 2003, 2008). How simulators for abstract concepts evolve and what constitutes such simulators is a very important issue. Abstract concepts, according to this model, build on the complex interaction of sensory-motor information, affective and introspective information within the dimensions of space and time to make up their own content and structure (Wilson-Mendenhall, Barrett, Simmons & Barsalou, 2011). This makes them accessible, in part, through complex multi-modal simulations, with introspections at centre. Endorsing this model, Barsalou & Wiemer-Hastings (2005) concluded that both, concrete and abstract concepts, assume a great deal of situational information. However, abstract concepts are more likely to build on added information from introspections (also see Wiemer-Hastings Krug & Xu, 2001). Barsalou’s account of abstract concepts does need to be reviewed in the light of the claims we have made earlier

2.3.2.2.1. Barsalou’s Account of Abstract concepts

Barsalou’s account encounters two critical issues, i.e., a sufficiency and a directness conditions (see section 2.4), due to ascribing a purely perceptual content as a basic content to all types of concepts. Representation, in this sense, would be limited to reproducing perceptual information. This makes every representation causally derivable from reality. Barsalou argues for a causal theory of categorisation where perception is essentially conceived as a straightforward encoding of objects or events into brain states giving rise to neuronal configurations (perceptual symbols). Barsalou writes:

> "The critical claim of perceptual symbol systems is that these *causally* produced perceptual states, whatever they happen to be, constitute the representational elements of knowledge. Most critically, if the environment is causally related to perceptual states, it is also causally related to symbolic states. Thus, perceptual symbol systems constitute a causal theory of concepts" (1999: 638; italic added)

Accordingly, concepts should stand for referents in the world and are causally related to it. The "perceptual origin" to which abstract concepts are causally traceable can be understood in several ways. One way is to relate it to those cognitive mechanisms which are used in the perceptual processing of the world. The other is to implicate that the raw core of the representations themselves is derived from perceptual processing.

Barsalou, however, seems to imply the second sense. This makes his claims pretty controversial, though, particularly when abstract concepts are questioned. If concepts emerge merely from the brain's physical capacity of causal perceptual processing, this certainly makes all individuals who share the same neuronal layout and configurations are capable to represent and interpret the same concepts objectively. Consequently, this renders it definite that the output concepts should encapsulate deterministically the same epistemological status as reality itself. This associates Barsalou's account with the innate or transcendental accounts of concepts, despite his frequent emphasis on that his claim does not implicate innatess of concepts and language. Barsalou, insistently, maintains that we derive concepts causally, from existing 'physical categories'. Besides, nothing is absolutely conclusive about the neuroimaging findings on the correlation between representational systems and the neurological layout and configurations at the physical level of the human brain.

To Barsalou, the abstract concept "truth" arises from the process of matching of a simulation and an external perceptual state. For instance, the meaning of "truth" arises from matching the perceptually driven simulation, i.e., the perceiver's attempts "to map the perceptual simulation" into that physical situation (Barsalou 1999: 601). The meaning of “truth” arises when “There is a balloon over the cloud”, is matched with a physical situation in the external world (there exist a balloon and a cloud in the external world, and the balloon is above the cloud). Launching successful mapping, the conceptualizer might say: "It's true that a balloon is above a cloud" with 'truth' being grounded in the sensory-motor information from the physical world. Such introspectively achieved matching and mapping does not fully exemplify the content of an abstract sense of 'truth'. Processing abstract concepts involves first a simulation of the concept of truth as proposition, retrieving a perceptual state, representing the situation outside. Finally introspective task occurs to verify the mapping between the two. However, Barsalou’s analysis tells us about how the individual judges introspectively about the truth-conditioning of situations rather than saying much about the concept of truth itself. The matching and mapping does not fully explicate the content of an abstract sense of 'truth'. Let’s take for instance,

(2.3). لو كانت الحقيقة رجلا لجفاه الناس

(Translation: If truth were a man, people would have alienated him.)

According to Barsalou’s explanation, “truth” and “man” show some level of content and structural similarity “semantic congruence” (Suied, Bonneel & Viaud-Delmon, 2008). The proposed mechanism responsible for the interpretation is the co-activation of the concept (truth) with the knowledge structure accessed by the concept (man) as a context (man being alienated). The two should be structurally aligned first, searching for a semantic match. This also implies that the situations of “a man being alienated” and “a balloon above the cloud” should have something in common. I couldn’t agree more with Gibbs and Berg (1999) on the observation that it is not always the case where abstract concepts need to be perceptually grounded or metaphorically filled. There exist in a considerable array of cases where abstract concepts themselves are grounded in concepts with similar referent-type (abstract referent) especially those “for which people have no direct experience” (Barsalou, 1999: 647). For instance, in an example like:

(2.4). It's all about you making life choices, exercising your free will gift.

In "life choices" and "free will", both components bear no perceptual realisations, nonetheless, individuals still manage to understand what this utterance means. So, how could they allow mapping and structural alignment to achieve simulations?

Another interesting question about the matter is how would Barsalou explain the capability of blind people to process and conceptualize abstract concepts despite their lack of "direct experience", unless indeed by means of other content-types. Extending the previous discussion of the neuronal basis of concepts, it doesn't make full sense how individuals would interpret concepts in the mind of their counterparts in communicative acts. Again, in the case of the blind people, this match has to be only partially not wholly perceptual. Again, language role could a viable way out for this controversy. Barsalou's proposal seems insufficient without the intervention of some system which could render the intersubjective transfer of concepts possible. Nothing more than the linguistic system could ever be necessary to take this role and sufficiently reconcile our differences at the conceptual levels during communication.

Later, Barsalou proposed Language and Situated Simulation (LASS) model. It implies that linguistic forms and situated simulations interact continuously. It assumes that the language system becomes engaged immediately upon word recognition to categorize the linguistic form and to highlight the associated linguistic forms, before situated simulations come to work (see Figure 2.1).

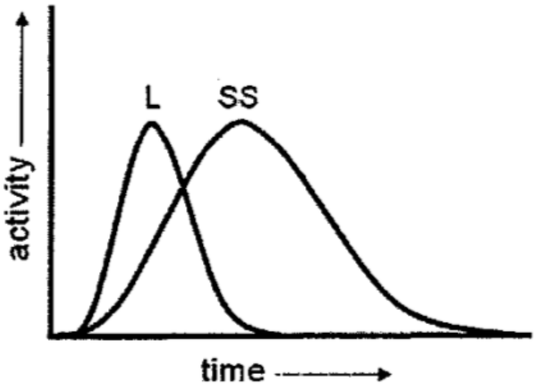


Figure (2.1): Language system and situated simulation (based On Barsalou, Santos, Simmons & Wilson, 2008)

LASS fits well in the presence of the distinction of shallow vs. deep processing. It suggests that the conceptualizer first processes the linguistic meaning, then simulates the situational content. Barsalou's LASS theory (e.g., Barsalou, Santos, Simmons & Wilson, 2008) seems to misrepresent the role of language in concepts. Much of the semantic content associated with words has been stripped and misplaced. We are left with impoverished representation of the linguistic system, while the conceptual system is thought to be the only source of semantic representation. Evans (2009) argues that

> The proposals developed by Barsalou et at, [..] diverge from the thesis of encyclopaedic semantics assumed in cognitive linguistics. After all, LASS Theory argues that the linguistic and conceptual systems, while they interact, involve different types of representation and different types (and levels) of processing (p.189).

Research on cognitive grammar has shown that much of the activated encyclopaedic knowledge is primarily configured by the "schematic content" of grammar[10] and the semantics of language use.

[10] Grammar could actively contribute to meaning construction, owing to the knowledge induced from structures, including passivization, clefting, dislocation, coreference, reflexivity, obviation, possession, quantification, scope, ergativity, relativization, subordination, ellipsis, coordination, agreement, case marking, and word order placement (MacWhinny, 2005)

Evans (2009: 36) argues that

> "grammar is no longer viewed as constituting an abstract set of rules which operates word. Rather, the lexicon and grammar form a continuum, each consisting of bipolar symbolic units comprising a form and meaning: … known as the lexicon-grammar continuum".

Even though the encyclopaedic knowledge is an independent body of knowledge, however it is intimately related to the lexical knowledge. This may inspire an alternative model which equally prioritizes the linguistic content. LCCM perceives simulations in terms of linguistic packages where lexical concepts act as simulators. Simulations, then, are configured by the schematic structures of these lexical concepts. The lexical concepts' tendencies of co-occurrence with each other counts as a relational property which seeks to achieve referential and conceptual transparency. This gives the interpreter a chance to ground the conceptual structure in the type of conceptual structure the other lexical concepts affords access to. For instance, upon reading or hearing the word "doubt", the individual, as we could assume, recalls simultaneously the instances in which "doubt" co-occurs with other lexical concepts, therefore activating diverse conceptual content. This could justify longer processing time (delay) which the individuals take in constructing simulations.

Complex compositional units, conceptual combinations, like "wife doubt" or "doctors' doubts", limits the scope of the processed conceptual content. The word "wife" acts as a context for "doubt" leading to the activation of more specific associations such as "affairs", "marriage", "mistress", "betrayal", etc., rather than "fever", "diagnosis", "cancer", "X-ray", "chemotherapy", "hospital", "tumour", "nurse", etc., which "doctor doubt" triggers (see Figure 2.2). The compositional property of lexical concepts operates under a set of principles of selection and fusion at the lexical level, which in turn guide interpretation at the conceptual level. The encyclopaedic knowledge becomes at the disposal of the integrated lexical concepts via the access routes they afford access to.

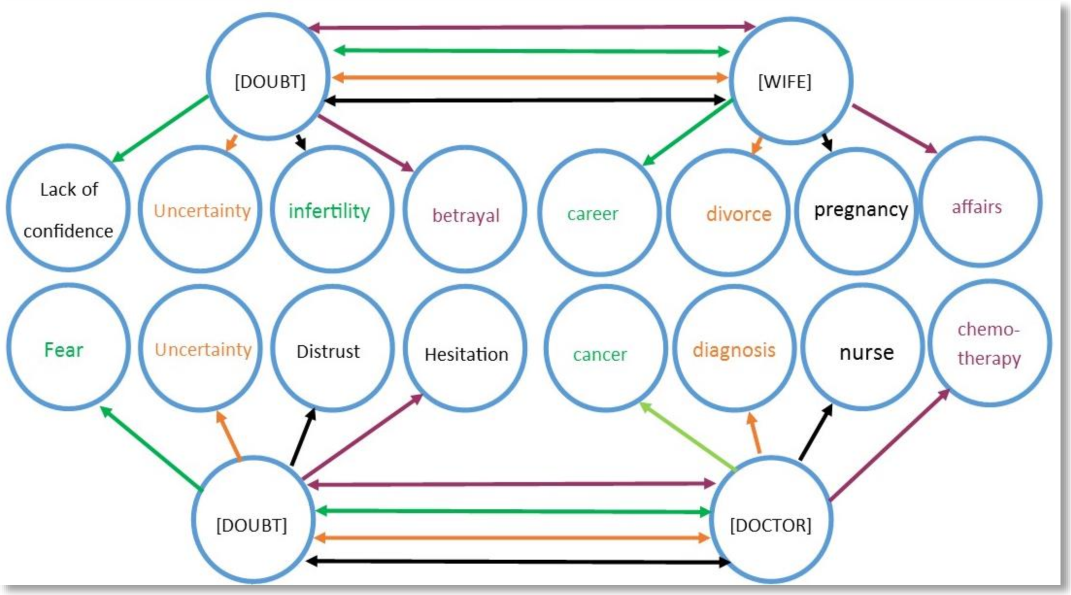


Figure 2.2: Schematic representation of [DOUBT]

Being a cross-over between the words and the conceptual structures, lexical concepts allow us to understand metaphorical structures and other figurative uses of language. The figurative use of language represents a key strategy for representing and interpreting abstract concepts. Lexical concepts afford access to rich multimodal knowledge structures or cognitive models. This time, the access which the lexical concepts afford can take multiple routes to access sites at more than one level. The selection of the activation route is determined by whether or not a clash/conflict arises during the process of interpretation (Ibid: 2010b). Abstract concepts need to be conceived as a network of evolving links (Sigman and Cecchi, 2002) to disambiguate their meaning.

In a newspaper headline, e.g., "The Arabic springs: absolute authority superseded by democracy", the concepts "authority" and "democracy" can activate a diverse and highly loose set of semantic associations and infinite number of contexts. The semantics of "authority" changes depending on the thematic and pragmatic configurations: agent (who is exercising that authority e.g., father, teacher, president, etc.), a patient, and a context that includes the exercise of authority (school, family, UK or Egypt). If properly interpreted, "Arabic spring" will narrow down the loose scope of the content and structure of "authority" and "democracy". The linguistic and conceptual components constitute what is referred to as human semantic knowledge (Evans 2009).

2.4. Embodied representation of concepts: Nonverbal Mode

The Human body and its parts are central to language and concepts. Embodied cognition is about how the internal states and spatio-temporal configurations of the body and its parts facilitate perception, conceptualization and interaction. Therefore, it represents a source of conceptual information.

Beside verbal representations, nonverbal representations, e.g., body postures and facial expressions can also serve the conceptualization of abstract concepts by making available a context to facilitate grounding. Emotional states like "happiness", "fear" and "anger" could illicit particular facial expressions which the observers experience as if they themselves were the subject of such experience (Foroni & Semin, 2009). Body movements and facial expressions facilitate indirect channel to the understanding of abstract concepts, however, it is not clear whether body gestures or internal states of unrest are constitutive part of the content of abstract concepts or non-constitutive by-products which come to mediate their meanings.

Beside sensory-motor and human verbal system, the network involves the activation of other representational system, i.e., body language or kinesics (gestures, hand and arm movements, leg movements, facial expressions, eye gaze and blinking, and stance or posture (Neuliep 2009). Such system is a very important system which meditates human conceptual structures by offering representational content available in a visual mode. Body representations could act as contextual cues for making explicit the content human conceptual system (Goldin-Meadow, 2003; Lantolf and Thorne, 2006; McNeill, 2008; Negueruela, Lantolf, Jordan & Gelabert, 2004; Nunez and Sweetser, 2006). Body language offers a rich source of information and allows individuals to gain "additional insights into how humans conceptualize abstract concepts" (Mittelberg, 2008: 23). The same neural circuitry of body language is shared by perception, action (cf. e.g. Damasio, 2003, Hesslow, 2002). Besides being an integral part of on-line simulations, non-verbal representations are likely to be recruited during off-line simulation, for instance, an individual's facials expressions can be activated by thinking of happy or miserable events.

Humans have developed a set of high skills in deriving conceptual content and emotional states from body postures and facial expressions. Individuals can state whether what is represented nonverbally by their interaction partners does (not) match up with what is said verbally. Irrespective of what they represent, nonverbal expressions can be informatively reliable sensory feedback for the perceiver.

It is also observed that even blind people use gestures when interacting with other blind partners (Goldin-Meadow, 2003; Iverson & Goldin-Meadow, 1998). While exploring the embodiment in language, Iverson and Thelen (1999) observed that body language is tightly allied and synchronized with language use, serving successful communicative acts. They incorporated three types of empirical evidence in this direction: One empirical effort came from (Ojemann, 1984) who argues that both language production and sequential motor actions incorporate the activations of the very same underlying brain regions. The second line of evidences came from (Bonda, Petrides, Ostry & Evans, 1996; Krams et al., 1998; Pulvermüller et al. 1996) who confirmed that motor functions and linguistic tasks are generally associated with the same brain areas. It is worth mentioning that the traditionally identified "language areas" show synchronised activation during purely motor tasks. Aphasic patients, who show dysfunction in gesturing, also show deficit in their language performance (Hill, 1998). The third line of evidence came from developmental studies of gestures. It is consensus among this line of research that nonverbal representational system develops prior to language and exerts positive effects on language development in infants (Goodwyn & Acredolo, 1998). In short, language system and body language system seem to be intimately related.

Rizzolatti, Fadiga, Gallese & Fogassi (1996) identified a class of brain cells, commonly referred to as “mirror neurons”, in the premotor cortex of monkeys that is dependent proportionally on previously acquired motor knowledge and expertise (Calvo-Merino et al, 2006; Kerzel & Bekkering, 2000; Kilner, Paulignan & Blakemore, 2003). The neurological basis for the contribution of body language becomes compelling after this seminal discovery. Mirror neurons activate simultaneously during imitations and mentalizing. Rizzolatti, Fadiga, Gallese, & Fogassi, (1996) have pointed out that “mirror neurons” contribute to the detection function of actions such as grasping or twisting. These cells fire when the monkey is performing a particular motion such as “grabbing” or “twisting.” They fire at an equal rate when the monkey sees a human or another monkey engaged in twisting or grabbing.

Here, the simulated and the simulation are compatible which makes this type of knowledge genuinely self-referential. Barsalou, Simmons, Barbey & Wilson (2003) note that such compatibility makes the cognitive processing operates more easily. The compatibility of bodily states and conceptual representations enhances the effectiveness of the simulations whereas the incompatibility, as such, makes cognitive processing less efficient. Chen & Bargh (1999, in Barsalou, Simmons, Barbey & Wilson, 2003) revealed in their experiment that participants actually perform faster, i.e., succeeded in conceptualizing the meaning of “positive” words than “negative” ones. Positive words were processed faster when accompanied by compatible body representations, e.g., pulling a lever towards themselves rather than pushing it away. The subjects responded faster by pushing the lever away upon hearing negative words.

Similar findings in support to the above claims came from memory tasks (see e.g. Fincher- Kiefer & D’Agostino, 2004), face recognition (see Zajonc, Pietromonaco & Bargh, 1982; in Barsalou, Simmons, Barbey & Wilson, 2003), facial categorisation (see Price & Harmon-Jones 2010), word recognition (see Siakaluk et al 2008), reasoning (see Riskind, 1984; in Barsalou, Simmons, Barbey & Wilson, 2003). The human body seems to be the central representational device which could enhance cognitive processing and interacts extensively with cognitive states. Chris Sinha (2005) extended the analysis to include the artefacts and material objects. His states that the nonverbal representational system contributes to the materially and culturally grounding of concepts during interactions. This features the idea that children's representation of fictive concepts during their symbolic play is "socially collaborative, culturally and materially grounded" (p. 1537).

Making a general statement from the above discussion, it has become acceptable to say that body language could represent and enhance the processing of abstract conceptual thoughts. Charades is a very interesting example of intersubjective acts of representation and interpretation which seek achieving referential and conceptual transparency during interaction using a single representational channel, body language. In (experiment 5), the charade technique will be utilized to extract the embodied non-propositional knowledge associated with abstract concepts. The sensorimotor analysis of bodily language is, in fact, an analysis of the individual's thinking. This will allow us to test the hypotheses: continuity of human concepts, sufficiency of the sensory-motor and embodied representation content and the directness of such representations to the structure of abstract concepts.

2.5. Sufficiency and Directness Conditions

As things stand so far, different views exist on the nature of the conceptual structures (representational content and format) of abstract concepts. One view assumes the predominance of purely sensory-motor and embodied representational content and perceptual format. The other proposes a combination of perceptual and symbolic representational content and format.

Meteyard and Vigliocco, (2008) put forward two conditions which could determine the nature of the content and format of representation associated with a concept. It is important to decide whether the perceptual or embodied content is necessary and sufficient enough to solely constitute the content of a concept like "car" in the same way it is for "truth". Directness condition is related to whether such a content-type is directly related to the concept's representation and interpretation. Necessity or sufficiency condition is related to the adequacy of a particular content-type to an informationally optimal representation and interpretation of a given concept.

The present work will address empirically the above conditions based on the claim that although perceptual and embodied representations and structures are fundamental to the conceptual transparency of abstract concepts, they are non-constitutive of the conceptual structures of abstract concepts. This claim builds on the fact that we acquire abstract concepts primarily through language use. The other addressed claim is whether the nonverbal representations are directly involved in the semantic content of abstract concepts. Experiments 2, 3 and 4 will test this claim (see chapters 6, 7 and 8).

Chapter 3
Linguistic Context: The Role of Language in the representation of Abstract concepts

3.1. Introduction

In this chapter, the role of language in the representation and interpretation of abstract concepts will be explicated. In line with Wauters, Tellings, Van Bon & Van Haaften (2003), the meaning of concepts can be acquired using the perceptual mode, linguistic mode, or both. We claimed that we initially acquire such concepts through the linguistic mode. Due to the non-physical and dynamic nature of their content, it becomes fundamental to address the linguistic role in their representation and understanding. The minimum linguistic unit, higher than a single word unit and lower than a discourse unit is commonly referred to as conceptual combination (e.g. Spalding and Gagné 2007; Costello and Keane, 1997; 2001; for detailed review Ran & Duimering, 2009).

Conceptual combinations are explicit realisations of the compositional property of language. Vaguely enough, both the process and the output of combining two lexical entities or more are often referred to as conceptual combination. Ran & Duimering (2009), for instance, defined "Conceptual Combination" as "the cognitive process by which people use two or more concepts to construct a new conceptual entity that a single concept is insufficient to describe" (p.39). Others may prefer to use the term "combinatorial" for the product. Compounding and compounds refer to units lower than a sentence and higher than single word. Evan's (2009) terms seem to be more systematic: the product is termed as "Complex symbolic units"[11], while the process is referred to as integration.

[11] Conceptual combinations, Compositional unit and Complex symbolic units will be used interchangeably in this work to mean the same thing.

Conceptual combination serves as a cognitive strategy to elaborate the organisation of a given concept by offering richer contexts to achieve a better referential and conceptual transparency. To address this aspect in relation to the understanding of abstract concepts, it is important to rock the core contribution of language compositional function in enhancing their referential and conceptual transparency. This could be achieved by observing the conceptualization or RT of combinations with variable compositional complexities, e.g., two-word “God’s love”, 4-word “God’s Love we deliver”, and so on (see Experiments 2, 3 & 4).

Sweetser (1999: 132) stresses that the compositional principle allows strong predictions on the semantic behaviour of the components. This could be easier to understand if we incorporate the notion of the mental lexicon where the lexical and conceptual networks are organised. Activating one node in this network, the access spreads to particular parts or the whole network during the processes of representation and interpretation. The core semantic properties of the lexicon needs to be explored in addressing many lexical phenomena such as polysemy, metonymy and metaphors.

The construct of the mental lexicon should not be accepted as an archive of distinct lexical entities the mind deposits in the memory, in a way that is similar to the lexical entries in a dictionary. Rather, it should be perceived a systematic organization of the sub-systems of forms, lexical structures, conceptual structures and relationships holding them according to experience and usage.

> “The mental lexicon, the dynamic organization of words in the mind, is the backbone of language ability, comprising a vast and complex network of mental representations, associations, and processes. Yet, like many complex cognitive systems, its functioning is largely shielded from the conscious mind. We never notice that the words that we read are interpreted in well under half a second. We rarely reflect on the fact that it is virtually impossible to stop ourselves from understanding a word that we see or hear in a language we know. Finally, although we

> might notice that hearing a word makes other words spring to mind, we do not have conscious access to the mechanisms that make this happen." (Libben , 2013; italics added)[12]

Semantic Compositionality presents itself as a fundamental phenomenon for meaning construction. Sweetser states that:

> "We still take seriously, as any linguist must, the need to account for the compositional nature of linguistic meaning. But we recognize that the task is a far more difficult and complex one than we might once have thought, since the meanings being put together are so much richer and less rigid than we might have imagined twenty-five years ago." (Sweetser 1999: 133)

The function of the linguistic compositionality can be instantiated by the features posed by one concept to define, elaborate and sanction particular content in the conceptual structure of the other. This should guide the re-organisation of the conceptual content of the combined entities. The former acts as a background (contextual cues) for the latter's particular conceptual structure to become diagnostic and transferable to achieve referentially and conceptually transparent. The process is referred to in this work as the "*linguistic contextualisation*". The immediate physical environment and the social-cultural aspects during online conceptualization, we refer to as the *situational contextualisation.* In this chapter, more focus is laid on the linguistic context.

The combinatorial property of language which facilitates the generation of more complex linguistic units of meaning according to some semantic and syntactic rules is referred to as the "*Semantic compositionality".* The semantic compositionality facilitates the integration of words' meaning, where "the meaning of the expression is a function of the meanings of their parts and of the way the parts are syntactically combined" (Pylkkänen, 2008: 712).

[12] http://www.linguistics.ualberta.ca/en/Research/Projects/WordsintheMind.aspx (last accessed 2nd, Dec, 2013.

Pylkkänen suggests another dimension, i.e., syntactic rules. Once composition has occurred, the meaning of the complex symbolic unit arises from the combination of its constituents, e.g., “desert” + “sand” → “desert sand”. Initially at this stage, this preliminary definition of compositionality equates Frege’s conception of compositionality: “the meaning of a compound expression is a function of the meaning of its parts and of the syntactic rule by which they are combined” (Janssen, 1997:417). However, the phenomenon of compositionality is more complex than this sense as we shall discuss later. Compositionality does not involve only words as “pre-packaged meanings”, but, as a “function of the particular linguistic context in which it is embedded.”(Evans 2007:2)

The above conception diverges from Frege’s conception in that the knowledge prompted by the word, “desert” will subserve delimiting the type of “sand” we should think of. In other words, it functions as a context which gives salience to certain attributes of “sand”, for instance, not-wet. The compositional mechanism underlying this combination “desert sand” is not additive. Rather, it is primarily *selective* in that some conceptual features and knowledge structures become more salient than others and available for integration. On the other hand, the property of “dryness” becomes more salient than the property of “wetness” in the case of “beach sand”.

In this sense, linguistic compositionality offers a key contribution for the conceptualizers to evade the diversity of the conceptual content associated with abstract concepts and allow the understanding of their meaning. For instance, the word-form “beauti*ful*”, on its own, could invoke diverse types of linguistic and conceptual knowledge with a large number of associations, most probably with equal strength. Such associations can be delimited, by language use, ascribing higher threshold to some associations at the expense of others, e.g., “beautiful face”, “beautiful sound” and “beautiful idea”. In “beautiful face”, the facial features (shape and size) become of higher dominance than pitch and loudness. Neither size nor shape or pitch applies to “idea”. According to how Sweetser (1999) puts it:

> Instead of each word or morpheme always representing the same rigid and stable semantic chunk or building-block, the same word can represent very different complex meaning structures in different contexts, and may alter flexibly depending on the meanings surrounding it [...]. (p. 136)

Section 3.2 addresses the question of how the compositional function of language subserves the subjective nature of the content and structure of abstract concepts (Evans, 2009:212).

3.2. Compositionality

Language is inherently compositional. Combining simple symbolic units (such as those represented by single words) to form larger and more complex symbolic units is a process often referred to as conceptual combinations (Ward & Kolomyts, 2010), compounds (Costello & Keane 2001) semantic combinatorials (Wisniewski & Gentner, 1991). The terms have been used interchangeably to address how the meanings of two combined words or more give a complex meaning by addition (e.g., red door), by extension (e.g., pet fish), part-whole relation in "traffic police", and emergence (guitar figure)to give more specified or novel meanings.

It is characteristic of conceptual combination research that units of combination were often confused. Mostly, their theoretical perspective was isomorphic in that words and concepts were used interchangeably. Inclined to the adopted theoretical framework, Evans (2009) LCCM, words and concepts are distinct and each assumes different representational contents and formats. This work needs to by-pass the disadvantage of the previous works, the "*isomorphic problem*" (section 3.4.2). The confusion specifically emerged from taking meaning construction as a process of words combination where words are taken as "pre-packaged units of meaning".

In this work, words are conceived to prompt concepts. A systematic account of the process of conceptual combination at these two different levels gives rise to more specialized conception of "semantic compositionality".

Furthermore, the lexico-grammatical knowledge and rules actively contribute to the access of particular conceptual knowledge, e.g., "flying bird" combination means "a bird flies" whereas "flying plane" accepts both "the plane flies" and "the pilot flies a plane". Grammatical roles, transitivity, clefting, dislocation, coreference, reflexivity, obviation, possession, quantification, scope, ergativity, relativization, subordination, ellipsis, coordination, agreement, case marking, and word order placement (MacWhinney, 2005:206) were downplayed in their accounts of the meaning of conceptual combinations at the utterance level. For instance, "John dumped Mary" is not equal to "Mary dumped John". In this chapter, I equate the term "word-form" with what LCCM glosses as the phonological form or "vehicle" and later in the remaining chapters, the use of the term "words" will be replaced by "lexical concepts".

In a complex symbolic unit such as "pencil bed", the isomorphic view is proved deficient enough to explain the emergent (novel) meanings to which "pencil bed" gives rise. The knowledge accessed by each word-form in a combination like "pencil bed" during, the process of meaning construction, remain highly subjective (Costello & Keane, 2001) and amazingly protean. The integration of the linguistic content that each word encodes is correlated with the fusion of the non-linguistic content. A number of interpretations are possible: "Pencil that you put beside your bed", "a pencil shaped like a bed", "a big flat pencil that is a bed for a doll", " a bed case", and so on (for more discussion on this example see Pereira 2007, Ch. 3).

In the rest of this chapter, we address the question of how compositionality operates at these two levels: word-level and concept-level. In other words, how do conceptual representations of single words interact in a combination to construct meaning? One claim is that the linguistic (schematic) content of each element, conditioned by the combination, prompts the activation of particular non-linguistic (conceptual) knowledge structures. The compositional aspect serves to highlight particular attributes and values "features" and make the relations "associations" holding between attributes and values salient (Evans, 2009:74).

3.2.1. Associations-based Semantic Compositionality

The output of meaning-construction can become more defined (referentially and conceptually transparent) by virtue of the prompts from the linguistic and situational context. A word-form such as "car" might have slightly diverse conceptual structures; yet, it yields relatively higher consensual agreement on its referential and conceptual transparency, even when it is used individually. This is at least because certain sensory-motor information could be accessed by default (driving, shape, tyres, engine, etc.). Such information becomes more specific when "car" becomes part of a larger linguistic context, e.g., "ice-cream van". The word-form "ice-cream" gives access to a conceptual knowledge which serves as a context for "van", making particular features more salient such as *shape, sound, and function*. Still though, some sensory-motor information remains prototypically preserved (driving", "parts such as *tyres, engine, and bonnet*, etc.). For now, I will refer to *shape, sound, function tyres, engine, and bonnet*", etc., as "*FEATURES*" and the relations between these features as "*ASSOCIATIONS*".

Such features have particular knowledge-types associated with them (Cree and McRae, 2003). For instance, "Tyres" are associated with predominantly visual knowledge-type (colour, surface and visual motion), knowledge-type associated with other primary sensory-processing (smell, sound, tactile, etc.), functional knowledge-type (what tyres are used for), etc. The information derived from such knowledge-types is inherent to the content and structure of the concept of "tyre", in other words, they are default (*defaultness*). Such features, e.g., colour and shape are non-transferable sensory-motor features of tyres. There is no chance for a rectangular shape tyre to be acceptable. The rectangular shape is epiphenomenal to the conceptual content of the concept, "tyre". Defining a tyre, in fact, could be done by listing the features associated with it.

Thinking of abstract thoughts, on the other hand, associations of a concept like "argument" seem to take different patterns. The observation is that defining the meaning of "argument" could mainly bring about associations with richer and more complex knowledge structures derived from other concepts like “war”, “fight”, and disagreement”. This occurs because “argument” does not invoke a threshold amount of sensory-motor information of its own in the same way “car” does. In a combination, e.g., “marital argument”, the knowledge being invoked by the word-form “marital” makes up a context for “argument” (figure 3.1). The latter seems to re-organise its content and adjust its associations of transferrable features. The distinctive pattern of features associated with the concept, “argument”, need to match with conceptual structure of the word-form “marital” according to the unique cost-demand relationship of their mutual compositionality. The cost-demand flow of transferrable features will be different from the pattern of flow activated in “parliamentary argument” or “academic argument”. Such characteristic properties and associations derive from the probability of co-occurrence (selectional tendencies) with each other’s structures.

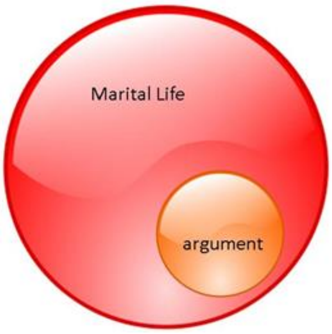


Figure 3.1: Schematic representation of marital argument

Contingent to their linguistic context, the associations are given variable weight or salience. Each set of associations assumes three characteristic properties, e.g., *strength*, *valence* and *direction* (Yamagishi and Miyamoto, 1996). As far as association strength (*weight*), many associations for “car” will be activated but not necessarily with equal weight, especially when one is constrained by the presence of the other such as in “ice-cream”. Similarly, in “race car”, features such as (“formula”, “speed” “tracks”, “laps”, “pit”, etc.,) serve as anchor points for features in “car”. Some activated associations are of high dominance, (e.g., speed, driving, winning, etc.) and others are low dominance, (e.g., colour, air-conditioning, etc.). The *valence* of an association implicates that the individual shows some bias towards to attend certain associations during the conceptualisation process rather than others. Associations are either positively or negatively valenced. For example, valence determines whether the individual takes a whale as fish or a mammal. Belief-systems are fundamental in steering the individuals' biases. Beliefs represent very basic cognitive shortcuts the individual resorts to make sense of the world. The activated associations tend to be *direction-based*. For instance, "room" in "storage room" demands more associations for informational characterization than in "chat room": In storage room, all of the properties of the "storage concept" are required to make sense of the physical properties of the room (its function, dimensions, its location, etc.). On the other hand, in "chat room", the direction of the demanded conceptual structure flows from the "room" to "chat" as the physical properties of room are derived for attributing a more unequivocal meaning to a "*virtual*" chatting.

The fourth property, if I may add, relates to whether the association between two concepts extends directly or indirectly (*directness*). For instance, the activated conceptual knowledge upon conceptualizing "car" can be directly associated with the type of knowledge associated with "driving" and "pleasure". However, "pleasure" could be associated with "car" indirectly through "driving". Evans' (2009) LCCM accommodates the notion of the "directness" of association by proposing two types of cognitive models with two different access sites: one level of cognitive knowledge is accessed directly; "Primary Cognitive Models" and another accessed indirectly "Secondary Cognitive models". I assume that their bodies of knowledge by words such as "pleasure", "wisdom", "reason", are accessed indirectly simply because they demand sensory-motor experience for their contextualisation. In fact, I could go even further to assume, that a fundamental property of abstract concepts is that they derive their meaning form extending multiplicity of relations to other concepts (indirect associations).

This interestingly dynamic scene of abstract concepts' content exchange with other concepts may seem to make it impossible for any two people to agree on a particular abstract meaning. The relative stability of the type of knowledge accessed by abstract words emerges from the relative stability of the linguistic knowledge. The meaning of the word “God” is generally associated with knowledge structures related to “father”, i.e., “*father loves and takes care of children*”. Due to the strength of “*fatherhood*” association, it becomes default or diagnostic association which makes the recognition of one activates the knowledge related to the other.

At the level of the linguistic knowledge, two bodies of lexical knowledge are combined schematically in a process of integration, meeting particular selectional requirements or selectional tendencies. Such selectional tendencies “form part of the conventional knowledge associated with a particular word sense” (Evans 2009: 31). A combination such as “soft steel” does meet the grammatical constraint of a noun phrase (NP), but it remains meaningless as steel does not often co-occur with “soft”, i.e., “soft” does not meet with the selectional tendencies associated with “steel”. This leads us to embark on two poles perspective: linguistic and non-linguistic, or in other terms, words and concepts.

3.2.2. Bipolar Structure

As discussed above, meaning is a potential of the interface between lexical concepts and concepts. The type of knowledge activated by word-forms configures the accessed non-linguistic knowledge under some contextual interventions from the situation. Language schematic structure imposes certain constraints on the interpretation of the non-linguistic knowledge of the combined lexical units. For instance, the combination “flying bird” means “a bird flies” whereas “flying plane” accepts both “the plane flies” and “the pilot flies a plane”, etc. as they are schematically acceptable but not “the plane sleeps”. At the linguistic level, this selectional strategy underlines the normative property of language use.

At the conceptual level, the demand for coherent conceptual structure lies at the core of the compositional process. For instance, the complex word-form “danger of death” on the label attached to an electricity circuit invokes some knowledge associations which differ remarkably form the same combination at a beach. In the former case, “shock”, “burn”, “electrical current”, “high voltage” while at the beach, it assumes lower dominance than “drowning”, “shark attach”, “water currents”. The associations like “harm” and “life termination” retain the same association strength. Recognising the word-form and the prototypical associations related to “harm” and “life termination” is not enough. More associations come from the physical context (e.g., fuse box). The more contextual information activated, the more sanctioning will be exerted on the set of activated associations.

The combination could compensate the absence of the information from the physical context. Such absent information can be derived from the co-text which allows us to recall and construct knowledge about the physical context as if it is present. For instance, in “shark attack”, the word-form “attack” alone brings to the foreground diverse options, but the co-text “sharks” delimits the knowledge associated with “attack”. It is very obvious that “attack” required associations from co-text to be grounded in a context: “Shark” can be conceived as a context which serves to ground the part of knowledge to be strongly activated

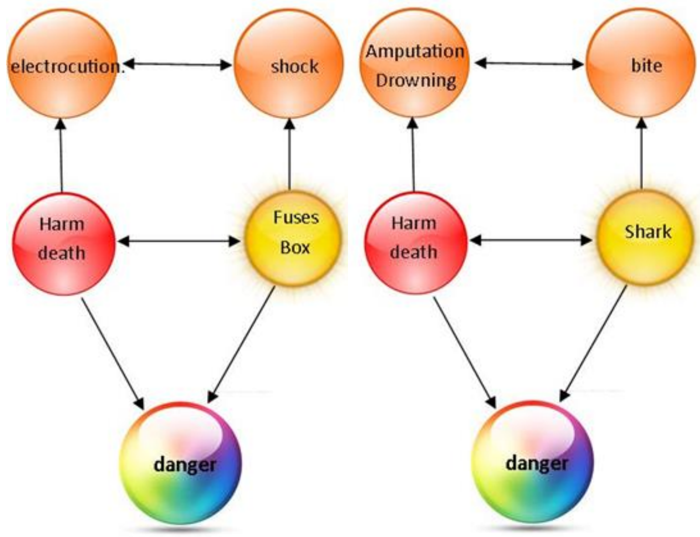


Figure 3.2: Schematic representation of “danger” in relation to two contexts

In an instance, e.g., “clinical death”, the referential and conceptual transparency is also sustained by the bipolar structure of language use. Despite the fact that it does not invoke “life termination” as in “my expired grandmother”. The simulation of some organs being still functioning with or without the help of medical devices is facilitated by the knowledge which the word-form “clinical” affords access to. Extremely though, the combination “political death”, does not involve anything of the above.

In metaphorical expressions, the co-text offers impoverished information or even some conflict at particular level. However, the individuals often recover the missing information or achieve resolution to the possible conflicts at higher conceptual levels. Individuals conceptualize all of the possibilities (choices) to achieve informational optimality (successful interpretations), building primarily on the schematic configurations and then on the accessed conceptual knowledge structures. A very clear case is the co-occurrence of “attack” with other words in "armed attacks", “panic attack”, “malaria attack” and “heart attack”. The individual needs to draw upon their knowledge-base or what is referred to as “encyclopaedic knowledge” relating to “attack”, “malaria”, “panic”, etc., to achieve the appropriate reading. (Sweetser, 1999; for more discussion, see Evans 2009:17). It is worth noting that the encyclopaedic knowledge is not a form of enforced selections; rather, we may attend to certain elements of knowledge at the expense of others based on particular goals, salient expectations about the future, intention of the individuals, scientific hypotheses, religious beliefs, subjective memories and cultural frames.

Unlike words encoding physically realised referents, combined words encoding less physical referents seem to pose a serious challenge. One example is the combination ”feminist theory” where both “feminist” and “theory” need highly introspective processing to verify the schematic and conceptual structures as well as the match between the two. Such matching could face conflicts which can only be resolved by stretching activations to other non-adjacent knowledge structures, i.e., (feminist: extends to “women”, “womanhood”, “inequality”, “gender”, “power”, “dominance”; while theory:

"general", "statements", "rational", "speculation", etc.). The meaning of the combinations where two or more abstract concepts are involved, e.g., "feminist theory", "loyalty reward", "schematic representation", "standard procedures", "citizenship test", seem to require a complex grid of associations and a knowledge-base with highly distributed knowledge structures in the sense Evans construes as "*Encyclopaedic Knowledge* ".

So far, it has been established that meaning results from the number of associations among different types of knowledge structures (directly or indirectly accessed). These knowledge structures incorporate linguistic and non-linguistic systems. The questions, which arise at this level, address the underlying mechanisms, processes and properties at the lexico-semantic levels and how could this apply to abstract concepts. Most if not all of the research on conceptual combination (see literature review in Section 3.3) fail to systematically answer these questions. This poses a challenge for the generalisation requirement that their methodological approaches need to meet, especially when abstract concepts are involved.

3.3. Conceptual combination models: Brief Review

This section extends the main theme of this work vertically by reviewing the literature on conceptual combinations. Recently, there exists a considerable number of models which sought to explain this phenomenon. Each builds on the core argument concerning how words combine and how people interpret them. As outlined in a number of works (e.g. Spalding and Gagné 2007, Costello and Keane, 1997; 2001; for detailed review Ran & Duimering, 2009) combinations involve the integration of two lexical entities or more. The process is deemed goal-directed cognitively-modelled communicative acts where associations are activated selectively to represent and construct acceptable meaning.

The point of reference for such models to explore the meaning of combinations in such research was to use one or more of some lexico-semantic features: Referentiality (reference types), familiarity (recognition), imageability (mental images) and acceptability (appropriateness). Some of those researches used stimuli from massive lexical databases and words lists such as BNC, WordNet, CELEX (Andrews, Miller & Rayner 2004; Citron 2012; Plag, Kunter & Lappe, 2007, etc.). The subjects had to rate the selected list of items in terms of their familiarity, imageability, diagnosticity, plausibility, informativeness and so on. Each has its own theoretical strengths and drawbacks (For review and discussion See Ran & Duimering 2009). The review of literature will base on the empirical design of the previous researches of conceptual combinations. In other words, the review starts, for instance, with some of the available research which used familiarity ratings, then the ones which based their conclusions on results from imageability ratings and so on.

Unfortunately, each of such lexico-grammatical features sheds light only on limited areas of the meaning and hence thee conclusions must be *partial*. Familiarity relates to the underlying processes of retrieving the deposited symbolic units from memory. Reference type (referentiality) encompasses a binary classification of meaning in terms of reference into concrete/abstract. Reference-type feature, apparently, is closely related to imageability. Imageability tests the availability of the mental imagistic and sensory-motor knowledge the stimuli might invoke. Reference-type represents a bridge between familiarity and imageability. Reference tracking builds on tracing down the properties of an entity in the external world or in the memory, by activating imagistic (real or imagined) or cognitive structures. Acceptability judgment encapsulates a wider array of semantic information and aspects of meaning construction, both at the linguistic and conceptual levels. The other disadvantage is that they tested *interpretation rather than production*.

3.3.1. Referentiality: Reference-Type

Reference has been the main concern of formal semanticists for a long time. Their focus was on the referential aspects and the relations between linguistic forms and the physical entities they denote. Reference-type rating should make a distinction between the physical and abstract properties associated with the referents that the lexical concepts encode. Imagined referents such as Venus, Mikey Mouse, Superman, Pokémon, etc., lie in the grey area between the physical and non-physical reference. Features listing and ranking shed light on the within-individuals and among individuals variation.

A typical piece of research which focused on the referentiality feature to understand conceptual combination was advanced by Zadeh (1976, 1982), "Fuzzy Sets Intersection Theory". This seminal model was one of the earliest in the field and was built on mathematical principles called "fuzzy sets theory". It had a predefined objective, i.e., to come up with formalized explanations on how humans combine smaller conceptual units into more complex ones to achieve category membership and referentiality. However, Set theory is very accurate at formally describing the classic view of categories. The main scenario behind this model is that a word encodes a set of referents it is used to refer to. The word "fish" refers to a set of all fish types.

When the word "fish" combines with a word which belongs to another set, the subsequent meaning equates the intersection of the two sets. Formally, if the concepts x and y being combined results in z, then xy interpretation C is achieved by computing the intersection of x's and y's extensional sets A and B. Let the intersection of A and B (denoted $A \cap B$) be the set $\{z : z \in A, z \in B\}$. In fuzzy set theory, the intersection of two fuzzy sets A and B with respective membership functions $f_A(x)$ and $f_B(x)$ is a fuzzy set C, written as $C = A \cap B$, whose membership function is related to those of A and B by $f_C(x) = \text{Min}\,[f_A(x), f_B(x)]$, $x \in X$, or, in abbreviated form $f_C = f_A \wedge f_B$ (Zadeh 1965).

One reason why Fuzzy set theory is conceived as an inadequate theory for concept representation simply stems from its applicability to intersective sets only. For instance, it is not clear in what way "*dream*" and "*house*" in a combination like "dream house" could be explained in terms of their intersective sets of features. So, its scope extends to physical and simple concepts only, leaving out non-intersective abstract concepts. It is more suitable for categories and exemplars rather than concepts.

The referentiality being encoded by X's and *Y*'s formal sets, in Zadeh's model, is impoverished and ill-defined in terms of category members. Although, this definition could easily apply to an array of entities in the world, i.e., (physical and imagined) with *"denotational reference"*; but it leaves out references to non-physical entities, e.g., "love", "doubt", "theory" which can be classified as what Evans calls "*cognitive reference*". This makes Fuzzy set theory incapable of explaining abstract concepts. Referentiality remains at the core of this work.

One more gap is the biased selection of the stimuli in that more reliance was laid on interpretation than production: predetermined word lists were chosen and structured in advance by the researcher.

Evans 2009 characterizes "reference" as a property of language where words are used to allow individuals to fetch reference in the external and internal world. Words index the properties of different types of entities: physical (captured by the available senses), imagined (made up by our imagination) and abstract (generated with the help of our cognitive processes). Evans (2009) made a distinction between two reference-types: denotational and cognitive. However, with the two reference-types, there is embedded a key sub-category which indexes imagined entities. McConnell-Ginet (2008: 510) maintains that "referential meaning embeds language in the rest of life, creating the possibility for socially shared and thereby extended or collectively enriched access to the world".

3.3.2. Familiarity

The experience of familiarity arises from the process of matching the perceptual content of a stimulus to previously archived knowledge-base in the memory (Meier, Rey-Mermet, Rothen & Graf, 2013). Familiarity can be considered a type of automatic response, i.e., a process which does not require controlled processing. It has been conceded that automatic processing (familiarity) occurs even in the absence of much contextual details (Yonelinas et al., 2005).This matching process involves an embedded process of searches for "prompts" for minimum similarity at least and coherence.

The Competition among Relations in Nominals (CARIN) theory emerged partially from familiarity judgments. CARIN discerns the thematic relations between noun-noun combinations in terms of the subjects' familiarity with the words and their plausibility judgments on their interpretation. The linguistic knowledge of the parts allows an automatic interpretation based on processes of matching and the recognition of the default thematic relationships associated with exemplars available to the head noun and modifier.

Plausibility, as Gagné and Spalding (2004) say, is about making subjective judgments on "whether an item had a sensible interpretation," (p. xx). It requires a more controlled and executive attention for integrating information in the working memory. The individuals form some subjective judgments as to whether the interpretation is grounded in (can be recollected from) the Episodic Memory (Oberauer et al., 2008). Implausible sentences are harder to interpret correctly than plausible ones (see Clark & Clark, 1977).

Familiarity judgement does not show for sure the nature of the knowledge content that the respondents experience as familiar. The individual may be familiar with the words rather than their meanings. So, all of the research, which built on familiarity rating, acquired very crude results which may invalidate their conclusions. Even though it gives very crude results, it is still important to make up valid stimuli: it prevents subjects from responding to stimuli they are not familiar with. In this work, items with low familiarity scores were excluded from the following tasks.

3.3.3. Imageability

Imageability relates to how easily words give rise to mental images and sensory-motor knowledge (Paivio, 1965,1968, &1971). Imageability effect is defined as the simultaneous recall and retrieval of words due to the mental images they invoke. By and large, high imageability words are accessed more easily and accurately than low imageability words. Imageability ratings are obtained by asking informants whether or not a word invokes a mental image on a scale of three, five or seven (Ibid).

Imagistic representations register the physical properties associated with a referent in a form of coherent imagistic record; therefore it is natural to assume that words encoding a denotational reference-type often achieve high imageability scores. However, this is not always the case. For the first instance "gardening trowel" is supposedly concrete as it appears, still its imageability scores were surprisingly low comparable to the high imageability scores for "angel" (Simonsen, et al., 2013).

In this work, there is no intention to disassociate the imagistic representations from the conceptual structures of abstract concepts. On the contrary, we believe that they do play a key role in the representation and interpretation of abstract concepts; however, we assume that such content type is not inherent to abstract concepts. We have to prove whether the two relate directly or indirectly. Individuals might associate imagistic representations through language use. Imageability rating in this work is used primarily to approve the continuous and gradable nature of the content of abstract concepts. The view of the continuity and gradability will be supplemented with other dimensions via the other tasks such as reference-type rating and verbal encoding tasks (features listing and ranking).

3.3.4. Acceptability

Unlike reference-type, familiarity and imageability, acceptability judgments appeal directly to the meaning of complex symbolic units such as combinations and utterances. It is concerned more with the conceptualization of the intended meaning from the perspective of the producer and the interpreter. It means that the judgment moves forward and backward from the selection and integration of the complex symbolic units by the producer for the interpreter to capture. The judgment equally arises from the conceptualization of the intended meaning by the interpreter as it was supposedly constructed in the mind of the producer.

Costello and Keane (2000, 2001) give a more systematic account of the acceptability of meaning by their construal of three central constraints of *diagnosticity, informativeness and plausibility* for the producer and interpreter to consider in their judgments. The interpretation of meaning as intended by the speaker is informationally and plausibly optimal when it meets such constraints (Costello 2000). According to their theory, the Constraint Theory, concepts assume a complex predicate structure (attributes, roles and relations). It also involves an access to a wider array of knowledge to facilitate the interpretation process, concept's senses, prototypes and related concepts. Sets of interpretations are evaluated against their acceptability scores.

3.3.4.1. **Diagnosticity**

To Costello and Keane, the term "*diagnosticity*" means something very similar to Rosch's notion of "*cue validity*" (Rosch 1978). It necessitates that the interpretation of a given combination should relate to the diagnostic properties of the combined concepts. Linguistically, diagnostic properties are realized as diagnostic predicates which should have a higher frequency of co-occurrence for some instances than for the others.

Tyre:

- *Tyre is round;*
- *Tyre is black;*
- *Tyre is made of rubber;*
- *Cars need tyres; etc.)*

Such predicates are automatically activated and cognitively processed with instantaneous access to the entire knowledge-base. Diagnostic features are computed prior to any non-diagnostic features and eventually any interpretations to be constructed. To exemplify, "A cactus fish is a prickly fish" would be a more acceptable interpretation than "A cactus fish is a green fish" simply because "prickly" is more diagnostic than "green" (Costello & Keane, 1997).

Smith, Osherson, Rips & Keane (1988) research is a good example of using diagnosticity in characterizing the process of combination. Their model, the Selective Modification Model, builds on the assumption that the representation of concepts is schematic in nature, i.e., concepts are represented by diagnostic association (with weight value for each association). The association with higher weight value is more salient than association with lower weight value. These values are numerical figures derived from diagnosticity rating. For instance, colour is more salient than size and shape for an apple (Halff, Ortony, & Anderson, 1976).

Smith and Osherson model accounts for diagnosticity in terms of "modifier + head" combinations where the modifier modifies a noun by activating the more diagnostic attributes to be transferred between the two, the modifier and the modified:

> "Each attribute in the adjective concept selects the corresponding attribute in the noun concept; then, for each selected attribute in the noun, there is an increase in the salience (or votes) of the value given in the adjective, as well as an increase in the diagnosticity of the attribute. Consider shrivelled apple as an example. Presumably shrivelled contains attributes pertaining to shape and texture; accordingly, it would select these attributes in the apple prototype, boost their diagnosticities, and shift their votes away from round and smooth and toward irregular and bumpy" (Smith, Osherson, Rips & Keane. 1988: 492).

Paul Thagard has two models of conceptual combination: Amalgam Theory (1984) and Coherence Theory (1997). The theoretical backbone of both is the diagnosticity of attributes and weight of concepts associations. He claims that diagnosticity is also related to coherence and problem-solving.

The first conceives conceptual combination as a problem solving process of reconciling conflicting expectations: "conceptual combination requires mechanisms for reconciling the conflicting expectations contained in the candidate concepts" (Thagard, 1984: 4), then he proposed that a system of coherent components is more stable and operational than a system of incoherent parts as their amalgam cannot be reconciled. Coherence Theory adopts the Connectionist framework and algorithms to compute the weight values of the accepted connections (associations). The accepted connections satisfy the constraints of achieving coherence in the system (network) and the rejected associations for not satisfying such constraints (Thagard & Verbeurgt 1998:2-3).

The amalgam model notion of "reconciling conflicting expectations" could be extended to match Evans' (2010b) "clash resolution" which could explain the metaphorical representation of abstract concepts, e.g., "near future". The conceptual knowledge accessed by [NEAR] AND [FUTURE] does not match at one level, i.e., the clash arises at the primary cognitive model profiles, but the individual resort to match features at higher levels, i.e., the conflict could be resolved by accessing the secondary cognitive model profiles.

The Concept Specialization Model was designed to address complex concepts to fill the gap in the previous models (Murphy, 1988, 1990, 2002). Conceptual combinations are rated using diagnosticity scoring which signals the underlying recognition of these *slots* and *fillers*. The schematic representation of concepts is still prevalent in this model despite its drawbacks[13]. Concepts assume schematic structures with slots (dimensions) and fillers (values for each dimension) where "knowledge is involved in choosing the best-fitting slot" (Murphy, 2002: 453). It, therefore, admits a bigger role of one component (specialized component) at the expense of the other (filler component).

One advantage of this model, as Murphy contends, is that it underlines the background knowledge[14] as a fundamental player in the interpretation of conceptual combinations. It accounts for the emergent features associated with some combinations. Yet, the concept specialization model is

---

[13] The schematic structure remains impoverished without reference to the rich multimodal knowledge structure of the encyclopaedic knowledge.
[14] Murphy's background knowledge was crude and underspecified.

disadvantaged by its schematic representation of meaning and the limited scope of interpretations it could address (Costello & Keane, 2000; Wisniewski & Gentner, 1993)

The Composite Prototype Model adopts higher-level theory-driven relations (Hampton 1987, 1988, 1989, 1990, 1991) in describing how concepts in conceptual combinations are represented and combined. The combination arises from interconnecting two sets of attributes according to their "importance" (Necessity Constraint), a notion which resembles *cue validity* (Murphy, 1982), *diagnosticity* (Smith & Osherson 1984), *definingness* (Smith, Shoben, and Rips, 1974), or *centrality* (Barsalou & Billman, 1989).

Conceptual combination, according to this model, is "a composite prototype… which is formed as a union of the sets of attributes from both 'parent' (constituent) concepts" (Hampton 1991: 107), e.g., "pet fish" is interpreted by virtue of interconnecting all of the important attributes of PET prototype and FISH prototype, so "LOVABLE is fairly important for PETS and irrelevant for FISH" (Ibid). The attributes with lower ratings will be discarded (filtered out) from the new combination set according to "Consistency Constraint", "Thus, if LOVABLE is now of relatively low importance, a subject may simply exclude it from the prototype for PET FISH" (Ibid).

This model bypassed the static schematic representation by proposing a constraints-driven process (e.g., the *necessity* and *consistency* constraint) which allows for more dynamic representation of the meaning. The constraints of necessity and consistency determine features' weight during combining the two sets of features belonging to the two components in a combination (combination is referred to here as *conjunction*),

> "The necessity constraint would ensure that all defining features of each concept remain critical for the conjunctive concept, and the consistency constraint would ensure the correct identification of non-overlapping sets. Well-defined concepts would, therefore, require no different treatment in the model" (Hampton 1991:108).

Similar to Thagard's model of amalgam, the Composite Prototype Model expounds some underlying mechanisms to make testable predictions. It predicts, for instance, that the "necessary feature" will get higher salience in the combination than non-necessary features. This represents an empirically testable claim in terms of diagnosticity rating. However, the notion of "*necessary attributes*" is still obscure. It is practically difficult to determine how to identify features of some concepts as necessary, especially in the case of abstract concepts. Any one of the prototypical associations (uncertainty, fear, hesitation, lack of knowledge or trust, etc.) of the abstract concepts, "doubt", do not qualify for necessary association without linguistic or situational contexts.

The diagnostic features offer a good window to closely look at the features (attributes and values) associated with the content of abstract concepts. The task of features listing for a given abstract concept gives us a possible access to the content associated with those concepts as they exist in the mind of the respondent. One way to investigate the structural hierarchy of their conceptual content is approached by asking the respondents to rank them according to their significance (*diagnosticity, typicality or defaultness*). Response time (*RT*) is a good predictor of the assumption that the first-order diagnosticity attributes require less time to retrieve while second-order attributes demand longer time to retrieve to the working memory. Features listing accuracy task could be used to reveal variations at the within-individual level and between-individuals level in the representation and interpretation of abstract concepts.

3.3.4.2. **Plausibility**

The plausibility constraint stems from the intuitive judgment of the match/mismatch between what is being attended to and the previously acquired knowledge (belief-systems), that the individual makes when he/she assumes that his/her partner means, based on previous experience. This requires a prior belief on the consensual (plausible) nature of the previously acquired knowledge in the first place.

The significant role of the plausibility constraint is very obvious in the process of meaning construction. It requires that the constructed interpretations are (not) consistent with the individual's prior knowledge which is "already known to co-occur on the basis of past experience" (Costello& Keane 2001). In this sense, some referent can (not) plausibly exist: "an angel pig is a pig with wings on its torso" would get higher plausibility rating than "an angel pig is a pig with wings on its tail" simply because our past knowledge endorses wings being attached to the torso rather than to the tail. Lower scores rating of plausibility interpretations arise from mismatches with our belief-systems. Technically, plausibility builds on the pragmatics of meaning construction (Sperber & Wilson, 1986).

Wisniewski, (1997a, 1997b), in his Dual-process Theory, introduced a higher and more dynamic format of representation than the proposed schemata of the previous models of conceptual combination. Wisniewski proposed higher units such as "*scenarios"*. This gives richer and more complex conceptual space for making plausibility and informativeness judgments. Scenario creation warrants a canvas for questioning relation-based interpretations (Wisniewski, 1997:174).

The interpreter of a combination such as "horse knife" identifies a slot in the head concept (knife) which needs to be filled with attributes from the modifier concept "horse" to form a plausible interpretation. In such cases, a multi-role scenario will be unconsciously tested (e.g., agent, object and instrument) in a scenario where "a knife used for butchering horses" (Costello and Keane, 2000). More support exists in literature for the *structural alignment process*, e.g., structural alignment in *analogy* (Gentner & Markman, 1997) and *metaphor comprehension* (Gentner & Wolff, 1997).

The alignment mechanism requires making structural comparisons to identify common properties first and then the selection of which properties can be transferred from the modifier to the head, e.g. size in "elephant fish". Alignment puts into work two sub-processes: *comparison* and *selection.* Comparison process builds on the identification of similarity "commonalities" between the two components. The notion of similarity plays a pivotal role in theoretical architecture of the Dual-Process Theory: for Wisniewski, "in order to apply a property of one concept to another, the concepts must be similar at least to some degree" (2000:36). Comparisons often result in two types of extracted information: alignable differences and non-alignable differences (Markman & Gentner, 1993; Markman & Wisniewski, 1997). Selection does not implicate that properties are just copied over to the head concept from the modifier. On the contrary, "a property in the modifier acts as a source of information for constructing a new version of that property in the head noun concept" (Wisniewski, 1997: 176) according to a rational and goal-oriented judgment of informational optimality and plausibility condition.

Wisniewski added two more sub-processes, namely the *Construction* and *Construal* processes which involve reflections on one's knowledge of the world. They involve transferring some properties between the combined concepts and require making possible "changes to achieve scenario plausibility". Construction "is an interactive process, in which the new property is a function of constraints specified by both the modifier and head noun concepts" (Wisniewski, 1997:176) where

> "the new property must bear enough resemblance to its source in the modifier so that people can determine how the modifier contributes to the meaning of the combination… at the same time, the construction of the new property must not alter the head noun concept in such a way that it destroys its integrity" (Wisniewski 1997: 176).

Yet, the elaboration or construction process remains "very complex and underspecified" (Costello & Keane 2000:334). It is assumed here that "Construction and Construal processes" can be conceived as the core of simulations in Barsalou's sense. Construal envisages emergent reference to some entity that exists in the external world that the concept doesn't typically or necessarily refer to, e.g., "cheetah bike" as "a fast bike". This would not be possible without actually simulating the two concepts in one scene.

Since abstract concepts assume a referent with non-physical properties, it is fundamental to address how individuals judge their plausibility (their match or mismatch with their beliefs systems). First, the conception of plausibility was employed in this research to address how it could arise from the processes of construction and construal. Secondly, lexical decision tasks were used to test how compositional complexity could contribute to human judgments of plausibility where variable compositional complexity, i.e., 2-word, 4-word and 6-word stimuli were used.

3.3.4.3. **Informativeness**

The informativeness constraint entails that the intended combination is supposed to be driven by the need to deliver sufficient information; otherwise the speaker would find the information inadequate for a referential and conceptual transparency. The more informationally optimal a complex symbolic unit is the more prompts it invokes in the construction of meaning (Bock and Clifton, 2000). The combination must assume more information than what the components afford individually.

The interpretation will not be automatically reduced to the cues afforded by the combined concepts, but a leading role is ascribed to the previously acquired knowledge-base. Any mismatches, due to insufficient cues from one or more concepts in the knowledge-base, leads to an automatic discard of the constructed interpretations for its uninformativeness. In this sense, the matching process is responsible for delivering an *informational characterization*—a "unified" coherent interpretation- mediated by some explicit structures. A successful interpretation could be achieved when all of the components in an utterance have attained an ordered informational characterization.

Enough evidences are available on the claim that the judgments of informativeness/uninformativeness are closely correlated with the individuals' attentional shifts in response to both informative and uninformative cues (Ortells, Vellido, Daza & Noguera, 2006). For instance, the complex informational characterization might relate to attributes being attended to in the lexical, conceptual and/or to parts of situational context. In this work, we conflate informativeness constraint with LCCM's notion of informational characterisation as both suggest the search, selection and fusion of information. LCCM's informational characterization is based on systematic and principled integration of linguistic information and non-linguistic information.

Informational optimality judgments will be used in this work to address how individuals recollect adequate information about some lexical entities whose referents hardly exist in the external world. In other words, from where do the individuals get the required information to construct the meaning of abstract concepts? What is the nature of correlation between the compositional complexity and the plausibility and informativeness judgments? Both semantic conditions (informational optimality and plausibility) will be studied in relation to compositionality (compositional complexity: 2-word, 4-word and 6-word complex symbolic units or utterances). RT is a decisive factor in the differentiation of plausibility as a cognitive shortcut and informational optimality processing as more reflective (deep) processing.

3.4. Semantic Representations and Conceptual Representations

This section addresses a fundamental issue within the theory of the semantics of natural language, i.e., the units of the semantic and conceptual representations. Indeed, the following discussion will be undertaken with special reference to a specific lexical domain, words representing abstract concepts. One objective is that it seeks to clear the confusion between words and concepts. In particular, it explores critically a stance in which one should opt for a two-level theory of semantic representation or a one-level isomorphic semantic representation.

Isomorphic stance is widely held in computational linguistics and apparently most of the models discussed in section (3.3.), simply because they consider lexical representations to be part of the conceptual system if not one and the same. This makes the two more or less confused with each other. In principle, it embraces unclear distinction between what is genuinely a linguistic knowledge and what is non-linguistic knowledge.

The two-level semantics assumes that the access to conceptual representations is mediated and constrained by some representational content with dissimilar representational format, i.e., the linguistic knowledge. This means that at least two distinct levels of mental representations exist, i.e., two discrete cognitive modules of knowledge. The semantics of words is a synthesis of the structured and principled configurations of both the systems of linguistic and conceptual systems (Evans 2009).

3.4.1. Conceptual and linguistic system: preliminary distinctions

To endorse a two-level model of meaning representation and interpretation, a number of distinctions have be systematically made. Concepts in this model can be expounded in terms of one of the following levels:

1. Ontological level: the concept as ontological content (what the concept stands for in the world in terms of sensorimotor perceptual information affordance)
2. Symbolic level: the symbolic content (phonological vehicle that encodes the linguistic content which in turn facilitate access to some non-symbolic (analogue) content.
3. Conceptual content (Gestalt-esque mental representations of the world, typically derived from perception and conception of such world. They become re-activated again during cognitive processing)

The following distinctions specify the relationship between concepts, categories, words and symbolic units at the level of the individual mind. This will support our approach to the representation and interpretation of abstract concepts.

3.4.1.1. Distinction 1: Concepts and Categories

Serious steps must be taken here to characterize the distinction between concepts and categories as well as their relations. It is a common assumption in folk psychology that concepts and categories are the same simply because both are ascribed to objects, actions, states, etc., in the world. The objects, actions, states, etc., form members of a category. In part, this is straightforward, yet, there is much of an agreement on concepts than on categories. Majid et al (2008:2) found that across languages "there is variation in the number of categories and the placement of their boundaries".

Categories are instrumental in partitioning and interpreting our experiences in the world. They are often formed on the basis of features similarities, giving birth to prototypes and exemplars based on their retrieval and recall (Hahn & Charter 1997). Concepts were seen as memory representations of classes or categories (Rosch 1983). Still, there was an unclear line between the two. Anderson (1995) perceives concepts as categories, which can have many shared features, attributes, or components. As Hampton puts it, a concept is "an instance belongs to a certain category if and only if it possesses a sufficient number of a set of features" (1981: 149). Not far from Anderson (1995) and Hampton (1981), Baddeley (1997) takes concepts as sets of descriptions forming the features which are characteristic or prototypical for a Category (Rosch 1978), Schema (Rumelhart, 1980), Scripts (Schank & Abelson 1975), and Frame (Minsky's 1975).

However, Murphy (2002) figured out the consequence of mixing the two terms, concepts and categories. He elaborated that,

> In general, I try to use the word concepts to talk about mental representations of classes of things, and categories to talk about the classes themselves. However, in both everyday speech and the literature in this field, it is often hard to keep track of which of these one is talking about, because the two go together. That is, whatever my concept is, *there is a category of things that would be described by it.* Thus, when

> talking about one, I am usually implying a corresponding statement about the other. (p. 5; italics added)

The claims above underline only one dimension, i.e., the ontological content categories may assume. This leaves us with two options. First, categories exist objectively in the external world while concepts are more or less some subjective mental representations of categories. This allows ontologically discrete distinction between mind-dependent concepts and externally independent categories which incorporate the concepts' referents. The second option is that the categories reside in the minds and can assume categorical variation. This leads us to define concepts in terms of categories. Seriously enough, if both are ascribed to objects, actions, states etc. and both reside in the mind of the individual, what is the point of having them alongside each other performing the same function?

Alternatively, we can assume that categories may not exist as discrete entities, external to the mind, but as relational co-activations of a number of concepts on the basis of similarity (shared features). In this sense, categories become convenient theoretical constructs for explicit description of similarity in relation to human concepts (see Fig 3.3).

This results in taking concepts as the most fundamental elements of cognition which can be approached by categories and determine the latter's members and borders.

It is nice to appeal to concepts' similarity, but unfortunately, similarity remains dauntingly flexible and context-dependent. This makes it, itself, much needy for characterization as much as concept formation and categorisation. Goodman argues that "when (…) two things are similar, we add a specification of the property that they have in common" (1972: 445). At this stage, we can argue that individuals acquire the concept first e.g., seeing a car (electric car then ascribe "electric car" to a category CAR. This is because the perceptual nature of concepts is what makes it possible to ascribe them to certain categories according to perceptual similarity. All humans are capable of thinking and categorizing not only about entities they can see and touch, but also about a host of other entities with which they have never had perceptual contact. For instance, it is also possible for the individuals to acquire a concept such as “recession” or “economic bubble” and ascribe them to a category, despite the fact that they have no basis for its membership according to similarity.

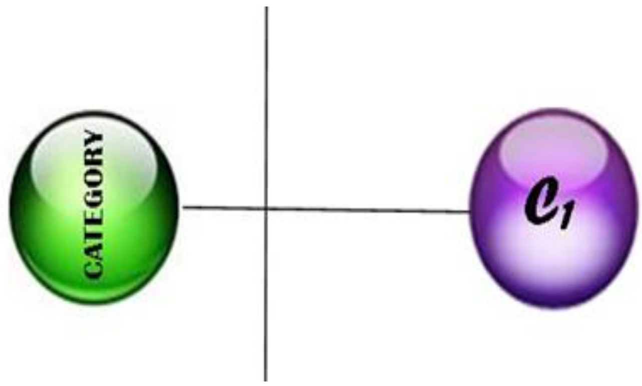


Figure3.3: Category – Concept

The conclusion here is that categories are derived by a process of some abstraction and generalisation judgments based on the adjacency of concepts. A substantial amount of this work is interested in explaining a range of ontologically problematic concepts, abstract concepts. Traditionally, they are classified under a general category whose members are characterized by the lack of perceptual content. However, this claim is not yet settled. If we submit that they have no physical content associated with them, it becomes harder to ascribe them a membership within a category as the condition of similarity wouldn’t work. On the other hand if we claim that they do have physical realizations in the world, the distinction between concrete and abstract concepts becomes redundant.

3.4.1.2. Distinction 2: Categories and Words

Accepting that categories are derived from concepts by a process of generalisation, now we are liable to explore whether words and categories are related by any means. Traditional semantic theories within the various fields of knowledge, such as philosophy and linguistics, concede that words are directly linked to categories, where the former are anchored in the latter. This allows two things: first of all, language could partition the world immediately around us and secondly is that meaning can be anchored directly in the categories' referential ontologies (Guarino & Giaretta, 1995).

Words and categories do not, in fact, relate to each other directly at the cognitive level, despite their co-presence. A word such as "car" does assume membership of the category [CAR], in every encounter of language use, e.g., "You drive a powerful car", referring to a particular ontological entity "a four-wheel vehicle with a number of properties". But, in a board note which reads "fast cars for sale here", it is unclear which car-type is there for sale. Different fast car types come to the mind but not all definitely. The reason for us to interpret this instance in certain way (think of particular car) is because of weight and direction of the associates the content and structure of the concept "fast" demand from the concept "car". The interpretation of words goes to concepts before thinking about to what category the referent belongs to.

So, it seems that words and categories needs something in between to mediate their dissimilar cognitive sources. We claim that words and categories are mediated by the concepts. Categories seem to relate to human tendency to make generalised meaning via a process of abstraction to minimize future cognitive processing load (Sweller, Ayres & Kalyuga 2011). As a partitioning filter of the world, categorisation compresses the details of our perceptual experiences to compensate the limits of our memory and meet the "economy principle" (Lemaire, Robinet, & Portrat, 2012).

On the other hand, words do play a bigger role to the transformation of thoughts, beliefs, desires and intention than to the act of categorisation and categories. This characterizes the direct relationship between words and concepts.

When combined, words efficiently serve sanctioning particular thoughts (a group of concepts) out of the individual's whole knowledge-base. To get access to others' conceptual knowledge, linguistic system (verbal and nonverbal language) is a dominant means of facilitating successful guesses of communicative intent. For my four-year-old daughter, the underlying conceptual content of "love" is expressed verbally using the words "love" and "big" and nonverbally, e.g., "I love you that big" (*stretching her hands wide apart*). This leads us to the third distinction between concepts and words. For instance, in a warning note on a house gate, e.g., "Beware My German Shepherd Dog Inside" the process of concept ascription becomes indebted to language use in which categorisation loses much of its realm to the intersection of words and concepts. Multi-word combination "German Shepherd Dog" serves sanctioning a more specific representation and interpretation to achieve a mutual consensus on concepts' structures and content.

3.4.1.3. Distinction 3: Concepts and Words

A typical rejoinder to the relationship between words and concepts in the writings of traditional philosophy and linguistics is that concepts and words are pretty much the same (see "Literalism"; Evans, 2009 and Recanati, 2004). However, how direct is the relationship between the two?

There are a number of semantic relations that could bind words and concepts together. Intuitively, by default an individual should have a least one word which correlates with a given concept, where "W" is a word and "C" is concept. Yet, in practice there are instances when the very individual may have a concept in his mind but no word available that could express it as illustrated in figure 3.4.

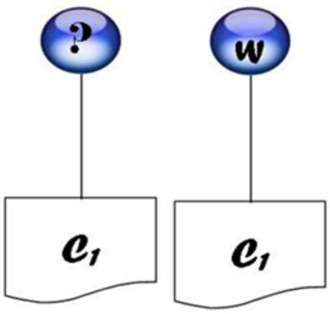


Figure 3.4: word concept correlation

It is also possible that the individual may fail to retrieve such a word from the memory. In such cases, the other means of expression come into action, such as paraphrasing, charade games, diagraming, pointing to the element of context (non-verbally using body language) and linguistically via anaphoric and cataphoric relations, and so on.

Words such as *here, there, this*, and many others, have no transparent referential and conceptual content associated with them; rather, they derive their referential and conceptual content from the immediate physical (situational) and linguistic contexts. They make more sense by incorporating extra information from the context in which they occur, providing a magnitude-neutral "topological reference" (Evans 2009: 115).

3.1.

(a) This makes a clicking noise, there! (*Pointing to something*)

(b) *Here*, in this work, adopting Evans (2009) book, I explore the contributions of the linguistic content to the representation and interpretation of abstract concept, as Evans perceived them there.

The conceptual content associated with "this", "there", "here", is unique to the context in which they occur. For instance, at a car garage, I might often specify which part produces a clicking sound, simply by using the word "this" or "here" pointing my hand to it, as I lack the exact word for such a part as in (3.1 a). Similarly, the lexical concept in (3.1 b), "here" derived its content from its integration with "in this work" and "there" from "Evans' (2009) Book". Words like "I", "him", "here" and "yesterday" are a class of linguistic expressions among many others with anaphoric, cataphoric and indexical meanings. Their meaning are derivable primarily from the linguistic context in a given situation (see Kaplan 1989). This means that their comprehension is rightfully linguistic rather than purely conceptual.

Extreme complexity arises when two words or more encode a given concept, e.g., synonymy, polysemy and metonymy. Synonymy is a semantic relation where two lexical entities or more are complete or partial equivalents in all contexts in which both can be uttered (for summary see Crystal 1987: 105-106). Complete or absolute synonymy arises when "two items are synonymous if they have the same sense" (Lyons 1968: 446). Absolute synonymy, as Lyons (1981) states, requires specific conditions which have to be met, e.g., identity, recurrence, etc. For Cruse (1985: 291), absolute synonymous relation exists if lexical items assume the same content and do not differ collocationally.

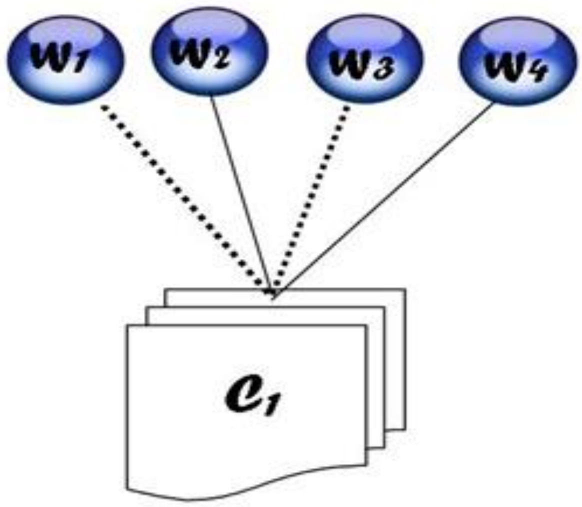


Figure 3.5: words-concepts

The other type of synonymy is partial or "scaled synonymy" where some pairs are more synonymous than others (Cruse 1985: 265-268). In partial synonymy, the encoded conceptual content of two words or more is partially identical (see Fig 3.6). For instance, in Arabic, the words "زاحلة" and "ناضحه" and "بدنة " "جمل " and "ناقة " encode one referent (a camel), but such words do not have exactly the same conceptual structure (see Fig 3.7).

3.3.

a. راحلة → Camel used for riding;
b. ناضحه → Camel used for watering
c. بدنة → Camel used for sacrifice;

In short, knowing the words does not entail a definite understanding of the meaning. Equally, knowing the meaning of the words is not enough to achieve a consensus on what is intended. Concept-specific, language-specific, context-specific and culture-specific factors seem to constrain the relationship between concepts and words.

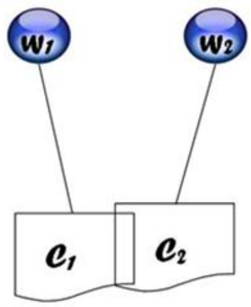


Figure 3.6: schematic representation of "camel"

The fact that a single word-form can be associated with more than one meaning (concept) is an eminent property of language. The majority of the research piloted within the field of 'lexical semantics' has a direct bearing on the issue of polysemy (e.g. Evans, 2009; Recanati 1995, 2004; Carston 2010; Blutner, 2004; Wilson and Carston 2006, 2007). In Arabic for instance, according to both linguistic and non-linguistic contexts, ("عين –eye") has a number of distinct senses. On the part of the interpreter, it requires conscious processing of extra information from linguistic as well non-linguistic context to get an optimal interpretation for every sense.

3.4.

(1) Blue eye عين زرقاء
(2) Green eye عين الصواب

(3) Water eye (fountain) عين ماء

(4) The enemy's eye "spy" عين العدو

(5) Needle's eye عين ابرة

We have previously discarded the implication that meaning is anchored directly in categories. As discussed above, words and concepts appear to be part of different systems. The relationship between categories, concepts and words is illustrated schematically in Fig. 3.7.

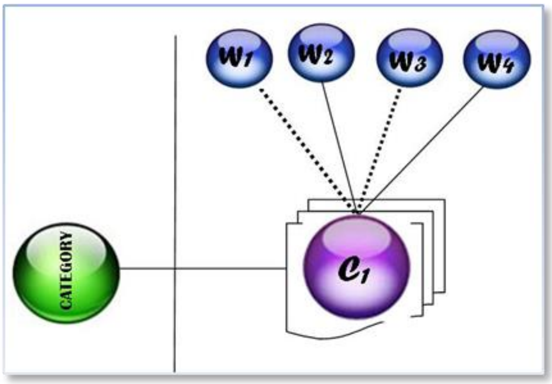


Figure 3.7: Category-Concept-Words

The absence of one does not disable the other in the interactive process of content transformation at the intersubjective level. The robustness[15] of the human cognitive system arises from the constant reflection and deliberation on its resources and optimal performance. The complex layout of connectivity and diverse structure of the layout of the cognitive sub-systems leads to such confusion between categories, words and concepts. The above distinction inspires our selection of the theoretical model, LCCM. The architecture of this theoretical model has a powerful descriptive potential to explain the robustness of the system of meaning construction as form of a complex system where "the structures of [most of] our words are mirrored in the concepts they express" (Johnson 2004:3s35).

[15] Robustness is the ability of a system to continue to operate correctly across a wide range of operational conditions.

3.4.2. Isomorphic versus non-isomorphic

It is well documented in the literature of human developmental psychology that concepts have ontological priority over the words: concepts are acquired earlier than the first well-formed words. This makes it very logical to assume that acquiring the content of a word necessitates associating it with some conceptual content. Words are perceived senseless if they fail to activate the corresponding concepts or what has conventionally been referred to as "*word meaning*". Neuropsychological researches have put forward considerable amount of evidences on the close relationship between conceptual and semantic knowledge (Cappa et al. 1998; Manrique, 2010).

Fodor hardly makes explicit any distinction between words and concepts which makes their relationship fairly direct. Fodor, however, admits that "it may turn out in the long run, for purposes of the present investigation, *word meanings are just concepts*" (1998: 2; italics added). As this shows, he admits but does not fully commit himself in other places in his works to what Johnson glosses as "*Isomorphism Assumption*". Isomorphism Assumption refers to the assumption that "the structure of [most of] our words is mirrored in the concepts they express" (2004: 335).

The claim of Jackendoff (1983) seems pretty straightforward and clearly isomorphic. He stated that the "semantic structure and conceptual structure denote the same level of representation" (p.95). His clear position dissolves the line that marks the distinction between words and concepts. The resulting conclusion is that concepts naturally become the meanings of words or the other way round.

After the advances made in experimental cognitive sciences on the dissociation between lexical and conceptual levels, the reading of the isomorphism assumption has lost much of its dominance. For instance, Vigliocco and Vinson (2007) mentioned the commonly apprehended folk psychology conclusion that humans possess more concepts than words, thus underlining the fundamental significance of dissociating conceptual and semantic levels of knowledge representation. They draw the attention to this theoretical slip which, as they say, “seems to demand a theoretical distinction between conceptual and semantic levels of representation” (p. 198). Polysemous, metaphorical and metonymic expressions that characterise human language use make an explicit realization of this crucial need for abandoning the isomorphic view and proposing two separate but intimately related systems, linguistic and conceptual.

Martinez-Manrique (2010) analysed and compared the findings of a number of neuropsychological studies which reveal that patients with brain lesions failed to perform well with linguistic tasks but do better in non-verbal tasks. These observations conclude that the deficit in processing domain-specific semantic knowledge, a property of coincides with the language system in these patients, does not necessarily affect the conceptual system; rather it could stay intact and malfunction-free (Hart and Gordon 1992; Cappa et al. 1998).

The separation issue has been taken further by a number of works which focused on the relation of lexical semantics and pragmatics, to propose an in-between layer that separates lexical and conceptual layers. Inspired by the work of Damasio et al (2004), Vigliocco, Vinson, Lewis & Garrett (2004) argue that concepts “comprise distributed featural representations” that the lexical semantic process contingently activates. The model, they designed, is entitled as “Featural and Unitary Space”, abbreviated as (FUSS). This model assumes, as Vigliocco and Vinson (2007: 209) state:

> “conceptual features (…) are bound into a separate level of lexical semantic representations which serve to mediate between concepts and other linguistic information (syntax and word-form (…) organisation at this level arises through an unsupervised learning process (…) which is sensitive to properties of the featural input”

But, this in-between featural level which separates lexical and conceptual layers, as we perceive it, does not qualify to constitute a level on its own. This is because it is meshed up between the two levels, linguistic and conceptual.

Pritchard (2009) proposes that the judgments which constrain the conceptual content are functions of some (imagistic) memories being ascribed to words. Our use of words is guided by memory-forms, which arise from our interactions with individuals, objects and events. Such forms provide constraints which we apply through making such judgements.

Vicente (2010) calls for a greater role by pragmatics, i.e., the selection of which part "of the cluster of concepts associated with a given lexical entry has to be active in the recovery of the thought expressed" (2010: 98) in similar contexts. Complex clusters of concepts are what serve to individuate word meanings, e.g., the meaning of the lexical entry "fast" arises from a cluster of complex concepts, e.g., "fast driver", "fast lane", "fast car", "day fast", etc. However, it is not clear yet, what constitutes a typical concepts cluster and what are the required conditions to be met for word meaning representation and interpretation. Pietroski (2009; 2010) perceives the relationship between words and concepts as "instructions to fetch", that the words afford to capture concepts. The instructions are procedures to couple words and concepts into (1-1, *n*-1, or 1-*n*) where *n* is any number of concepts or words (2010).

Very interestingly though, Recanati's Meaning Eliminativism model (2004) claims that words have their own "semantic potential" that they compile as a result of "the collection of past uses on the basis of which similarities can be established between the source situation (…) and the target situation" (2004: 152). Yet, it calls for a measure that could eliminate the abstraction associated with word-concept relationship. Recanati argues that the measure is to:

> "get rid of abstract meanings for [word] types, in favour of particular uses. The contextualized sense carried by the word on a particular use depends upon similarity relations between that use of the word (…) and past uses of the same word" (p. 151).

Considering the insights from the abovementioned models, we become tempted to think that such features as constitutive part of words' meaning whether they are *perceptual* in nature as Pritchard (2009) and Recanati (2004) suggest or *conceptual* in nature as the model of Vigliocco, Vinson, Lewis & Garrett. (2004) entails. This is in itself, however, quite problematic as it poses the following questions to which the two models offered no definite answers: *what is the nature of the representational content and format of these features*?, i.e., how to specify whether they are perceptual or conceptual?, how are these features integrated?, and finally, how do they acquire their content if they are conceptual? On the top of that, "*How do they contribute to meaning*?

Evans' (2009) LCCM theory claims discrete levels (linguistic and conceptual), mental structure (lexical concepts and mental model) and two autonomous systems (language system and conceptual system). In other words, as Evans puts it

> My approach to accounting for the inherent variation in word meaning is to posit a principled separation between the linguistic system—the linguistic knowledge that words encode—and the conceptual system—the non-linguistic knowledge that words facilitate access to (p. xi).

The theoretical architecture of LCCM Theory, as an account for meaning construction, is based on two theoretical constructs, *lexical concepts* and *cognitive models*. It makes two general statements: a statement on symbolic representation (linguistic pole) and one on lexical composition. LCCM, of course, generalisations on these two statements constitute what Evans calls "*Front-stage cognition*[16]".

Up to this point, the separation between two distinct systems is apparently an indispensable necessity. For Evans (2009), meaning construction arises "by virtue of a dynamic exchange taking place between the linguistic and conceptual systems" (2009: 43-44). He is very clear in his perspective on the non-isomorphic interface between lexical and conceptual level. He claims that "semantic structure and conceptual structure form two distinct levels of

---

[16] Evans gives a brief outlook on what applies to the part of meaning construction at the purely conceptual level, by forwarding the readers to accounts of "Back-stage cognition" such as, conceptual blending and mental spaces (Fauconnier, 1994; 1997; Fauconnier & Turner 2002).

representation, and do so because they inhere in two distinct representational systems" (2009: 43). This could offer a pretty clear prospect for the study of abstract concepts as will be discussed in chapter 4.

3.4.3. Normativity

The "*normativity*" of the processes of the representation and interpretation of concepts is "the (imagined) end goal of our present scientific advance" (Hampton, 1989:40), and can be viewed as a roadmap to achieving referential and conceptual transparency inside the individual's mind towards what the optimal choice or interpretation should be for a given concept. Normativity relates to what determines the most relevant or best match (or fetch) in a given context from the least relevant and worst match in such context? In the examples of "fast" mentioned above, each instance should fetch (Pietroski, 2009; 2010) a particular sense from a number of senses associated the word "fast", under semantic, pragmatic or whatever context.

Normativity facilities the necessary degree of stability for meaning representation and interpretation in an intersubjective context. The property of normativity offers a sets of principles and constraints that govern and guide the two systems' interaction during the process of meaning construction. It is necessary to give a broad guideline for making selections by complying with some regulative measures. Excessive normativity (e.g., Determinism) requires excessive idealisation and ends up with a diminishing return of too many exceptions (Lyons, 1968). Applying excessive normativity to the interaction of the conceptual and linguistic systems can only give highly idealized concepts, exactly similar to the way formal semantics perceives concepts. This does not mean that objectively true and unique concepts cannot be approached; at least, individuals could be well involved in goal-directed and context-dependent acts in making fuzzy-edged but distinct categories (Ratneshwar, Barsalou, Pechmann & Moore, 2001).

The experiential nature of concepts does not make them completely random. Experiential concept tolerates having more than one unique and correct theory of the world (*conceptual variation*). However, adapting to such variability makes humans what they are. Our cognitive processes such as conceptualization, inferencing, reasoning, analogical reasoning and metaphorical thinking are highly instrumental in supporting their quest for optimal interpretation and mutual consensus (intersubjectivity).

In Recanati's account, the major ditch in the way is to explain how words activate and make salient the particular memory traces out of a large volume of memory traces (semantic potential) being triggered. There is an urgent requirement for a principled mechanism for selecting only the most relevant and coherent traces for a given context. The balance between the two positions has been preserved in LCCM with the proposal of a set of principles for lexical concept integration and interpretation.

Following LCCM, this work proposes that the contents of lexical concepts are in themselves executable procedures that trigger and integrate concepts, giving access to non-linguistic content. LCCM does capture all these turns, and consequently, has managed to offer very systematic and plausible interpretation of how meaning is constructed through the principled interaction of different components at different levels. Moreover, LCCM adopts the constructs of the modern theories which link grammar to language usage. It could also offers a systematic explanation for and frames the results from familiarity, imageability, diagnosticity and acceptability judgments to highlight the relevance of such measures to the verification of the claims we make in this work as elaborated in part 2.

3.5. Summary and Conclusion

It is very useful here to outline very briefly the theme of this chapter and tidy up the table of discussion. As stated clearly at the outset of this chapter, the discussion of conceptual combinations develops the main theme horizontally. In other words, our main claim is that the compositional property of language plays a leading role in the enunciation of the representational content and structure of abstract concepts due to their unique nature. The basic compositional unit is what is generally referred to as conceptual combination. However, this unit has different implications as a result of the convergence and divergence in theoretical and methodological orientation the models which addressed this linguistic phenomenon.

Unfortunately, the reviewed research has shown considerable divergence on the core construct of their research, i.e., compositionality. This came as a result of number of confusions, most importantly, the fuzzy distinction between words and concepts as well as confusing compositionality as a process with its outputs. Words and concepts were used interchangeably reflecting an isomorphic view of meaning. The ways the role of compositionality was handled in facilitating meaning representation and construction was compatible with Frege's Principle of Compositionality which builds on isomorphic and unified perspective of words and concepts (Janssen, 1997).

In contrast, the models of semantic compositionality in cognitive semantics assume a clear-cut distinction between words and concepts as well as the role of mental grammar contribution to this distinction. Complex phonological vehicles, encoding internally complex lexical concepts, have part-whole structure and are governed by experimentally tested guiding compositional principles at the level of their semantics (see section 3.4.3 for “Normativity” discussion). The meaning of combinations require a very clear account of the linguistic and conceptual normative principles of integration which allow shared interpretation at the intersubjective level. Evans sketches these processes very briefly as follows:

> Lexical concepts can be combined in various predictable ways in service of activating semantic potential and thus facilitating meaning construction. Combination of lexical concepts involves the integration of linguistic content—a process termed lexical concept integration—and the activation of a subset of the semantic potential accessed via the open - class lexical concepts in the utterance—a process termed interpretation. Lexical concept integration and interpretation—

> collectively termed fusion—are governed by various constraints modelled in terms of a set of principles. (p.140)

This gap calls for an empirical proof which could link LCCM constructs to the nature of the representation and interpretation of abstract concepts and sheds more light on the diversity of knowledge structures associated with them. This work should derive evidence to show how such knowledge structures are mainly invoked by language use.

The other challenge is that they are more concerned with verbal stimuli, encoding denotational reference (physical or imagined entities) with high imageability scores and have exclusively neglected using stimuli indexing non-physical reference (Cognitive reference). Besides, when they come to consider abstract concepts, they were attached to the misconception that concepts are typologically divided into concrete versus abstract concepts. This conventional typology is based on the physical properties associated with words' referents. A considerable array of abstract concepts become misplaced within this typology. A new perspective on human abstract concepts as graded and continuous should be modelled to account for the multitude and diverse knowledge-types and structures associated with the content of abstract concepts. The existing view that abstract concepts are a homogenous and unified category needs to be abolished.

Research on conceptual combinations employed a number of lexico-semantic features such as familiarity, imageability and reference-type in their address of the underlying content and structure. Testing such lexico-semantic features, however, could only give a very crude and partial scene if abstract concepts are questioned. Such features will be tweaked and supplemented with other tasks in the methodological design of this work to offer a more adequate view on the content and structures of abstract concepts. For instance, the present work introduced lexical decision tasks to complement the rating task. The selection of this task is justified by the fact that it involves more elaborate selection and judgment on the part of the subjects.

Chapter 4
Theoretical Framework

4.1. Introduction

This chapter explains how LCCM theory offers all of the previously developed claims and facilitates achieving our research objectives. Its descriptive powers will eliminate the gaps in the other models. It makes available a theoretical perspective, jargon and analytical toolbox that the present research could utilize to explicate the answers. This chapter presents and defines the main constructs and assumptions LCCM makes in addressing the process of meaning construction and the embedded processes of representation and interpretation. LCCM will be pursued in relation to the main objective behind this work, i.e., the representation and interpretation of abstract concepts. So, this review brings to the foreground the applicability of the model to the understanding and the analysis of the unique nature of the conceptual content and structure of abstract concepts. This is not to underrate the other accounts, but to fill the theoretical gaps.

The robustness of LCCM's architecture comes from its plausible theoretical structure, general applicability and testable predictions. It plausibility arises from incorporating the symbolic representational format (phonological vehicles), linguistic representational format (grammar-constrained lexical concepts) and multimodality-specific representational format (simulation-based knowledge). This should allow a wider coverage of linguistic and conceptual variations. LCCM's applicability was tested against a number of tasks in part II.

In addressing the question about the complexity of the knowledge structure associated with the meaning of abstract concepts, the interface between the symbolic and conceptual system in LCCM will be instrumental. Evans makes a clear-cut distinction between the two poles: form and meaning. This distinction is very interesting as it demarcates the distinct knowledge-types that the individuals deposit in their memory for a given word (phonological, grammatical and conceptual). The word "recession", for instance, could only be a phonological assembly we haven't heard before, a phonological vehicle we have heard and used without actually knowing exactly what it means or we have heard/read, use and know exactly what it means. Similarly, the rest of the theoretical constructs of LCCM will be reviewed with special reference to the empirical tasks.

4.2. Lexical Concepts and Cognitive Models

In the light of the discussions undertaken in the previous chapters, a number of questions have been raised concerning the representational content and format of abstract concepts: the questions which remain pending are primarily concerned with the diverse and gradable nature of content of abstract concepts and another one on the characterization of the conceptualization process of their meaning.

One major duty of any theoretical model, within cognitive linguistics, is that it should account for the meaning of concrete alongside abstract concepts, e.g., it should account for car, door, fire, etc., in the same way for the nature of the representations and interpretation of abstract concepts, e.g., love, fear, system, debit, inflation, god, hell, peace, democracy, government, oxidation, piety, value, etc. It should also account for any variation at the within-individual and between-individual levels.

The other strong point of LCCM theory is its novel construal of the "semantic compositionality". It perceives the notion in terms of selection, integration and fusion of lexical concepts. Lexical concepts are deemed as the basic linguistic units. The combinatorial property of language phonological units facilitates the semantic compositionality of the construction of meaning. This process is syntactically and semantically principled (normativity). Lexical concepts mediate the conceptualization of concepts by giving fairly configured access to very complex multimodal knowledge structures, cognitive models.

LCCM's account of semantic structure of words builds on "an account of the knowledge of usage patterns associated with words, including what counts as an appropriate context of use" (Evans, 2009:4). This usage-based account incorporates the dynamics of the linguistic and non-linguistic contexts. Due to the fact that the conceptual knowledge structures of abstract concepts are highly protean and context-dependent, the selection of LCCM theory becomes instrumental.

Lexical concepts serve a referential function as their encoded linguistic knowledge index the "entities [actions and events] which relate to a region in some conceptual domain" (Ibid: 109). Due to their lack of definite referents, the basic structural units within the abstract domain, abstract concepts, show an exceptional need to achieve referential and conceptual transparency. One way to meet this end is to derive more information from linguistic and situational contexts. Situational contexts are highly dynamic, therefore a relative transparency can only be derived from pointing to the referents (body language) or/and the relational property of lexical concepts to each other. At the intersubjective level, the meaning of abstract concepts should be stable enough to achieve informationally optimal interpretations. Lexical concepts offer this relative stability. For instance,

4.1

a) "moral value"
b) "mathematical value",
c) "land value",
d) "value stock"
e) "truth-value"

The conceptual region associated with the word "value" is highly protean, for instance, in 4.1. (a) invokes highly abstract knowledge about social norms, standards and collectively accepted ethical principles. "Value" in 4.1 (b) relates directly to numbers and quantities. In 4.1 (c) triggers the sense of price while in 4.1 (d), it is more concerned with commodities. The combination in 4.1 (e) appeals more to the logic of the distinction between what is true or false in relation to propositions. The underlying polysemous uses associated with [VALUE] in the above examples unfold with a very interesting and worth noting property associated with the informative interface between linguistically encoded knowledge and conceptual knowledge structures that LCCM seminally offers. In other words, such distinct senses reveal a flexible and dynamic nature associated with the conceptual content of prototypical abstract concept which can only be specified and stabilized by a normatively stabilized structures, i.e., usage-based units of linguistic knowledge[17], lexical concepts.

4.3. Lexical concepts

The core construct within the architecture of LCCM is "Lexical concepts". They are bundles of semantic knowledge and units of semantic structure, encoded and externalized by phonological assemblies. Linguistic content encoded by a lexical concept takes a sequential form that could be externalized using verbal and non-verbal channels of representations (sounds and signs). They facilitate access to highly protean and conceptually rich knowledge structures, i.e., cognitive models. The access to non-linguistic content that the lexical concepts facilitate is distributed over more than one brain area. Our multimodal experiences are often richer in content and more complex in structure than the linguistic content and structure the lexical concepts themselves assume (see figure 4.1).

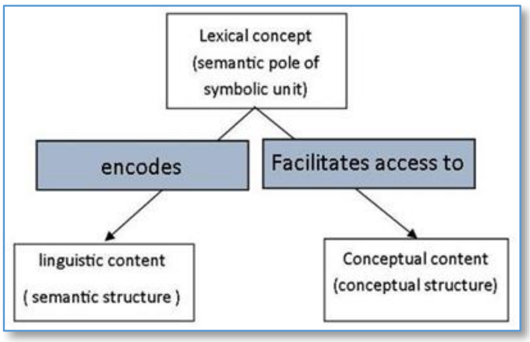


Figure 4.1: The bipartite structure of a lexical concept (adopted from Evans 2009)

[17] Lexical concepts are referred to as linguistic knowledge structures when the schematic structures are highlighted, but when they are referred to as semantic units, their potential to afford access to non-linguistic knowledge structure is under due focus.

In this section, more focus goes to the nature of the lexical symbolic units. To start with, section 4.3.1 will focus on the phonological forms (vehicles) while section 4.3.2 elaborates the linguistic referential content and finally section 4.3.3 expounds the schematic structure associated with lexical concepts.

4.3.1. Phonological Form

LCCM Theory holds that words do not directly relate to meaning, rather meaning emerges from the contributions of two interrelated facets: symbolic units and cognitive models. Symbolic units are composed of phonological forms, “vehicles”, and lexical concepts (lexico-grammatical knowledge). As Evans states:

> The LCCM approach works as follows. Words encode a core content, the lexical concept, which relates to highly schematic information: linguistic content. This represents the core information associated with a given word. In addition, words facilitate access to a large body of non-linguistic content: conceptual content. This is achieved by virtue of a lexical concept facilitating access to a body of cognitive models, which I refer to as a word's potential. (p.xii)

The linguistic system consists of a continuum of form and meaning. The pole of form is referred to as phonological assembly or vehicle while the meaning pole of the continuum is referred to as lexical concepts. The phonological forms (words) are assemblies of complex string of sounds governed by phonological rules. Words combine together according to different types of rules within the language system and give rise to *Complex Symbolic Units*. Such rules constitute what is referred to as syntax. Unlike the traditional perspective on the scope of syntax, LCCM perspective incorporates the Construction Grammar and Cognitive Grammar. The Construction Grammar and Cognitive Grammar assume different levels of non-analogue (schematic) content. To illustrate the anatomy of the symbolic unit, Evans (2009) adopted the following diagram from Croft, see Figure 4.2.

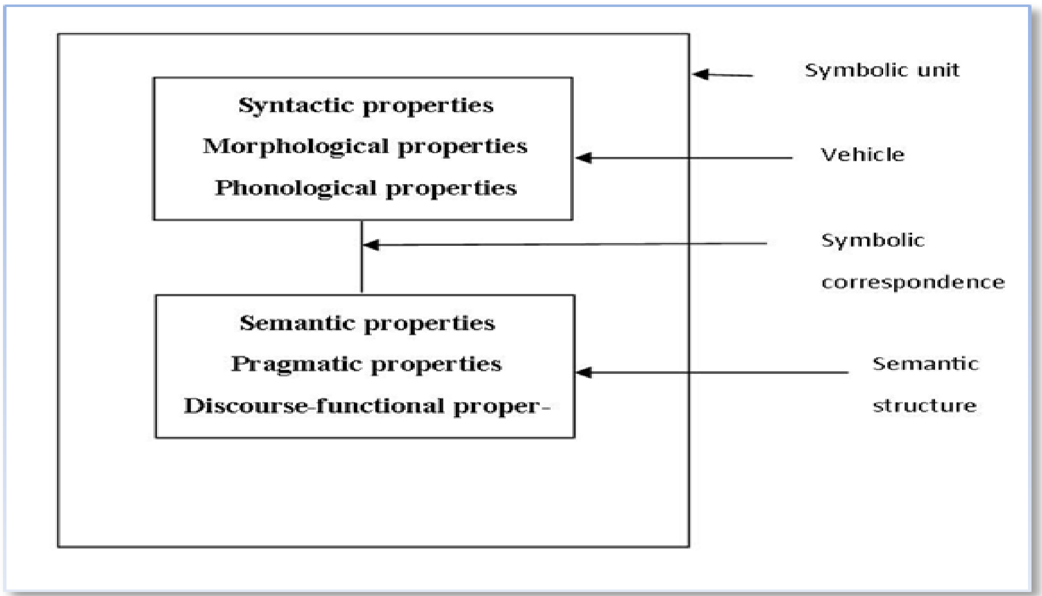


Figure 4.2: Anatomy of a symbolic unit (Croft 2002: 18; quoted in Evans 2009:95)

The complexity of the linguistic content can be reflected by a set of more compressed abstractions that Evans (2009) referred to as parameters.

Parameterization is “a highly reductive form of abstraction” which characterizes the lexically filled phonological assemblies. To illustrate this point, let’s take the word “kick”, for instance. A child, upon hearing the phonological assembly “kick”, gradually evolves a knowledge structure for such lexical concept [KICK] in his mind out of various instances of usage. Initially, it is a process of identifying it, as a phonetic potential, followed by lexically filling such phonetic form, Evans writes, “this symbolic unit, by virtue of consisting of a phonetically overt vehicle, is lexically filled” (p.98).

When a lexical concept is associated with a phonetically overt vehicle (internally closed), it can also be associated with implicit vehicle by acquiring complex schematic content and incorporating simpler lexical concepts, e.g., “NP kick FINITE NP" which relates to a more complex internally-open lexical concept [THING X CAUSES THING Y TO MOVE]. Being internally open, it accepts the integration of infinite lexical concepts, kick the ball, kick the bucket, kick the habit, etc. (p. 98).

4.2.

a. Ball kick
b. Foetus kick
c. Habit kick

In 4.2., the uses of “kick” give rise to a number of meanings via the lexical integration of “kick” with other internally-open lexical concepts. It reflects the diversity and dynamicity of its paradigmatic and syntagmatic structure. Such properties embody its richer semantic profile. The example, kick a ball, gives a conception of some dynamics of “X uses part of the body to initiate a trajectory for the ball from one point to another”. 4.2. (b) assumes a different scenario which is still physical where the baby uses any part of the body against the woman’s womb whereas “Habit kick” is a representation of a more abstract concept of quitting a bad habit such as smoking. These examples show that different regions of different conceptual domains are accessed.

First of all, now we have distinctions between phonetically overt vehicles, which are meaningless without being lexically filled with some linguistic knowledge. Such linguistic knowledge has a referential function (reference-type) as it indexes the properties of the entities and events they refer to as we have seen in 4.2. This perspective reveals how simplistic the practices among traditional research is to envisage words’ meaning as very straightforward definitions of a unified content, similar to the entries in a dictionary. The distinctions of lexically-closed and lexically-open give an in-depth description of the underlying formula of the linguistic content in a state of integration.

4.3.2. Lexical Concepts and Reference-type

The linguistic content associated with lexical concepts has a referential function in that it indexes or points to some entity (people, artefacts, abstract notions and relations). Evans’ model assumes that the types of reference any lexically-open concept may make should be either *denotational*, *cognitive* or *contextual.* The difference between the first two reference-types seems to be primarily based on the index of the available imagistic and sensory-motor information associated with the entities rather than on how real or physical the entities themselves are. Denotational reference is correlated with both actual physical entities (e.g., car) as well as imagined entities with no actual physical existence (e.g., Pegasus, Unicorns, etc.). On the other hand, cognitive reference is based on the intention to index abstract notions or ideas with no physical substance, whether real or imagined, (e.g., love, war, etc.).

The distinction between denotational and cognitive reference types appeals directly to the broader distinction between concrete and abstract concepts. The intended referent for a concrete concept is basically an entity with some indexed physical properties, (e.g., horse: size, four-legged, tail, mane, wide nostrils, strength, etc.), while "freedom" is a cognitive entity for there is no "spatio-temporally constrained" referent associated with it. However, this distinction seems fuzzy, especially when it comes to the imagined entities on both denotational and cognitive reference. Finally, the contextual reference relates to entities which are present in the linguistic or the extra-linguistic context from which the addressee can recover the identity of the referent.

In this sense, the dominant focus has been allocated to the study of the meaning of words with denotational reference (physical), because they are easier to study. The meanings of words with non-physical reference (cognitive reference) has received less attention because of being hard to contemplate. Without taking data at the level of utterance and discourse, a lot will be missed about contextual reference.

One way to derive the referential content or reference-type is by setting up rating tasks. The subjects were required to judge whether the referents that the stimuli index exist in the external world or not. The judgments in this type of tasks are crude because they vaguely refer to the existence of some properties associated with some entities in the external world but do not show whether such properties are physical or imagined by the respondents. The rating tasks, though, could derive sufficient statistical results to support the claim of concepts' continuity in terms of their abstractness.

4.3.3. Schematic nature of the linguistic knowledge

The linguistic content associated with lexical concepts is non-analogue (schematic) content as introduced briefly in section (4.2.). The schematic content could take different forms. The complexity of the linguistic content can be reflected by the more compressed abstractions that Evans (2009) referred to as "*parameters*". Parameters signal an impoverished and reductive bundle of content associated with language. The distinctions like past and non-past (kicked vs. kick), number (book vs. books), gender (prince vs. princess), person (kick vs. kicks), etc., are instances of this reductive form of abstraction. For instance, the rich and diverse conceptual content associated with "Person grammatical category", a distinction is typically made in an event, between the *speaker*, the *addressee*, and *others* with reference to their number. Such reduced bundles are reflected linguistically by the presence and absence of (-s) attached to the verb for the third person singular in English and more elaborate inflections in Arabic for the first, second and third persons. This distinction is also apparent with the use of English pronouns; however, apart from such two forms of representation the distinction remains very impoverished.

At the level of the conceptual content, the underlying knowledge associated with the grammatical category of person is richer in terms of the multimodal perceptual information, it encapsulates. The (–s) of the third personal singular contributes to the simulation of the event via indirect access it affords to the analogue information we have already acquired and stored in memory about the roles and mechanism in a communicative event.

Parameterization encapsulates a finer-grained classification of linguistic content into domains (TIME, SPACE, COLOUR, MOTION, FORCE, TEMPERATURE, MENTAL STATES, with a number of categories embedded within each of such domains, i.e., "Punctuality, Durativity, Sequentiality, Simultaneity, Synchronicity, Roundedness, Time reference (e.g., Past versus Non-past, etc.), Time-reckoning (e.g., 10.05 pm, etc.), and so forth." (p. 116).

Another distinction within the linguistic content is between nominal and relational content. Lexical concepts which are conceptually autonomous, i.e. "Nominals", invoke knowledge about independently identifiable entities, such as "chair", or "shoe". "Relations", on the other hand, refers to knowledge which is conceptually dependent on the knowledge invoked by other lexical concepts; thereby constituting a relation with others.

4.3.

a. Max hid the key under the bed
b. He hid the truth.

The overall meaning of [HID] emerges from its relation to other lexical concepts [KEY], [UNDER] and [BED]. Such relational lexical concepts are modelled in LCCM theory in terms of schematic participant roles. Still, it remains an impoverished and underspecified way to represent the rich conceptual content associated with the roles. LCCM Theory assumes that the distinction between what is nominal structure or relational structure "emerges from perceptual experience, and hence relates to a highly salient, humanly relevant, dimension of embodied experience." (Ibid: 120). Evans explain that according to the Natural Partitions Hypothesis, there exists in "the experiential flow certain highly cohesive collections of percepts that are universally conceptualized as objects, and... these tend to be lexicalized as nouns across languages" (Gentner 1982: 324: quoted in Ibid: 120).

Lexical concepts are integrated into larger lexical concepts based on their compositional nature in what Evans calls (nested integration). The process of integration is regulated by grammar, where meaning is "a function of an utterance, rather than a given lexical representation associated with a word, or other symbolic (i.e., linguistic) unit" (p.25). The integration of the schematic structures of the combined lexical concepts is governed by a principle of schematic coherence to ensure informationally optimal interpretation (p.245)

The lexical concept "on" organises the linguistic structure schematically, based its relational nature. For instance, "the picture on the wall", the meaning of on is specified by its relation to "picture" and "wall". However, individually, the closed-class lexical concept [ON] has no distinctive meaning.

The schematic coherence reflects one part of the lexical profile of a given lexical concept, i.e., the number of lexical concepts with which it co-occurs. It is largely dependent on the inherent selectional tendencies or selectional preferences of that lexical concept to co-occur with other lexical concepts, e.g., [CANCEL] + [APPOINTMENT] but not [CANCEL] + [ACCIDENT].

4.5.

a) cancel meeting/wedding/ concert/.., etc.
b) ? cancel birth/accident/ sunset/ invention/.., etc.)

The lexical concepts make up the basic elements of human mental grammar. Due to the unlimited instances of language uses, the semantic contribution of any vehicle is configured by the organisation of lexical concepts within the mental lexicon. Particular structure becomes more salient as a result of its integration with other lexical concepts in a particular language use. The salience of this structural organisation arises from a set of selectional tendencies which evolve over time. For instance, "hold a ball" and "hold a breath", the semantic contribution of phonological vehicle "hold" in both combinations is licenced by particular lexical concepts.

Evans made a necessary distinction between *formal selectional tendencies* and *semantic selectional tendencies*. One consequence of the knowledge of the selectional tendencies is to endorse which lexical concepts co-occur together (combine). The output structural organisation should conflict with the schematic knowledge as a result of combining the schematic structures of the components. The formal selectional tendencies are not enough to endorse the acceptability of the meaning of a complex symbolic unit. Other tendencies, the semantic tendencies, are needed to endorse the acceptability of the combination's meaning. Semantic tendencies stem from *unpacking* the content of the combined lexical concepts.

During the process of the integration, the linguistic content encoded by each lexical concept becomes subject to a process of "*unpacking*" to receive a semantic value. Then alignment, matching and fusion are required for the accessed non-linguistic (conceptual) knowledge during a process which Evans refers to as "Interpretation".

The claim which transpires from the discussions is that the nature of the content associated with abstract concepts requires unique sets of selectional tendencies at work. The schematic structures of physical entities, e.g., "lemon" do not apply to non-physical entities, e.g., "idea". The selectional tendency which makes up the grammatical category of person for, e.g., "lemon makes it good" and "this idea makes it good" is not the same. Unlike the concept of "lemon" which has referent with sufficient physical properties to constitute its membership to the PERSON grammatical category (third person), the concept "idea" meets this selectional tendency for person not by its spatial configurations but by its being personified to achieve plausibility and informational optimality. Metaphor, metonymy, personification are language mediated cognitive strategies which allow the individuals to conceptualize both the concept "idea" and the concept of PERSON grammatical category itself (Mittelberg, 2002).

The selectional tendencies will be the core of the lexical decision tasks which measure the correlation between the compositionality condition and the semantic condition of plausibility and informational optimality or characterisation.

4.4. Cognitive Models

Cognitive models are coherent bodies of multimodal knowledge which constitute a rich potential for coherent and vivid simulations. Cognitive models constitute access sites of an extensive network of world knowledge. Each cognitive model is comprised of functional network of interrelated concepts. In general, cognitive models encode knowledge that relates to entities, events and states in the world. Evans (2009) exemplifies

> For instance, they include knowledge relating to specific entities, such as the complex knowledge associated with a specific entity such as 'car', or a more specific entity such as 'my car'. They include information such as whether my car needs filling up and when I last cleaned its interior. (p. 512)

The conceptualizer's access to such rich network of information about the world is mediated by lexical concepts. In a nutshell, cognitive models form the core of simulations by activating personal experiences which in their turns framed by socially shared knowledge. In the same way, abstract concepts are populated by a process of simulation, in the sense Barsalou puts it, via the activation of a network of coherent cognitive models. One difference is worth mentioning here, i.e., the lexical concepts as simulators assume a significantly active role through their relational rather than nominal function.

4.4.1. Perceptual Symbols

Theoretically, the construct of cognitive models relates to a range of terms such as *perceptual symbols*, *simulators* and *simulations*, *world models* and *frames*. Despite LCCM's dependence on the assumptions of Barsalou's theory, yet it has its unique perspective. Its uniqueness manifests itself in several forms. Essentially, the content and organisation of cognitive models stem experientially from our embodied and situated (direct and indirect) interaction with the world. As we have discussed in Chapter 2, the theoretical architecture of Barsalou's (1999; 2003) model of Perceptual Symbols System (PSS) evolved from a number of behavioural and neural studies which were mainly concerned with concrete objects and actions rather than abstract entities. This necessitates a brief overview of what these notions mean and their relation to cognitive models.

The basic building blocks of mental representation, according to Barsalou, are the *perceptual symbols*. They are modality-specific imprints left by the interaction between our body and the external world (individuals, situations and events) in a form of mental embodied and situated representations.

Barsalou's perceptual symbol system is a fully functional conceptual system, which

> "[R]epresents both types and tokens, produces categorical inferences, combines symbols productively to produce limitless conceptual structures, produces propositions by binding types to tokens, and represents abstract concepts." (1999b: 581).

A perceptual symbol serves the representation of diverse concepts and contributes to the representation of a host of contexts. In other words, it "simply implements a recording system that partially reproduces experienced states" (Barsalou, Simmons, Barbey & Wilson, 2003: 88).

Perceptual symbols constitute images and events while a collection of images could depict a frame (Scheufele, 2004; 2006). Images are spatially constrained static representations that populate a considerable array of referents, especially the denotational ones. For a cognitive model of a physical entity , such as "car", we store in our memory, not only the generic abstraction about "car" as a type, but also all of the perceptually vivid imagistic representations of the prototypical instances of "car" as a category, specifying information about its shape, its tyres, colours, how it moves, etc.

Barsalou suggests three phases for the generation of simulators: the first is to generate perceptually-based[18] schemas via "free exploration". Then, simulators evolve and are stored in the memory. Third, the simulators become continuously involved in simulation during direct experience or indirectly via language use. Finally, simulators serve the generation of new concepts such as "iPad" and "iPhone" are acquired by system update and self-organization. The concepts are continuously synchronized when new perceptual symbols are acquired adding new features. For instance for the concept "car", a charging socket besides the petrol/diesel inlet to incorporate the new "electric cars". When it comes to abstract concepts, the weakest link is the first phase, i.e., how do schemas evolve for something like "fair" as in "it is not fair". I have

[18] Barsalou stresses that such representational format is perceptual not pictorial.

every reason to assume that phase one and two swap their sequence to make up phase three with the help of language. Lexical concepts as simulators combine to compensate phase one. However, this time, phase two is inherently linguistic. After one of my twins wanted to take the whole piece of a cake, I might say, “it is not fair now, split it with your brother”. After cutting the piece into two halves, I would address him and say “Good boy, now it is fair”. Their conception of “fair” is coached primarily by my language use and feedback to their actions. The cutting instruction framed their conception. If the slices were not equal, I would have said “that is not fair either, you got a bigger slice”. How rich the conceptual content of “fair” is depends on how diverse our experience is, e.g., (fair trial, fair options, play fair, etc.).

4.4.2. Frames

The verbally mediated instruction “split it with your brother” offers a frame for the meaning of the concept “fair”. A frame is a more dynamic and coherent representational structure which is constituted by coherent pieces of information that serve as interpretative contextual bodies via supporting a web of relations (Shah, Boyle, Schmierbach, Keum, & Armstrong, 2010). The term is derived from the context structure where something is enhancing and making sense of something else. It constitutes a higher unit in the hierarchy of the conceptual organisation of a cognitive model.

The difference between images and frames, therefore, is the integrated diversity of information and the dynamicity of the structural organisation. This work considers the combination of frames beyond immediate contexts in its attempt to explore abstract concepts. Intrinsic to frames contribution to the process of making sense of the world is the incorporation of more contextual cues (Berinsky & Kinder, 2006).

According to LCCM, frames can be a contextual body of interrelated information about things or events. Such frames are either for *episodic* or *generic* situations. Episodic situation frames encapsulate information about the sequential order of states and events while generic situation frames are derived from a process of abstraction to construct more general statements with high applicability on how similar things and events are structured (p.199).

For abstract concepts, the episodic situation frames help to generate their conceptual structure and make sense of their distinct senses especially when contextual cues are required for referential and conceptual transparency. Generic situation frames are required to foreground the relational aspects of abstract concepts.

4.4.3. Belief-systems

Abstract concepts are tightly related to our belief-systems in many ways. This section will elaborate the relationship between the two. One of the most relevant construct to belief-systems is Barsalou's "World Models": the individuals' conceptions of the worlds' current state and how it should look like. This includes the spatial and temporal information about the ontologies and their behaviour in the world (p. 195-196). This lies at the core of the belief-systems.

Barsalou stated that "A World Model is a person's beliefs about the current state of the world" (1993: 9). Human belief-systems are not a unified body of knowledge. One belief-system, in the way Barsalou contemplated it, arises from direct perceptual experience and representations of people, things, actions and events. The underlying representational format is mainly perceptual. Such a system is continuously synchronised and updated in accordance with any new experiences or changes to our conception of the same ontologies in the world, "birds fly". Language schematic content could efficiently simulate this part of human belief-systems for the referential and conceptual transparency of perceptual contents.

The other part of our belief-systems may develop by reflection where the individual acquires World Models indirectly from another individual (teacher, TV programme, or what I gloss as expertise).Other more plausible models are developed in terms of reflection. For instance, the concepts of "igloo", "atom", "genes", "big bang", etc. Some these are available to our sense by different means; others are known by their causal or scientific evidence. We bridge the gaps in their perceptual content from other beliefs. The big bang is completed by our perceptual beliefs about explosions. Not far from this part, beliefs based on our imaginations are still beliefs and have some ontological status. The terminator cyborg, travelling from the future to the past, is a creation of human imagination. Yet it builds on some realities, e.g., robots and spatial travelling which were extended to a human-like T-800 prototype with organic tissues and fibre muscles capable of traveling across time.

A wide array of our beliefs evolves indirectly by deference. This means that there is no definite direct experience. Religious and moral beliefs involve embracing models about parts of the world and referents as represented by others rather than directly experienced. Such beliefs may be explicitly accredited to others with no obligation imposed on the individual to believe in them or take them as plausible. For example, the models about *judgment day, Armageddon, resurrection, moral values,* etc.

Intuitive beliefs seem to work differently thanks to the internal drives which seem to be wholly or partially preinstalled and culturally conditioned. Eyelids respond automatically to danger. They are instinctively embodied and innately preconfigured. I should mention Sinha's model of bio-cultural embodiment (1988; 2005; Sinha and Rodríguez 2008), which highlights and explains such part of human belief-systems. Unfortunately, this model is not within the scope of the present study.

Cognitive models seem to incorporate most if not all of these parts of human belief-systems. More elaboration should be made, though, on deferential and intuitive beliefs which makes the construct of cognitive models descriptively more powerful.

The compositional nature of lexical concepts overrides the fact that abstract concepts lack the vividness of perceptual representation of their ontological referents. It is true that lexical concepts are informationally impoverished due to their schematic nature, but their property of integration and the principled access they afford to cognitive models during simulations offer very unique cognitive strategies to achieve referential and conceptual transparency. Grammar is very crucial in overriding the diversity of the conceptual structures,

Simulations are grammatically-constrained mental events where the meaning, at the utterance level, is guided by the normative constraints imposed on the parts to integrate. The simulations which an utterance could instantiate mirror real life or imagined situations. For instance, in the utterances, “winning athlete” and “winning card”, the concept of “wining” is accessed by the lexical [WIN] which mirrors the prototypical sense of crossing the end line in a race. It acts as a simulator for winning situations. However, the combinations, according to the rules of grammar, give rise to distinct schematic structures for wining. The understanding of the contribution of grammar in these instances can be expounded in terms of works on mental grammar by Langacker (1986, 1987) and Talmy (1983, 1988, 2000a, 2000b), Fillmore (1978, 1985, 2006). Talmy observes that “[...] linguistic expression exhibits a strong bias toward conceptual dynamism as against staticism." (Talmy 2000: 171).

4.4.4. Hierarchy

LCCM’s Cognitive models, comprised of individual frames or related frames, are organised on a hierarchy. They are sub-categorised into primary and secondary cognitive models. Primary cognitive models (PCM) have the characteristic of high threshold in that they can be accessed directly via a lexical concept and act as a hub for the access to Secondary Cognitive Models (SCM). The distinct PCMs accessed by a lexical concept constitute a primary cognitive model profile (PCMP). In addition, the SCM profile (SCMP) consists of all the SCM which are indirectly associated with a lexical concept. However, Evans notes that “they still form part of the semantic potential to which a given lexical concept potentially affords access, although there is not an established connection between the lexical concept and secondary cognitive models” (2009: 208).

For example [DOUBT], whose interpretation arises from the conceptual content that lexical concept affords access to, assumes an initial search at particular PCMs access site and whose impoverished content necessitates a further search into sites of indirectly connected SCMP. This establishes a framework from which the interpretation of a particular, unique and unconventional uses of lexical concept such as [DOUBT] can be explained.

4.6.

a. Her doubts turned into certainty when her breast cancer was confirmed by the latest ultrasound.
b. The philosophers' doubts about human existence are nonsense.
c. A woman will doubt everything you say except it be compliments to herself
d. Her jealousy lives upon doubts that he is having affairs

In 4.6, (a) the linguistic knowledge which is activated to form the conception of [FEAR] should involve the access to a primary cognitive model profile or the "sense", i.e., fear (Evans, 2009:79; 207). Based on lexical coherence, such linguistic content encoded by [DOUBT] provides an initial step to allow access to some conceptual content associated with the primary cognitive model, "suspicion". Once lexical coherence is not maintained due to a syntactic or semantic clash between individual primary cognitive models within the higher complex symbolic unit, further search is initiated to compensate the incoherence. Otherwise, this will result in a degree of incongruity.

In 4.6 (b), a semantic clash may appear when [Doubts] and [human existence] are integrated. For [DOUBT] to activate [UNCERTAINTY] as its PCM does not fit with our common sense of human existence as the latter is beyond disbelief. A search for more coherent conceptual content SCMP is being initiated at higher levels. [PHILOSOPHICAL ARGUMENT], for instance, could be activated and invalidated for its coherence, thus make more sense of the meaning in this complex symbolic unit. However, a search for coherence is done first at the PCMP, thereafter in the SCMP. In other words, it is very logical to assume that processing of an integration of two lexical concepts involving some sort of semantic clash should take longer processing time and response time (RT).

Reference-tracking of an entity in the physically constrained world often entails the activation of modality-specific knowledge structures (cognitive models). But, when such an entity lacks the physical spatio-temporal constraints, reference-tracking requires other cognitive strategies. Evans (2009) described abstract concepts as “not to be directly grounded in sensory motor experience” but have “inherent content”, arising from what he calls subjective experience as a replacement for Barsalou’s term “introspective experience”. Evans, for instance, discussed in depth the inherent content of the concept of “time” and illustrated how time is represented and structured schematically with the help of the linguistic content (p.212-213). Still, concepts such as “truth”, “doubt”, “recession”, “honour”, etc., need more elaboration to show how the representation and interpretation of such concepts relate to such inherent subjective content. What is the nature of this inherent content? I claim that the structures and hierarchy of the cognitive models facilitate the process of reference-tracking not because of the nature of accessed cognitive models but due to the emergent relationships between the cognitive models at different levels of the hierarchy.

4.5. Semantic Composition

As concluded in section (4.4.4), the inherent content of abstract concepts is characterized by qualitatively relational nature in that their conceptual transparency is dependent on linguistic and situation contexts. The meaning of concepts relates directly to the process of semantic composition. LCCM perspective implicates that the schematic content of the integrated lexical concepts, i.e., via compositional property of language, is guided by grammar. Furthermore, Evans (2009: 36) maintains that,

> “grammar is no longer viewed as constituting an abstract set of rules which operates word. Rather, the lexicon and grammar form a

continuum, each consisting of bipolar symbolic units comprising a form and meaning: … known as the lexicon-grammar continuum".

For instance, [BAKE], as Evans exemplifies, encodes the ditransitive structure (X INTENDS Y TO RECEIVE Z). The selectional tendencies of [BAKE] embark on the lexical concept's typical co-occurrence and grammatical preference (p. 36). The semantic composition is a complex process, within which other fundamental processes are embedded (see figure 4.3):

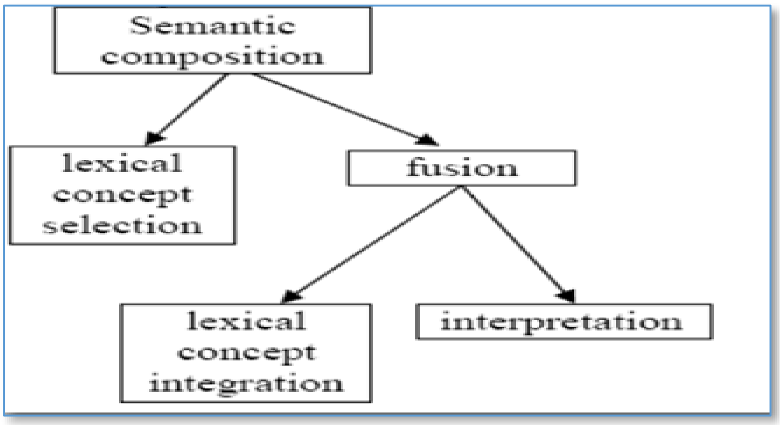


Figure 4.3: Semantic composition (Based on Evans 2009:75)

Evans (2006) argues that words' meaning is "protean", that is to say indeterminate. Their meaning is context-dependent (p.29) and is "a function of language use" (p.8). LCCM cannot satisfactorily account for the adaptability of language to the dynamic and complex nature of communicative situations without a systematic perspective on the semantic compositionality. The rules of the semantic compositionality apply when lexical concepts combine into higher complexity symbolic units such as combination, utterances and discourses. As an illustration

4.7

(a) The midfielder kicked the ball to the forwarder who was already in the offside position

(b) She smiled and kicked his ankle under the table.

(c) My wife let me feel our baby's kicks.

(d) The marathon runner tripped by the crowd, kicking the marathon organizing committee platform in his way down to the ground.

(e) I have been smoking heavily recently, I need to kick this habit.

(f) The speaker kicked another stone, the argument this time to underline the Green Deal.

As in (4.7) above, the default meaning of the lexical concept [KICK] is [STRIKE X WITH ONE'S FOOT]. However, these examples embody more diverse and complex contexts associated with [KICK]. It associates with more diverse conceptual contents than the default sense actually bears due to the unique compositional contributions of compositionality in each context. Each conception involves differential activation of the cognitive model profile that the lexical concepts facilitate access to. This process involves two component processes: (i) lexical concept selection and (ii) fusion.

4.5.1. Lexical Concept Selection

The process of lexical concepts selection is a key process as it represents a benchmark for the rest of the other processes. A goal-oriented rational selection of the most appropriate lexical concepts for a given vehicle to match other lexical concepts is crucial for fusion. This gives selection a priority: being familiar with a given vehicle, the conceptualizer needs to identify which lexical concept makes more sense from among the different lexical concepts encoded by that vehicle, e.g., “sea sickness”, “sleeping sickness”, “morning sickness”, “sickness benefit”, “sickness claimants” etc. The semantic contribution of the lexical concept [SICK] associated with the vehicle activates distinct regions, such as disease, nausea, illness, abnormality. The selection process is not only constrained by the lexical structure of the complex compositional unit but by other higher compositional units, e.g., discourse.

This process is responsible for filtering the diversity of the lexical concepts of a sequence of vehicles according to many dimensions. The multiplicity of lexical structures associated with each vehicle, i.e., the lexical potential, is narrowed down by the input of the integration process to single lexical concepts ready for fusion. The selection may seek to bring to the foreground a particular lexical concept from a number of possible lexical concepts (broad selection) or particular structure of the same lexical concept is being selected (narrow selection).

Selectional tendencies are a set of imposed natural, syntactic, semantic and pragmatic conditions. They are governed by the specificities of the linguistic context or the extra-linguistic context. The selectional constraints can be defined as the semantic constraints which are imposed by "X" on the semantics of "Y" in "XY". For instance, "?thinking stone", the selectional restrictions underline some semantic incompatibility between human properties of "thinking" with a non-human entity, "stone". Our knowledge on such selectional restrictions is instrumental for lexical disambiguation (McCarthy, Carroll & Preiss 2001). In this work, the predominant interest goes to the semantic selectional tendencies at the level of the complex symbolic units.

At the linguistic context, two kinds of selectional tendencies arise: formal selectional tendencies and semantic selectional tendencies.

> *Semantic selectional tendencies* have to do with the (range of) lexical concepts with which a lexical concept co-occurs and in which it can be embedded. *Formal selectional tendencies* have to do with the vehicles with which a given lexical concept co-occurs, or in which it can be embedded.(Ibid:134; italics added)

The two selectional tendencies are distinct but closely related. Models of semantic composition have normally supposed an independent but close relationship between semantic and syntactic composition (e.g., Heim & Kratzer, 1998; Pollard & Sag, 1994). Semantic combination of words can only occur when such a process is guided by the structural composition (e.g. Ferreira & Clifton, 1986; Frazier & Clifton, 1996).

The formal type operates at the level of the vehicles while the semantic type operates at the lexical concepts level. Formally, for instance, the schematic content is another source of organisation, for instance, Transitivity, Person, Passivation and Perfective Structures (see the examples in 4.8)

4.8.

(a) John presented his seminar first, then Mary.
(b) John presented Mary a present.
(c) John snores at night
(d) Mary and John live together
(e) Mary looks angry
(f) Mary was dumped by John.
(g) John dumped Mary.
(h) John has broken his leg at work.
(i) John broke his leg at work before.

According to the formal selectional criterion, transitivity, a salient grammatical feature for relational lexical concepts is associated with verb form. It licences the occurrences of “presented” in “a” and “b” where objects are necessary while intransitivity licences the occurrences of “snores” and “live” in “c” and “d”, where the requirement for a direct object does not apply. The selection is a rational task which could reflect an optimal foraging strategy to search in a patchy environment (Abbott & Austerweil, 2012). The formal criterion alone is not adequate to explain the process of lexical matching of the knowledge accessed by the component lexical concepts during the interpretation or how acceptable the resulting knowledge is (acceptability judgment). This means that when a clash of resolution emerges at one level, e.g., as in metaphorical structures, new selectional revisions are required, possibly selecting other lexical structures to resolve the clash.

Typically, the semantic content is assumed to affect interpretation when the syntax is ambiguous. For instance, 4.9

(a) Ball kick
(b) Head kick
(c) Baby kick
(d) Habit kick

The involuntary activation of default conception [STRIKE X WITH ONE'S FOOT] does not satisfy a number of instances according to their contexts of use. Some contexts such as (b) in 4.9, the lexical concept “kick” does not assume the same force dynamics and actor to the one in (a). This may require a further search in almost the same region to satisfy their integration and interpretation. Baby kicks (b) requires the activation of different sets of cognitive models, as the kick may not necessarily be a leg kick. Shift of salience (from leg kick to head or body kick) can be explained systematically in terms of LCCM’s conceptions where a lexical concept could activate a direct but not default route for some search regions. Similarly, in (d) the action of kicking assumes a different configuration of kicking action which is wholly determined by the nature of quitting, a non-physical fictive dynamics.

The process of selection is intimately relevant to the representation and interpretation of abstract concepts. It unpacks the distinct inherent knowledge structures associated with a lexical concept [DOUBT] in a lexical conceptual unit “cancer doubts” [X SUFFERS FROM CANCER] in comparison to “affairs doubts” [X HAS AFFAIRS]. The first structure X is not willing to have cancer whereas in the latter X has the willingness to have affairs. On the basis of selection, the contents of the selected lexical concepts become ready for a further process of compositionality, i.e., fusion.

4.5.2. Fusion

Fusion is at the heart of semantic composition in LCCM Theory, and “applies to semantic structure, which is to say linguistic content” (p. 217). It is a compositional process within which two processes are embedded, lexical concepts integration and interpretation.

4.5.3. Lexical concepts Integration

The integration process is focused on the construction of larger and coherent "lexical conceptual units" (p. 76), based on the selection of the appropriate lexical concepts. Integration, therefore, involves combining the linguistic content "encoded by lexical concepts" and "the subset of cognitive models profile" that lexical concepts facilitate success to (p. 137). The integration at the linguistic level offers a semantic value 'scaffolding' for the integration at the conceptual level. This necessitates the implementation of some semantic criteria to adequately describe how the lexical concepts fit (align) together to generate more acceptable meanings.

The process of integration builds on a key process of *unpacking of the linguistic content* to allow content alignment at the linguistic level and prompts the same process at the conceptual level (p.205). The interface which the lexical content of the lexical conceptual units makes with the non-linguistic content such units afford gives rise to interpretation. Grammar plays a key role in the disambiguation of this interface. The scaffolding function of the grammatical content of the lexical conceptual content provides the non-linguistic content with a particular structure. This unique structure determines their "informational characterization" (p. 236).

The difference between the content encoded by the linguistic content of the lexical conceptual units and the non-linguistic content is that the former is schematic while the latter type is multimodal. As Turner (1996: 145) reflects on Fillmore's proposition, "In a construction, certain story structures go with certain grammatical structures. When we want to tell that story, we use that grammar. When someone uses that grammar, it prompts us to think of that story". For Talmy's (2006) "cognitive dynamism", "force dynamics" entails that the dynamics is explicitly represented through language and introspection. For instance, the linguistically coded schematic structures in the individuals' mind instantiate partly a form of an imagined "factive or fictive" locomotion. The embodied perspective of the individual contributes to the viewing arrangement, i.e., landmark point, the path, etc., and how the dynamics are mentally represented (Langacker 1999: 88). For example:

4.10.

a. Evaporated hope
b. Flowing thoughts and emotions.

The integration depicts schematically relational structures such as landmark-path-destination dynamics. They are encoded by the linguistic content of the relational or conceptually dependent lexical concepts (e.g., evaporated and flowing), rather than the conceptually independent "hope", "thoughts" and "emotions".

Guided by a number of linguistic principles in context, the fusion of diverse information from linguistic, conceptual and extra-linguistic inputs allows the individual to achieve optimal reading. The Principle of Linguistic Coherence is one of the principles which govern lexical concept integration. This states that a lexical concept that is internally open may only be integrated with a lexical concept with which it shares schematic coherence in terms of linguistic content.

> (p.1) Principle of Linguistic Coherence: A lexical concept that is internally open may only be integrated with a lexical concept with which it shares schematic coherence in terms of linguistic content (p.245).

The Principle of Schematic Coherence, a principle which regulates the integration of schematic structures according to coherence. This states that the content associated with entities, participants, and the relations holding between them must exhibit schematic coherence

> (p.2). Principle of Schematic Coherence: The content associated with entities, participants, and the relations holding between them must exhibit coherence in fusion operations. (Ibid)

4.5.4. Interpretation

The interface between the semantic structure and the conceptual structure feeds the outcome of the process of integration, lexical conceptual units, to a process of interpretation in order to produce "a situated reading: an informational characterization" (p. 240). Interpretation is very necessary to track reference and acquire conceptions.

Interpretation is intimately related to the concept of "perspective" which implies casting your own subjective and socio-cultural simulations, where language use facilitates viewing arrangements, i.e., "language provides the means—by way of instructions of specific kinds—for the conceptual system to produce complex simulations (p.252). Perspective embarks on the subjective and social-cultural orientation to intentionally sanction, integrate and interpret part of the world for the hearer to take. The hearer simulation of this part of the world is based on the informative use of language compositionality together with the mentalization of the intended perspective by the speaker.

The representation and interpretation of perspective using language poses a challenge as the speakers and the hearer are likely to converge and diverge on what constitutes that perspective (Brown & Duguid, 1998; Krauss, 1987). The speaker's communicative act obliges him/her to be as informative as possible for the latter to fetch what the former means. The hearer should assume that the former's words should mean something that the hearer himself assumes them to mean, otherwise the speaker wouldn't have selected such words. This is called perspective-taking and perspective-giving (Krauss & Fussell, 1991).

The notion of "*Informativeness*" is built on what has been advanced in the literature of pragmatics. Following Recanati's (2004) *Pragmatic Interpretation* refers to the recognition of any communicative actions performed with an intention as recognised by the hearer and well-expressed by the speaker. This commitment entails very conscious and goal-oriented choices of language use and combinations which qualify for successful pragmatic interpretation. Recanati defines pragmatic interpretation as:

> Pragmatic interpretation is a totally different process [from semantic interpretation]. It is not concerned with language per se, but with human action. When someone acts, there is a reason why he does what he does. To provide an interpretation for the action is to find that reason, that is, to ascribe the agent a particular intention in terms of which we can make sense of the action. [. . .] A particular class of human actions is that of *communicative actions*. That class is defined by the fact that the intention underlying the action is a communicative intention—an intention such that (arguably) its recognition by the addressee is a necessary and sufficient condition for its fulfilment. To communicate that *p* is therefore to act in such a way that the addressee will explain one's action by ascribing to the agent the intention to communicate that *p* (p. 54, emphasis in the original).

LCCM's thesis is built on solid postulation of the bipolar interface of semantics and pragmatics. Acceptable simulations emerge from pivotal dynamic processes of structural matching and alignment which are necessary for achieving situated conception. Coherent simulation relates to the individuals' judgments of compatibility of the simulators combinations and the simulated knowledge with respect to:

i. The normative constraints, meeting the formal and semantic selectional tendencies
ii. Subjective and socio-cultural constraints, meeting the intuitive, reflective and deferential certitude for the encountered concept, event, situation, etc. in terms of the sufficiency of information and plausibility. This includes the match/mismatch between the encountered concept, event, situation, etc. and the previously acquired knowledge (belief-systems).

The integrated conceptual structure that the integrated lexical conceptual units give access to is administered by principles of interpretation, i.e. the Principle of Guided Matching. Such principles facilitate informativeness and plausibility. Furthermore, the Principle of Schematic Salience in Matching facilitates selections revision and narrows down the accessed knowledge based on the schematic structure inherent in the combined lexical concepts. In "Gluten free", the meaning of no gluten included is facilitated by the schematic structure of an empty container. For Fillmore a lexical representation of meaning is when,

> "a lexical set whose members index portions or aspects of some conceptual or actional whole. The items in a frame, in other words, are only understandable to somebody who has (conceptual) access to the underlying schema onto which the parts of the frame fit." … one example is found in connection with the 'commercial' event. The event type is one in which one person exchanges money for some sort of goods or services received from a second person. There is a large set of words that key onto various parts and aspects of the commercial event schema. Examples are "buy", "sell", "pay", "spend", "cost", "charge", "price", "money", "change", and dozens of others. Within the set of words linked together in a frame can be found many that form paradigms, contrast sets, Taxonomies, and the rest; but all of them require for their semantic specification, a prior detailing of the nature of the associated conceptual schema" (Fillmore, 1978:165).

The schematic content afforded by "free" with that of "Gluten" were matched for coherence to achieve informationally optimal characterization (Principle of Conceptual Coherence). The access sites for the lexical concept are searched for the primary cognitive models which make sense. This search seeks to highlight the most salient attribute and values which serve informatively optimal and plausible interpretation. In case of possible clashes, further searches are prompted for further access sites at the level of the secondary cognitive models profile for higher resolution (Principle of Ordered Search Matching).

Plausibility judgments employ the Principle of Conceptual Coherence where two separate effects could emerge: conflict and revision. Conflict arises when the interpretation associated with the lexical conceptual unit does not agree with the previously acquired knowledge and belief-systems. Revision occurs as a result of arriving at a mutual consensus on the informativeness and plausibility interpretation of the novel combination. This allows abstracting away new meanings from novel combinations, some newer ones which could stabilize over time, mostly without destabilizing the internal coherence of the older ones unless they have proved unacceptable. *Conflict* cost is incurred when the preferred structure as predicted by the syntactic or semantic model conflicts with the globally preferred conceptual structure. *Revision* cost is predicted when the interpretation of the globally preferred conceptual structures (beliefs) are destabilised.

Although LCCM theory does not explicitly account for plausibility, yet it puts beforehand a number of constraining principles for interpretation which could contribute to the judgment of plausibility of meaning. It also endorses the principles which operate at the backstage cognition proposed by other models, e.g., Conceptual Blending and Mental Spaces (Fauconnier, 1994; 1997; Fauconnier & Turner 2002).

Abstract concepts e.g., fictive, scientific and religious concepts could be deflated by a negative plausibility judgment. For instance, atheist people deflate the conceptual content of the lexical concept “God”, as they do not believe in the existence of any form of divine deity. This raises a fundamental questions: what is the nature of the conceptual content of such a category of abstract concepts, how are they represented and constructed in the mind? And how do we find them implausible?

The empirical contribution of this work on the process of interpretation is manifested by tasks which pertain to the correlation between the compositional constraints and the semantic condition of informational optimality and plausibility.

4.5.4.1. Matching

The matching process seeks to deliver an *informational characterization*—a "unified” interpretation for the content of the lexical conceptual units: a linguistically mediated simulation. Lexical concepts within complex compositional structures, lexical conceptual units, are matched to achieve informational characterization, allowing their unique cognitive model profile to move around and (re)match until they give a more coherent conception. Since the formation of the lexical conceptual units' is recursive, interpretation is consequently recursive. The process of matching lies at the core of simulation which is instantiated by language. Evans writes

> from the perspective of LCCM Theory, it is not so much that encyclopaedic knowledge "gets into" language. Rather, language provides the means—by way of instructions of specific kinds—for the conceptual system to produce complex simulations (p.252).

By applying LCCM Theory, it can be suggested that the lexical concept [VEHICLE] affords access to at least the following cognitive models, see figure 4.4.

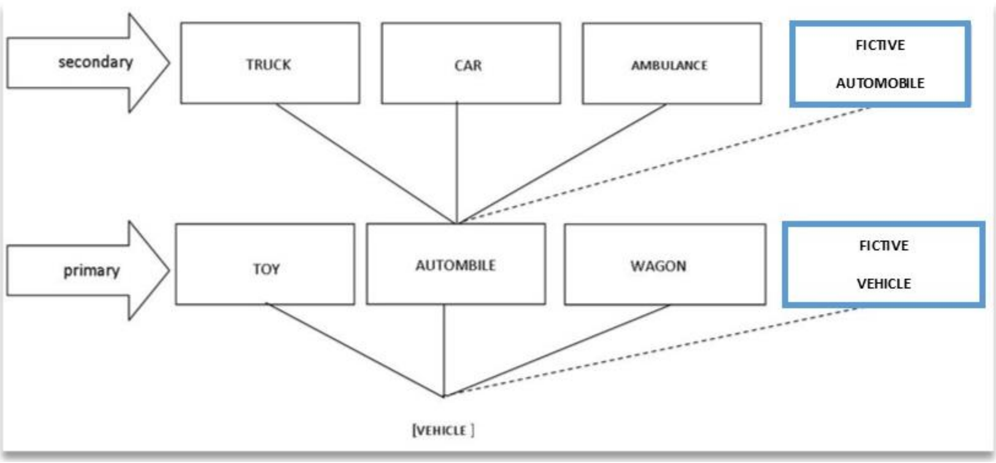


Figure 4.4: Primary and secondary cognitive models for [VEHICLE]

In agreement with LCCM, the lexical conceptual unit encoded by the integration of the lexical concepts [SPACE] and [VEHICLE] in an utterance like "I build my own space vehicle", gives the interpretation of a fictive automobile which does not have a physical reality except in my mind. Most of the properties I may associate with this imagined entity must be based partially or wholly on the category of vehicle, but does not make it easy to track as a physical entity like a real car. In other words, it cannot be classified as denotational. This may, in part, diverge with Evans conception of reference, but it leads to wider-coverage typology of reference. I propose that imaginative referents should be detached from the physical referents in make a typological classification of the referential functions of language.

However, in an utterance like "lexical concepts are encoded by phonological vehicles", the lexical conceptual unit undergoes a process of matching to solve a clash between the two integrated lexical concepts. The interpretation of [VEHICLE] as a cognitive entity inheres its fictive conceptual nature from the associative organization of the attributes and values it acquires from other lexical concepts. This *cost-demand* transfer of attributes and values is enhanced by the encyclopaedic knowledge which serves to invalidate the optimality of the achieved informational characterization. LCCM suggests that a lexical concept [VEHICLE] affords access to an access site with multiple associative areas. Evans (2009: 205) refers to specific locations "in the conceptual system with which a specific lexical concept is associated", i.e., "*association area*".

The lexical concept [DOUBT] facilities access to a complex access site with inherent relational conceptual content. The content accessed in this access site is not solely modality-specific, as is the case in the primary and secondary cognitive models profiles; rather, it is highly linguistic. [DOUBT] represents a hub for more complex network of other lexical concepts which in their turn afford access to access sites at the primary and secondary cognitive model profiles (see figure 4.5). For instance, [DOUBT] in wife's doubt in 4.10 "d" activates uncertainty directly and lack of trust indirectly.

4.10

a. Her doctor's <u>*doubts*</u> turned true about her breast cancer by the latest ultrasound.
b. The philosophers' <u>*doubts*</u> about human existence are nonsense.
c. A woman will <u>*doubt*</u> everything you say except it be compliments to herself.
d. Her jealousy lives upon <u>*doubts*</u> that he is having affairs.

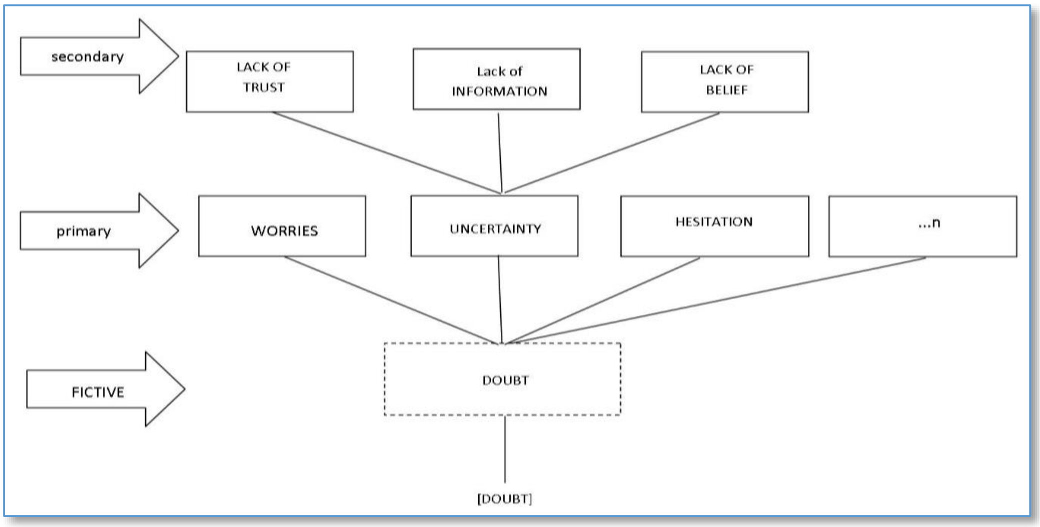


Figure 4.5: Primary and secondary cognitive models for [DOUBT]

A very interesting type of activation, though, is the Partial Primary Cognitive model activation which explains activating limited attributes and values from the matched cognitive models as a facilitative function to achieve informational characterisation. Again, in the example wife's doubt, the attribute of jealousy is activated due to Partial Primary Cognitive model activation. This invites various high-order cognitive processes and heuristic strategies, e.g., conceptualization, inference, reason, decision-making and preferential selections.

4.6. Conclusion

In this chapter, we have reviewed the main theoretical pillars of Evans' model LCCM and established why it is adequate for the description of the representation and meaning construction of abstract concepts. However, the starting benchmark for addressing these two issues is to underline the indispensable contribution of the linguistic system in the sense LCCM proposes it. Due to the unique nature of human abstract concepts, more focus was allocated to how the interface of the linguistic and conceptual systems serves to frame the meaning of abstract concepts by the prompts from the linguistic context to fetch optimal informational characterisations. LCCM proposes a clear-cut distinction between a linguistic system and a conceptual system. Lexical concepts are the basic semantic units that constitute our language system and cognitive models are the most fundamental units of our conceptual system.

The constructs of lexical concepts and cognitive models could explain the claims we have made so far on the content of abstract concepts. The distinction between the two constructs may lead to elaborate human concepts as representations of the following reference-types:

i. Denotational referents: a category of ontological referents, which can be tracked due to their physical properties. The accessed cognitive models, by virtue of the lexical concepts which index them, are perceptual records of such physical properties. Language has the capacity to denote such properties.
ii. Imagined referents: a category of phenomenological referents, how we perceive or imagine them as phenomena without certifying their connection to an external reality. The crucial point which follows here is that for a concept to be identified as abstract does not necessarily mean that it is completely non-imageable. In a fictive setting, one can imagine things like "paradise" and "hell", "ghost", "aliens", etc. without having any ontological presence.
iii. Cognitive referents: A category of linguistically realized referents without any physical or imagined properties. Their inherent content is derived from their linguistically mediated relational organization. To track their referent seems to build on unpacking the linguistic and situational contexts associated with language. Language becomes the main structuring device. To explicate such structure can be approached by language, verbal encodings in this work. These metalinguistic statements in our verbal encoding tasks should construct a broader impression about the relational properties associated with the concept in question (Wiemer-Hastings and Xu 2005: 731).
iv. Contextual referents: a category of referents which can be ontological, phenomenological or cognitive but can only be derived by lexical entities like "*this, that, here, there,* etc.".

In terms of the above classification of referents, a qualitative and quantitative analyses of the content of human abstract concepts were made to test the claims we have developed in this part in Part II.

The application of Lexical concepts selection and fusion on how the meaning of an abstract concept is explicated will be tested in terms of a number of tasks. To bridge the methodological gaps in prior attempts to address the main questions, the interpretive and productive aspects of abstract concepts' representation and meaning construction will be addressed. The interpretive aspects will be tested in terms of judgement of a number of lexico-semantic features (familiarity, imageability, reference-type, verbal encoding, etc.) to derive the content and structure of abstract concepts. The productive aspect will be tested in terms of verbal description task, features decision, lexical choice and so on. The statistical and analytic findings of the tasks should agree with the assumptions that the present work outlined in chapter 5. LCCM theoretical constructs and constraining principles, whose adequacy will themselves be validated, should offer theoretical lenses for analysing the empirical findings and results and linking them to the research questions.

The methodology and design of the tasks will be elaborated in part II. Most of the tasks were based on previous works but were instrumentally tweaked to meet the objective of the present work.

PART II

This part falls into four chapters. The departure point for this part is to provide an empirical contribution to the understanding of abstract concepts. Some experimental techniques which base on an array of theoretical assumptions from cognitive linguistic will be recruited to answer our two main questions. The main general questions addressed here are:

1. What is the nature of the psychological content and structure of abstract concepts?
2. How do humans represent and interpret the conceptual structure of abstract concepts?
3. Whether Evans' LCCM could adequately account for the uniqueness of the conceptual structure of abstract concepts and how individuals conceptualise them?

This part aims at taking some steps further by testing a number of claims that we have previously developed on the nature of abstract concepts. Based on the discussions and reviews, the empirical contribution is based on a systematic design of four experiments within which a number of tasks were embedded. The results of experimental part require a subtly designed theoretical framework with a repertoire of terms and constructs to frame and interpret. LCCM is perceived to adequately frame the underlying the representation and interpretation of the abstract concepts. In the same way that the design elaborates the nature of the abstract concepts, it will experimentally test LCCM's theoretical architecture in a number of ways.

In short, the design seeks to figure out how accurate these claims look and how plausible the proposed model is. So, methodologically systematic empirical tasks should be designed to rock the core of the claims about the abstract concepts and LCCM's theoretical architecture.

The Experimental Design

According to the theoretical perspective of cognitive linguistics, concepts are the basic elements of cognition and reason: they constitute the core of the words' meaning, categories and conceptualisation. Theories of cognitive linguistics have a number of equivocal theoretical claims about how we understand abstract concepts. Still, to the best of my knowledge, not enough empirical investigations exist on the psychological content and structure of abstract concepts or the specification of the linguistic contribution to their evolution. So, this empirical part is a serious attempt to bridge these gaps.

a. The General Paradigm

The conventional classification of concepts into concrete and abstract concepts is mainly based on the physical properties of their referents. A more accurate typology of human concepts in general and abstract concepts in particular is needed. We suggest an approximative continuum of concepts distribution (continuity claim): from concrete concepts (purely denotational reference-type) on one end to highly abstract concepts (purely cognitive reference) on the other end with the rest distributed between these two ends.

The "search after meaning" is the core principle underlying the design, where the individuals naturally seek to construct meaning from perceptual input, language use and social interactions. To get a good grip of this matter, we should first envisage a meaningful system which embodies human cognitive architecture. In this system, the abstract concepts could coincide with the referent of the broad term "knowledge" and the more specific term "conceptual structure". One way to address the parts of such system architecture and the phases of its processes against our aim to understand abstract conceptual structure is by considering a basic system of information processing as follows:

i. Input information, i.e., the nature and typology of the information out of which the abstract concepts evolve over time and in a given context. This involves feeding the system with the inputs which the individuals capture online from the external world and retrieve offline from the memory (see chapter 5 & 6).

ii. Cognitive processes, i.e., an array of cognitive processes which are executed to select, organise and approve particular structure for such inputs. This involves the underlying motivation for such processes (see Chapter 7), and

iii. Cognitive products, i.e., complex structure of features and relations which the individuals represent, interpret and share successfully, giving rise to some conceptions. This involves a special reference to the human belief-systems (see Chapter 8).

Accordingly, the claim assumes that the content of abstract concepts is a combination of different knowledge-types which evolve from different systems (perceptual, imaginative, linguistic and cultural). One way to envisage the organisation of the content of concepts is by assuming indispensable joint contributions and involvement of more than one system:

i. The perceptual system which selects, organises and abstracts the perceptual information from the multimodal inputs of the interaction of the body with the external world through the available senses. Highly subjective representation of realities which takes either an online mode (seeing a car) or offline mode (retrieving or imagining the experience of some realities). The representations derived from this system are vivid and assume high-resolution representational formats.

ii. The linguistic system which involves symbolic representations (verbal and non-verbal symbolic units). This system evolves and gets enriched over time. It enhances and mediates the processes of other systems. Linguistic content triggers one knowledge structure or more of conceptual content. This linguistic-conceptual path is biased positively or negatively by some top-down structures, namely, the beliefs. The representations of this system are highly schematic.

iii. The cultural system which affords top-down templates for the individuals to use as cognitive shortcuts. The culturally guided representations are coherent and deeply entrenched in the cognition of the group. They are characterised by a high degree of certitude, which resides in the group as a source of the social, mutual judgments. Language use is the main source for acquiring, mediating and negotiating their mutual ground.

The processes of selection and integration of information from the various systems are guided by coherence, goals and preferences. Such processes are rational or based on deference.

Rationality (manifested in processes such as *unpacking, selection, fusion,* etc.) is fundamental in assimilating newly encountered concepts, propositions and events with previously acquired experience. Rational reasoning could determine whether such concepts, propositions or events are match/mismatch to the content from previously acquired experience. The output judgment of the process of matching is not deterministic but accepts further reasoning and search. The cognitive output of fusion during the process of matching builds on complex abstraction, which is founded on previously generated selections, and come up with newer templates and cognitive models.

One seemingly plausible layout for the proposed architecture could be linked up to human brain biological layout (neuronal networks). This network-like layout of input-process-output incorporates concepts, schemas, frames and cognitive models. Even though the representational format at the neural level is not a primary concern for this work, however, it helps in understanding the layout of the cognitive system of human conceptual structures in general and those of the abstract concepts.

The basic local network of a stored knowledge structure assumes at least a dyadic structure: a pair of concepts which are connected by some relation and can be represented as a cognitive network (Raaijmakers & Shiffrin, 1992). In this sense, knowledge acquisition could be modelled as making new connections and others being declined (Shah, Kwak, Schmierbach & Zubric., 2004). Accordingly, a minimum network requires at least two concepts and a plausible relation which connects them and makes up some semantically coherent unit. What makes the basic unit of knowledge fundamental in the process of making sense of the world may not be the connected concepts, but the very nature of the *relation* which connects them. For instance, the lexical concept of [MARRIAGE] like [SELL] AND [BUY] assumes a schematic structure which relates more to the kind of relation of commitment between a man and a woman apart from who were those men and women to be married.

One important characteristic of the relationship between the concepts of the basic unit of the conceptual structure is the maintaining of semantic coherence. Semantic coherence is derived from perceived relations that makes sense by representing parts of the world (Kintsch, 1998). The conceptual systems of individuals have been found to have primarily evolved schematically (Doise, Clémence & Lorenzi-Cioldi 1993).

The *input-process-output* network-like model assumes both representational formats: symbolic and perceptual. It is based on the general hypothesis that word-forms (vehicles) and concepts are indirectly linked with an intermediate level, i.e., linguistic content which facilitates access to a higher level of conceptual networks. On the conceptual level, this model also meets the "*cognitive economy*" where features (such as "redness"), as manageable units, are shared by concepts which in their turns are shared by the next higher unit in the hierarchy of the structure of knowledge. Indirect connections of nodes allow less effort in searching and more informationally optimised processing. The global network (symbolic, linguistic and conceptual) constitutes human general knowledge (encyclopaedic knowledge).

By means of cognitive processes, nodes of the local networks within global networks are linked to each other by a process activation during their integration. Local networks are linked to each other by means of various cognitive processes (e.g., categorisation, composition, metaphor and metonymy, simulations). The activation of a node due to recognition or retrieval will activate contingently the other nodes and local networks, but with variable strength, valence and direction. The activation is controlled by a higher system of *control* and *inhibition*.

The outputs which evolve from the input-process-output network-like model could be attributed to the inputs and the underlying processes of the system. The balance between the inputs and the nature of the process determine the qualitative nature of the output representation and interpretation.

In short, for systematicity purpose, this experimental part empirically embraces this model (input, process and output network-like system) in the investigation of abstract concepts. In other words, this enhances the systematic designs of a number of tasks which address the nature of the inputs, the process of acquisition, the output representation and interpretation of abstract concepts as mutually shared outputs. The objective of the design is to address the claims directly by constructing more viable tasks which could extract more relevant and authentic data. The authenticity and plausibility criteria are met as follows:

I. Psychologically plausible data is the type of data which are derivable from unsupervised tasks or indirectly supervised tasks. Adequate data arises from deliberate and careful choice of the stimuli and the address of predetermined variables. Authentic and natural use will be acquired by instructing a number of subjects to respond to stimuli in context (linguistic and non-linguistic). Beside the single-word stimuli, the other tasks therefore contained both single-words and multi-word from naturally produced texts from http://www.kitabat.com/ar/ (see Appendix 6 & 7). The tasks are assumed to provide significant amounts of data from which this work may derive a fairly good picture on how the contents of abstract concepts are structured in the mind.

II. To address the conceptual structure and knowledge-type associated with the abstract concepts, the present work will systematically classify the knowledge-types using a knowledge classification scheme and statistically model the acquired responses in terms of a number of lexico-semantic conditions, namely: familiarity, imageability, verbal coding and acceptability to show significance, correlation and variance.

Chapter 5 mainly addresses the typology of concepts and the placement and borders of the category of abstract concepts within the human conceptual system. Primarily, the typological classification builds on subjects' judgements as to what constitutes the conceptual structure of concepts. One typological implication is that concepts should be placed on an approximate continuum of abstractness. One way of investigating and measuring such continuity of conceptual content could be undertaken by measuring individuals' subjective judgments in terms of a number of lexico-semantic features such as imageability (are they associated with sensory-motor and imagistic content?), reference-type (what kind of entity do they index?), verbal coding (what are their definitions in terms of the kind of lexical concepts they are associated and co-occur with?) and finally acceptability (how informative and plausible are their meanings?). Such lexico-semantic features should provide a valid statistical basis for abstract concepts' gradability of conceptual content (heterogeneity claim).

As concepts are mental entities whose content can only be explicitly accessible through human verbal and non-verbal representations, Chapter 6 empirically derives content and structural hierarchy, via, instructing the subjects to verbally encode (define) the meaning of abstract concepts by listing the underlying features. Features listing and ranking tasks were adopted to meet this end.

Chapter 7 investigates the contribution of the compositional property of language use which allows counteracting the polysemous nature of abstract concepts. Combining linguistic units together helps in sanctioning and narrowing down the intended meaning for given abstract concepts from among a diverse number of senses.

Chapter 8 questions whether the embodied cognition models could explain fully the inherent content and structure of abstract concepts. In other words, it explores if the content of abstract concepts arises directly from our embodied and situated representations (i.e., the interaction of our bodies with the external world or not)? Is perceptual and imagistic information adequate to constitute the content of abstract concepts (necessity condition)? Is it directly related to the content of the abstract concept (directness condition)? Chapter 8 seeks to establish that abstract concepts could be (partly but not solely) mediated by embodied representations, for the sake of attaining more grounding for better subjective interpretation and intersubjective understanding. This makes the availability an amount of imagistic content at the disposal of the conceptualizers to understand abstract concepts more feasible; yet, insufficient.

The choice of Arabic language was instrumental for two reasons. First, to my knowledge, *NO* single study of a similar nature has ever been done on Arabic. On the contrary, most of the research was based on European languages. Second, addressing Arabic language provides the basis for a further cross-linguistic and cross-cultural studies of the representation and interpretation of abstract concepts. This will highlight the cultural intervention in the evolution of the conceptual structure of abstract concepts.

b. Training

To make the subjects familiar with the design and to derive accurate responses, training sessions were planned and invested in for this purpose. The training sessions were conducted between July, 2013 and September, 2013, a total of 18 hours training in session of 2 hours to 3 hours in length, distributed across 6 days. The training was scheduled two to four days before conducting the experiments to make sure that the participant had enough time to absorb the training materials and yet had a fresh memory of the training when they come to the task session. For accuracy, the subjects were required to respond to the same tasks again one day after.

Step-by-step training sessions were carried out to make sure that the participants fully grasped the training instructions and the questions to be answered. At the beginning of the training session, individuals were informed about the purposes and procedures of the research. They were asked to sign a consent form after the researcher had explained the research to them. The training was done to cover the tasks and objectives in a check list made for this purpose. A similar environment to the actual tasks was created. This was to familiarize the participants with the tasks and to top up their confidence.

c. Software and System Environment

The participants were asked to sit in a windows 7 based workstation environment provided by the researcher. A previously installed set of software, which the researcher needs, was set for the elicitation of responses. The questionnaire was constructed using http://www.esurv.org/, a free source website that provides a tool for designing, conducting online and administering web surveys (see Appendix 4).

Chapter 5
Conceptual Content Identification of Human Concepts

5.1. Introduction

The experiment in this chapter investigates the gradability of the conceptual content associated with human concepts based on the individuals' subjective judgments (rating) on their familiarity, imageability, reference-type and verbal coding or descriptions. Four tasks were embedded in this experiment. These tasks were not intended as an exhaustive end. Rather, they make up a founding benchmark for the gradability and heterogeneity of human concepts' content.

The main purpose of this study is to find out what the conceptual content of the abstract concepts is, or simply what is in them? According to the paradigm of input-process-output network discussed previously, it is necessary to derive a classification of the input of concepts in general to demarcate the broader line between concept-types. This can be made by deriving the information which constitutes the core of concept-types. Ultimately, this will test our claims of "conceptual heterogeneity" and the approximative continuum "conceptual continuity" against the conventional claim of a bipolar typology of concepts into concrete versus abstract concepts. Experiment 1 was designed to address these claims building on the subjects' subjective judgments as a source of statistical data.

The questionnaire is a basic tool which can serve the objective of this chapter. Based on the discussions in part I, four lexico-semantic features (Familiarity, Imageability, Reference-type and Verbal encoding) were selected as judgments variables for the rating tasks. The results from rating the lexico-semantic feature, familiarity, for instance, shed light on subjects' recognition (being familiar and knowing the stimuli). Such results give a vague but systematically very important filter for the idealization of the stimuli to be used in the other tasks in this experiment and the other experiments. Stimuli with no or very low familiarity rating will be excluded for the purpose of other experiments to give more sound and plausible results. It is a commonplace belief that instructing subjects to respond to stimuli which they are unfamiliar with, may lead to random guessing responses.

5.2. Hypotheses

This chapter is motivated by the objective to test the general hypotheses:

I. Concepts can be categorised according to their content's abstractness rather than concreteness. This hypothesis stems from the assumption that the predictor for concreteness, i.e., the perceptual and spatial configurations, seems insufficient measure for concepts typology

II. In terms of abstractness, concepts can be perceived as continuous and gradable.

5.3. The Paradigm

The questionnaire technique is very helpful to figure out the subjective judgments especially when the decision response time (RT) is taken for granted. This technique is very well known among researchers of social and cognitive sciences. It has been used widely in linguistic and psychological research to derive judgments on particular features. This experiment primarily uses a pre-prepared list which is based on that of Altarriba, Bauer & Benvenuto (1999) and Oatley & Johnson- Laird (1987). The other experiments develop unique stimuli lists which are derived from verbal coding task of single-word concepts that the participants produce (Experiment 2).

The questionnaire was constructed using http://www.esurv.org/, a free source website that provided a tool for designing, conducting online and administering web surveys. The students were asked to do the tasks individually. The participant sat on a comfortable chair and was instructed to respond to a 4-section questionnaire file designed using http://www.esurv.org/ XLS and CSV formats. Each section was devoted to one lexico-semantic feature. The same 50-word list was used in each of the 4 sections.

Windows 7 based workstations were provided by the researcher. Previously installed set of software which the researcher needs were set for the elicitation of responses. Camtasia studio can offer the time calculation for the participant's response in millisecond (msec) with very rich tools of video annotations.

Recruitment flyers (see Appendix 1) were distributed via papers handed over to students or emailed as attachments using .pdf format to email lists of students. Students signed up for the research on a voluntary basis. A total number of 214 signed up, 149 were undergraduate and 65 postgraduate from various Schools at the University of Basra. The selection of the participants was done on the basis of their native tongue, expertise (low verbal abilities high verbal abilities), and computer use. They reported having no history of language disorders at the time of testing.

The selected participants identified themselves as Arabs, i.e., they have sufficient knowledge on the subject domains and full understanding of Arabic. The participants also identified themselves as computer-savvy users with average computer use of no less than 2-3 hours per day. As an incentive to participate in the research, students were paid at a rate of (20000 Iraqi Dinars, i.e., £6 per task) for their participation. The compensation was provided to the participants for the substantial time and effort they invested. They signed a consent form which reads that their response will be recorded and used for research purposes (Appendix 2). Participants completed the tasks using a workstation provided by the researcher.

According to academic-performance, two groups of participant were identified, based on language experiences (high and low verbal ability groups). The two groups were intentionally established to warrant within-individual and between-individuals variations. The second year undergraduates were taken to be representative of lower verbal ability while postgraduates who were in their second year thesis writing phase were taken to represent high verbal abilities group.

5.4. Task 1: Familiarity

There is consensus that the feeling familiar with something relates to the amount of "evidence" for the individual to realize that the stimulus has been encountered previously. It represents how well a given stimulus matches the contents of memory (e.g., Clark & Gronlund, 1996; Mandler, 2008; Rugg & Curran, 2007; Yonelinas, 1994, 2001; Yonelina, Otten, Shaw & Rugg, 2005; Wixted, 2007). However, it does not tell much about what kind of memory trace that was. Familiarity has been deployed in a range of previous researches (see for example Barsalou 1985; Hampton and Gardiner 1983). They attempted to associate a stimulus with some kind of cognitive status of its referent and its referential transparency. It marks the variable degrees of mental accessibility of conceptual content.

Models of memory recall and retrieval accept that familiarity arises from the matching process of the perceptual content of a stimulus to previously deposited contents in the memory (Meier, Rey-Mermet, Rothen & Graf, 2013). This matching process instantiates searches for "prompts" of similarity and coherence to achieve minimum coherence, the experience of which gives a sense of familiarity. However, it is not clear, however, what constitutes "enough prompts," and very scarce was suggested about the specific content that makes stimuli feel familiar (Rugg & Curran, 2007).

Familiarity ratings extract vague but necessary information on the existence of mental representations associated with a given stimulus being identified accessed and recalled. Familiarity rating values are measures of the process of recollection of the mental representation of a given stimulus based on accessibility, i.e. frequently experienced stimuli are easy to access. Frequency of occurrences often safeguards the experience of familiarity, and explains the reaction times in tasks such as lexical decision (e.g., Whaley, 1978).

Familiarity ratings have often been interpreted as a measure of the frequency of exposure to a word itself rather than its referent or meaning. So, familiarity rating represents a subjective judgment, which can be taken as a trajectory for the identification of content but not in an exhaustive sense. It, in fact, gives a very vague picture of the content-type that the individuals have recalled (symbolic, linguistic, modality-specific non-linguistic knowledge). However, having heard/read a word, knowing the meaning of the word and knowing the other words with which it co-occurs, might be all considered as signs of familiarity but they are not the same thing. Knowing the vehicle which encodes the lexical concept without knowing the knowledge it gives access to is also perceived as a sense of familiarity. Nothing is certain about the conceptual content of the stimulus and its mode of acquisition (sensory, linguistic or both). This makes it impossible to objectively measure the identification without directly requesting participants to reproduce the type of knowledge they hold for the stimulus in question and they are familiar with.

The task within this experiment seeks to test the prediction that the present work makes on identifying (recalling) an abstract concept: being familiar with a word does not necessarily mean that the individual recalls the knowledge underlying a concept in a deterministic sense. It is predicted here that the individual may only recall (is familiar with) a content at one level (symbolic, linguistic, non-linguistic/conceptual knowledge), two of them or possibly all.

The most important empirical implication for this task is that it refines the stimuli set for the next tasks. Stimuli with low familiarity scores were excluded. It prevents the subjects from responding to a stimulus they are unfamiliar with. This guarantee their results' plausibility: guessing responses are minimized.

5.4.1. Hypotheses

It is hypothesized here that

i. Familiarity is correlated with mode of acquisition. Perceptually-based acquisition result in higher familiarity while linguistically-based acquisition correlates with lower familiarity
ii. Familiarity correlates positively with imageability and reference-type and negatively with verbal encoding
iii. Concepts with high abstractness score low in terms of familiarity than low abstractness concepts.

5.4.2. Task Design

Following Nusbaum, Pisoni & Davis (1984), a 7-point Likert scale is used: Rating an item by ticking ☒1 indicated that the subject had never seen the word before; the rating ☒ 7 indicated that the subject was very familiar with the word and knew its meaning. Ratings of 2 through 6 indicated intermediate degrees of familiarity. The instruction (translated into English) then will be as follows:

Dear Participant!

This questionnaire investigates some aspects of Arabic words. We would like to ask for your help by participating in this survey. Please, rate the following words on a 7-point scale in terms of their familiarity; the task is to decide how easy or difficult it is to identify the items or their meaning. How familiar you are with something has nothing to do with how much you like the referent that the word names. Your familiarity with it has more to do with how much you know about the meaning of the word itself, or how often you encounter it, read about it and so on. Here's an example. Suppose the item is "Pulpit" and you have no idea what Pulpit is. In that case you should tick 1. Tick 7 if you know what it is and feel that you are very familiar with it.

An example of the layout of the items is shown below:

	very familiar	familiar				never seen
Pulpit ***☐7***	***☒6***	***☐5***	***☐4***	***☐3***	***☐2***	***☐1***

5.4.3. Results and discussion

Results from familiarity ratings were fed to repeated measures analysis of variance (ANOVA) for both groups of subjects. No significant interaction was found between familiarity scores at the between-individuals level. However, the difference between groups was larger for the medium and low familiarity words than for the high familiarity words. Examination of mean familiarity (MEAN) and standard error (SE) of the familiarity ratings showed that there were three distributions (word groups).

The Mean of the whole list (N: 201) is (Mean 6.80) and (SD: 0.33397827). The mean familiarity ratings for Words Group 1, the low familiarity rating words, (N: 56), the (Mean= 6.46) and (SD = 0.48900132). For the Word Group 2 familiarity ratings, (N: 77), the (Mean= 6.88) and (SD = 0.01927104). Finally, for word GROUP 3, (N: 68), (Mean: 6.99) and the (SD = 0.01759862). Figure 5.1 displays familiarity ratings for both groups of subjects and all three words groups. The reason why our entire task on familiarity measure addressed different verbal ability participants was that we wanted to ensure that the familiarity measures obtained from the low verbal ability participants could be generalized to high verbal ability participants and vice versa. In other words, this generalization validates the results that the same subjects could make in the coming tasks, building on the assumption that they all have identified the stimuli with very insignificant variation at this level.

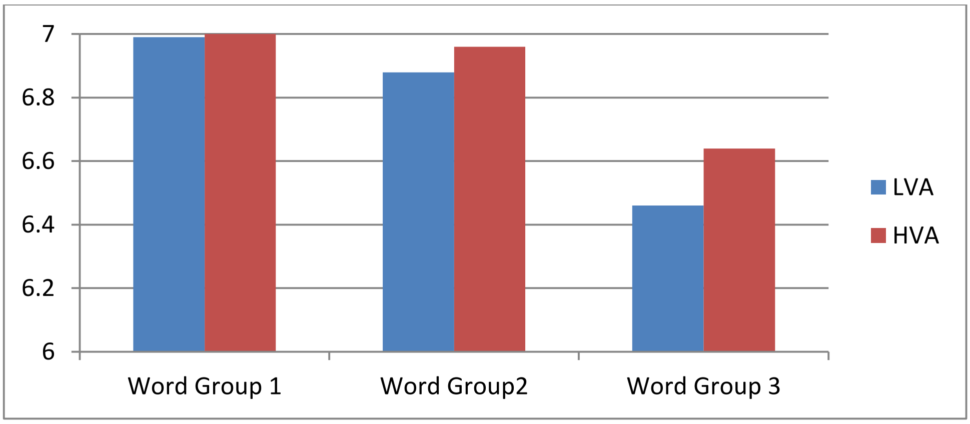


Figure 5.1: between-groups familiarity scores

Figure 5.1 shows the correlations between the rating measures for Word Group 1, Word Group 2, and Word Group 3, respectively. In all cases, the correlations are marginally significant.

According to the scores of familiarity task, the total stimuli (items list) was minimized to “200” items.

5.5. Task 2: Imageability

Human beings retain mental images for the entities in the external world. They are acquired by the individuals over time and have been shown to affect language processing and memory processes in a variety of ways. Imageability ratings have been suggested as a proxy for perceptual salience and conceptual accessibility of imageable entities (Bock & Warren, 1985; Eberhard, 1999). Bird, Franklin & Howard (2001, 2003) empirically determined that nouns are largely more imageable than verbs, adjectives and function words. Imageability rating can be a good predictor of quantifying and grading abstractness. Rating a word as imageable (invokes mental images and information we see, feel, taste, hear, etc.) means that the referent assumes some physical and imagined properties and sheds light on its mode of acquisition.

The imageability hypothesis in relation to learning has been highly endorsed. Tests were made to confirm that words with higher imageability ratings are very likely to be learned faster and earlier than words without imageability ratings (Ma, Golinkoff, Hirsh-Pasek, McDonough & Tardif, 2009: McDonough, Song, Hirsh-Pasek, Golinkoff & Lannon 2011). Imageable sentences and words are recalled more accurately than less imageable ones (e.g., Begg, 1972; Begg & Pavio, 1969; Groot & Keijzer, 2000; Nelson & Schreiber, 1992; Pavio, 1965; Sadoski, Goetz, & Fritz, 1993).

According to Paivio’s standpoint (1986, 2007), concreteness is associated with imagistic and verbal (linguistic) systems: we can retrieve images (modality-specific information), as well as verbal content (Kounios, 2007; Prinz, 2002). This makes a strong correlation between reference-type and imageability ratings (Paivio, 1986). Neuro-scientific research strongly endorses this standpoint. Based on their lack of the perceptual properties for their referents, abstract concepts are more likely to inhere more linguistic and lesser imagistic representational content and format. Abstract concepts do prove to co-occur with bodily and imagistic representations, however, it is not clear whether they are constitutive or facilitative.

Concepts do not stand alone but in relation to larger contexts. Contextual information is also incorporated within imageability. At the level of single word concepts, contextually related information can be incorporated with notions such as 'semantic frames' (Fillmore, 1985), 'scripts' (Schank & Abelson, 1977) 'idealized cognitive models' (Lakoff, 1987) and cognitive models (Evans 2009) which involve more complex structures of encyclopaedic knowledge being simultaneously activated (Geeraerts, 2010). Unlike concrete concepts, abstract concepts are very likely to involve whole scenarios and situations to achieve referential and conceptual transparency. The coherence of contexts necessitates the inclusion of concrete objects as basic components of the structure of events and actions (Ungerer & Schmid, 2006).

The information which could be extracted from this task could shed light on the correlation between imageability rating and the abstractness continuum. It underlines the continuous and graded abstractness of human concepts which is not yet fully investigated. Words such as "shadow", "phantom" and "ghost" provided interesting finding with regard to imageability and reference type ratings. Ghost, for instance, scored comparatively higher on a seven point scale (5.37) but lower on a concreteness rating (2.97).This indicates that abstract words can assume mental imagery without having really a referent in the external world with physical properties (Paivio. 1968:3).

5.5.1. Hypotheses

i. Imageability correlates negatively with higher abstractness concepts
ii. Imageability correlates positively with familiarity
iii. Imageability can serve as a predictor for reference-type

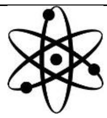
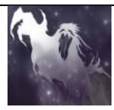
5.5.2. Task Design

This task is intended to group the stimuli (the selected word list) into any possible fine-grained groups according to the evoked bodily, sensory-motor and imagistic mental representations. Imageability can serve as a primary scale of the continuity and gradability of human concepts in general and abstract concepts in particular. Unlike previous works on the relationship between such information and the deterministic distinction between concrete and abstract concepts (Desrochers & Thompson 2009), this task aims to decline the commonly held basis for the distinction between the two reference-types in favour of a continuous and graded abstractness.

However, we have no disposition at this stage to assume a direct link between imageability (the sensory-motor content) and abstractness. This needs to be dug deep by implementing a different measure (see Experiment 3).

The instruction (translated into English) was as follows:

This task has to do with what images we have in mind when we say/hear/read words: we may have an images which represent them as they simply exist physically in the world and we have seen/heard/smelled/touched /felt them. Or we have mental images for them because we can imagine them. Let's take saying/hearing/reading words apple, and imagine a virus, an atom or a ghost as example, they can bring to our mind

Lexical concept	***Image it may evoke***	***Lexical concept***	***Image it may evoke***
Apple		***Virus***	
Atom		***Ghost***	

You are to rate how concrete an apple is by ticking a number on this 7-point scale. A 1 means that you think the item is highly imageable as you have an image of it in your mind. A 4 means you feel the word could trigger an image in your mind but not clear enough to fit within imageable entities the same

way apple does. A 7 means you have no image of whatsoever in your mind for that word.

not imageable **highly imageable**

Wind **☐7 ☐6 ☐5 ☐4 ☐3 ☒2 ☐1**

5.5.3. Results and discussion

The pattern of imageability scores for the whole data sample shows a continuum as appears in Figure 5.2. For fine-grained division, Standard Error and Medians were used to come up with three word groups: high (Word Group 1), medium (Word Group 2) and low (Word Group 3) scoring ranges as illustrated by Figure 5.3.

The statistical Mean of the whole list (N: 201) is (M=4.22), the (SD: 1.651218608) and the median (4.64). The Mean for Word Group 1 (the low imageability ratings words) (N: 68) were (Mean: 6.05) and the (SD = 0.567672), (SE= 0.058599) the Median (5.96). For the Word Group 2 with medium imageability ratings words (N: 75), the (Mean= 4.47), (SD = 0.383330967), (SE= 0.059794) and the Median (4.54). Finally, Word Group 3 (N: 58), the (Mean= 1.85) (SD = 0.420515917), (SE= 0.051377) and the Median is (1.78).

Imageability ratings were analysed, using repeated measures (Two factors 2*3 ANOVA) model of the three word groups (three levels of imageability) and Verbal ability Condition (two levels: High and Low), as between-groups factors that measures the effect of subjects' Verbal Ability (LVA and HVA) on imageability scoring across the words groups, nested factors.

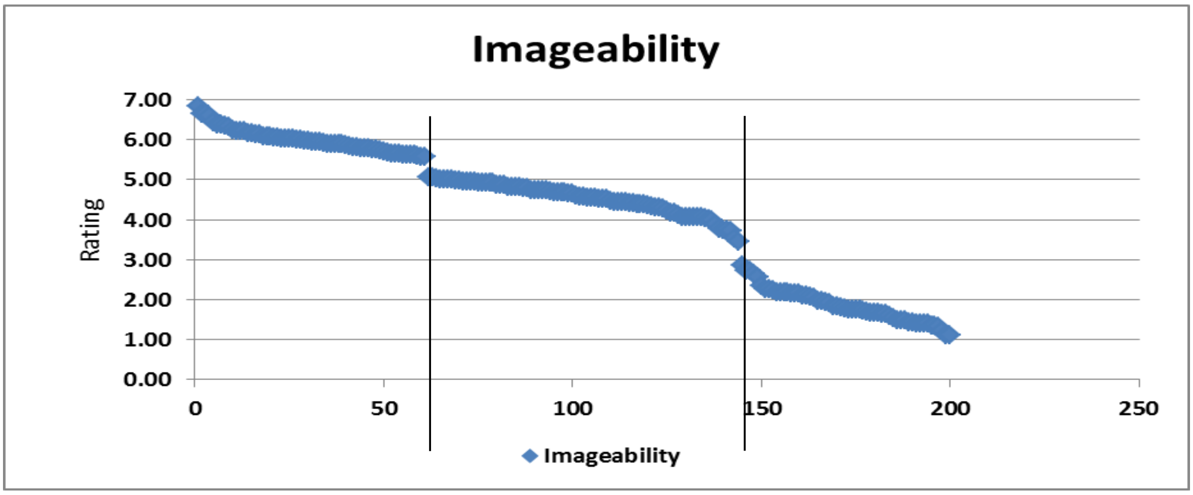


Figure 5.2: Imageability rating of the whole data sample

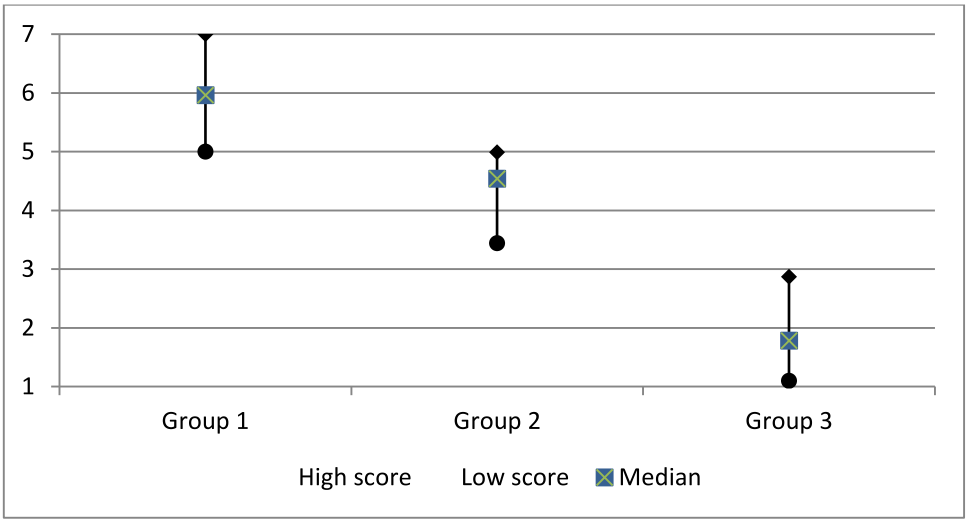


Figure 5.3: Word Groups

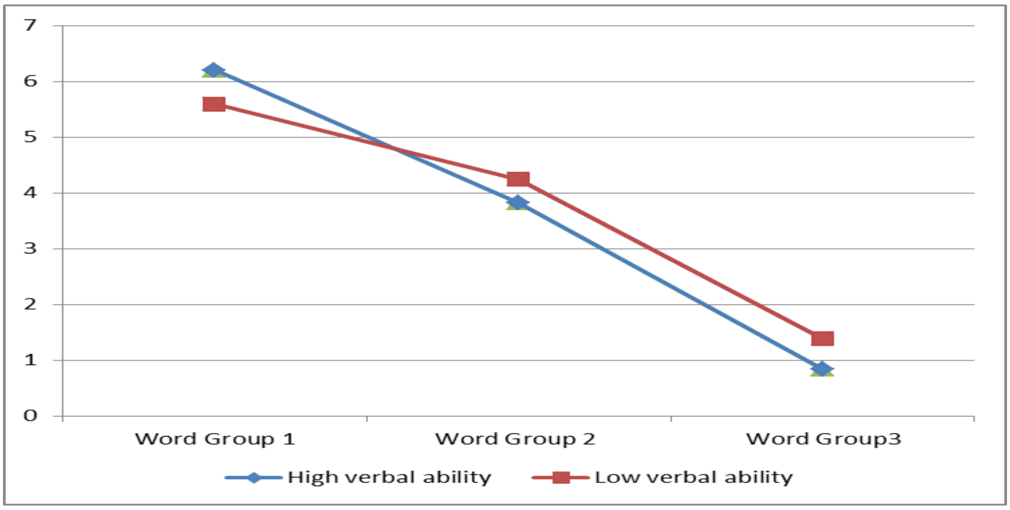


Figure 5.4: Imageability Individual variation

These analyses showed marginal effect of imageability on either verbal ability condition via the measurement of judgments accuracy F (1,200)=1.59, *P*=0.208) and RT (F1,200)=0.33, *P*=0.548). However, the main effect for word groups was significant for both verbal abilities F(1,200)= 111.24, *P* <0.0001) and RT F(1,200)=169.81, P <0.0001), with Verbal Ability Groups taking longer RT for making imageability judgments with variable mode of acquisition (previous experience).

The standard deviation (SD) and standard error (SE) of both groups of individuals were compared, showing that their performances were variable. The two groups diverged on the imagistic content invoked by the sub-samples. However, such convergence shows more significant variation in the area of Word Group 1

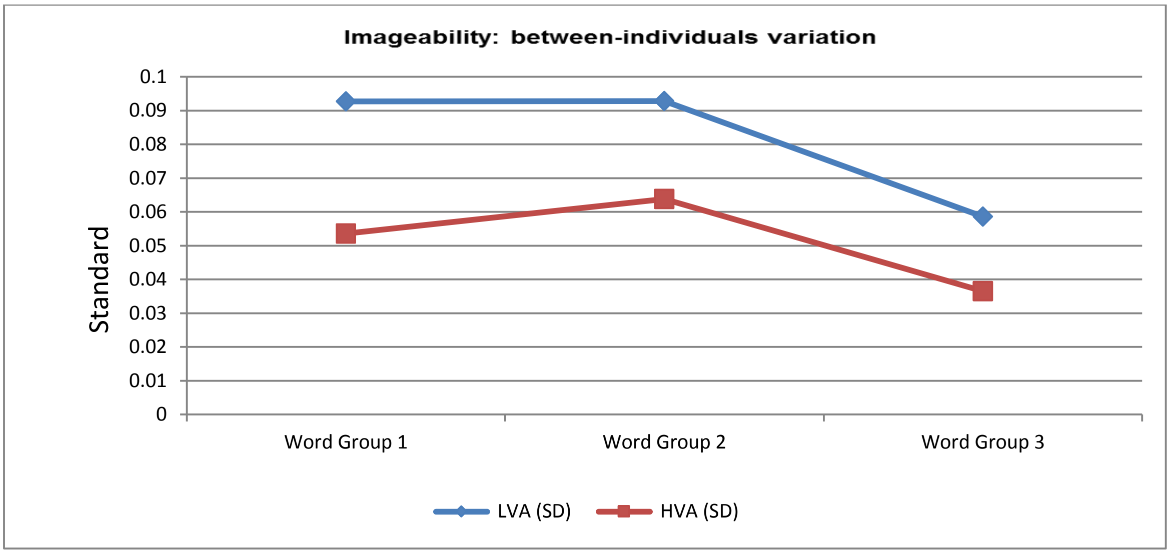


Figure 5.5: Imageability: between-individuals Variation in terms of standard deviation

The imageability rating in this task by no means intends to disassociate sensory-motor and imagistic information from lexical concepts with cognitive (abstract) referents and associate them with those with denotational referents; rather, it seeks to quantify them against the two lexical concepts types to establish their graded nature thesis. To take one more step further in this route, the verbal encoding (description) to define features and content-type associated with lexical concepts indexing different cognitive reference-type, offered even more illuminating evidence for the conceptual content associated with the abstract concepts (see Experiment 2).

5.6. Task 3: Reference Type

Referentiality plays an important role in shaping natural languages into powerful communication tool: it maintains mutual comprehension and help avoids redundancy, ambiguity and misinterpretation. In order to understand the nature and mechanisms of language processing, it is essential to understand how reference is resolved.

Reference, as we may put it, is the process of picking up an entity from the external world or imagination (Evans, 2009). Lexical concepts mean by representing aspects of a mentally projected world as represented in the mind of the individuals. The physical properties associated with the referent that a given word denotes could affect and maintain reference-tracking. Denotational reference indexes physical entities while cognitive reference indexes entities with no physical entities (Evans 2009). This process of reference resolution (referential transparency) is one of the central aspects of language use.

Mostly, reference resolution transpires online from limited available information, accessed primarily through introspection of representations constructed during previous experience (encyclopaedic knowledge). It is a probabilistic rather than deterministic act as it transpires from set of probability judgement as to which possible referent is being intended (indeterminacy). Context allows to narrow down the sets of alternatives of referents, i.e., which particular domain should be underlined , e.g., light in the religious domain is dissimilar to light in physical sciences (Brown-Schmidt & Tanenhaus, 2008).

Important questions to examine here include: on what basis do the individuals make their judgments on reference-types? Are individuals variable in assigning reference to lexical concepts? How different reference-types are linked to abstract concepts? Most importantly, how do these questions apply concepts with abstract (cognitive) reference-type, e.g., (truth, doubt, imagine…)?

5.6.1. Hypotheses

i. Reference-type judgments constitute a good measure for abstractness continuum.
ii. Reference-type rating correlate positively with imageability rating.

5.6.2. Task Design

This task is concerned with the participants' subjective judgment as what reference-type they ascribe to the verbal stimuli. The instructions, translated from Arabic, were printed on the front of the webpage as follows:

This task has to do with whether the entities that the words refer to do/do not have any physical properties (such as colour, size, sound, smell, dimensions, etc). By entities that words serve to index we have in our minds the entities that inhibit the world such as "people", "artefacts", "pain", "ghost", "angles", "truth", "faith", etc. However, a "person" has more physical properties than a pain and the latter has more physical properties than a "ghost". We may draw/ hear/see a ghost but can't do the same with "faith". So, "faith" could be rated as ☒ 7 while "Car" could be rated as ☒ 1. A ghost and pain could get higher ratings than "faith".

	(Highly abstract)					(Highly physical)
	Cognitive					Denotational
Wind	☐7 ☐6	☐5	☒4	☐3	☐2	☐1

5.6.3. Results and discussion

For the validity of the graded abstractness of reference-types based on the psycholinguistic evidence that this task presents, the individual items of our 201 data were distributed according to their mean ratings forming a continuous line (see Fig. 5.6)

For the lexical concepts indexing denotational reference-type, Word Group 1 which indexes entities with cognitive properties, the (Mean= 5.60) (SD =

0.718984413), (SE= 0.096947838) and the Median is (5.5), ثقة (trust) 5.77, ربى (nurture) 5.18, تقوى (piety) 6.91.Word Group 2 of entities with medium physical properties, scores were as follows: the (Mean= 4.20), (SD = 0.459804587), (SE= 0.049015334) and the Median (4.36), for instance, جدال (dispute) 4.38 , حذر (alertness) 4.17, etc. Finally, Word Group 3, the Mean rating was (1.96) and the (SD = 0.279393588), (SE= 0.037006585) the Median (1.91), for instance, شجرة (tree) 1.43, حطب (log) 1.61.

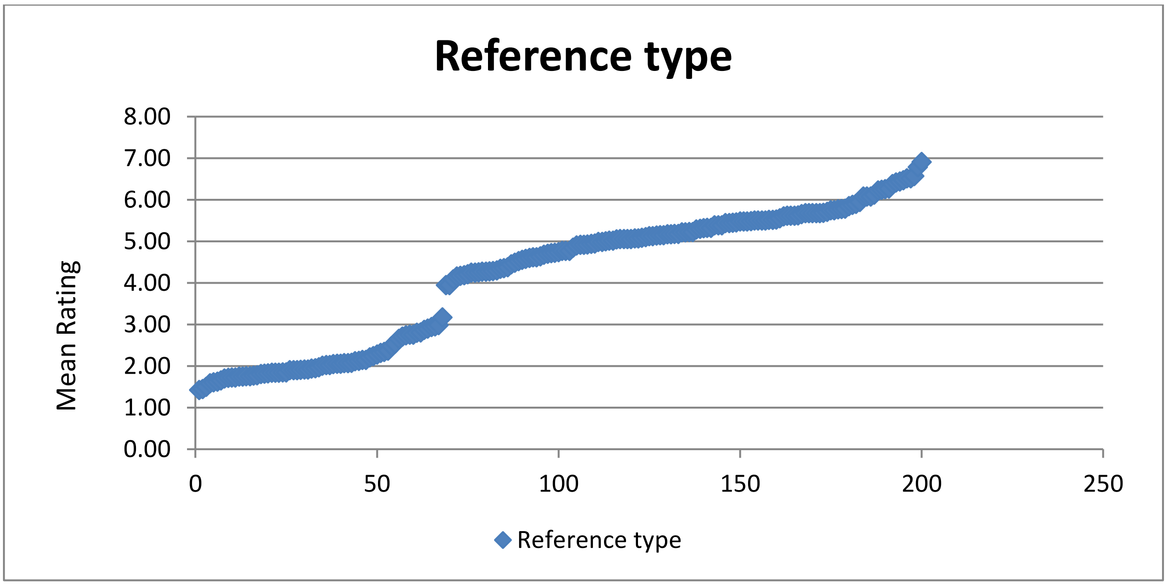


Figure 5.6: Reference-Type Mean rating for the entire data sample

The total number of participants show higher divergence on the referents of Word Group 1 with (SD=0.3897555) and (SE= 0.085473555) and significant convergence on the referents of Word Group 3 with (SD=0.6987909) and (SE= 0.020658741). Figure (5.7) shows three ranges of physical properties' availability as perceived by the task respondents. As far as between-individuals variation, the grouping is supposed to reflect variation in their reference-tracking.

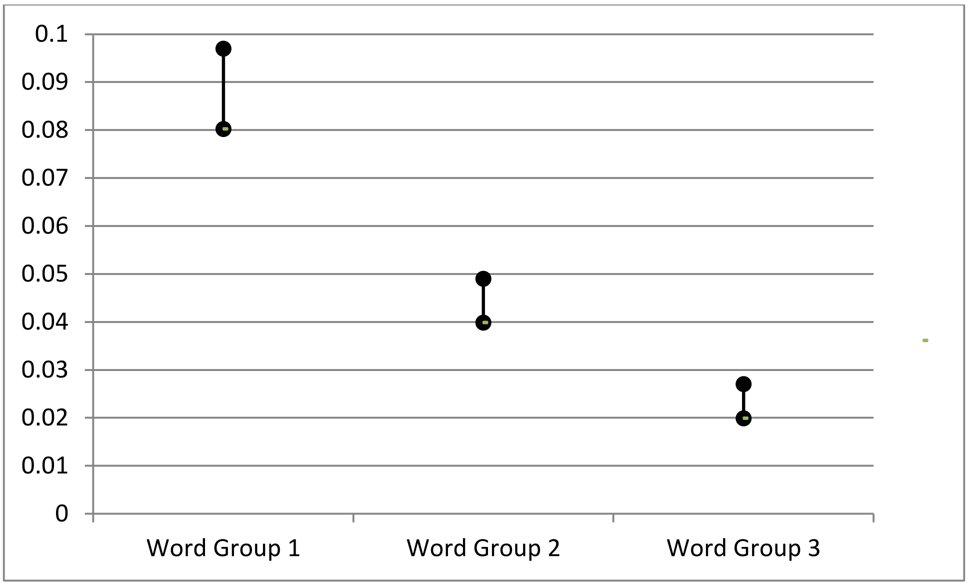


Figure 5.7: Reference-Type Standard Error

Generally, no significant correlation is found between reference-type and verbal ability. The two verbal ability groups seemed to converge in their judgment on reference type, with standard deviation at (SD=0.058682056) for participants with high verbal ability and (0.071293814) for participants with low verbal ability. Interestingly, though, the two groups vary significantly with respect to the medium and low abstractness words categories (as shown in Figure 5.7). The variation might be related to the small number of human subjects in this study. Nevertheless, there appears to be three distinct reference-types words (highly cognitive reference words which index non-physical properties for highly quantified abstractness, e.g., قدر (fate), highly denotational reference words which index highly quantified physical properties such as قلم (pen) and a reference-type which seems to be in the middle where physical and non-physical properties can be ascribed to the entity it indexes, e.g., انتباه (alertness).

Comparing two sets of ratings (high verbal ability score and lower ability participants' scores) on the whole samples, Spearman rank correlation (ρ) and the Kendall's coefficient of concordance (W) were used to measure the interdependence between the two sets of scores and assess the variation at the between-participants level (see Table 5.1).

Correlation	Participant groups	High rating category	Medium rating category	Low rating category
Spearman Rank Correlation (ρ)	High Verbal Ability	0.654	0.498	0.851
	Low Verbal Ability	0.498	0.628	0.809
Kendall's Coefficient of Concordance (*W*)	High Verbal Ability	0.424	0.497	0.651
	Low Verbal Ability	0.445	0.611	0.787

Table 5.11: Spearman rank correlation and Kendall's coefficient of concordance Among-individuals difference

The significant values, greater than >0.5, show that higher ratings on cognitive reference-type are quite strongly correlated with Higher Verbal Ability (ρ=0.654) (W=0.424), however they show overall agreement on denotational reference-type (Low rating category), e.g, (ρ 0.851) for High Verbal Ability subjects and (ρ 0.809) for Low Verbal Ability subjects. This provides evidence that concepts' sensory-motor information is shared and shows lower variation at the between-participants level. It shows the tendencies of the higher verbal ability group towards more abstraction. "جوز" (husband) scored higher in terms of abstractness for the higher verbal ability group (Mean 5.91) than low verbal ability group (Mean 3.51). The former group allocates more salience to the relation than the individual.

5.7. Task 4: Verbal Encoding Informativeness

The representation of the meaning of concepts may rely variably on language use which takes the form of producing verbal description (set of properties and features).Verbal Encoding signals how language enables its speakers to define its lexical entities by the use of other lexical entities. It represents the ability to give metastatements on the meaning of a given lexical entity. This can be addressed in two ways: First, by deriving subjective judgments, asking the subjects to rate how easy is it to define a given stimulus to achieve the level of informativeness in case they want to adequately express its meaning (to ensure that each participant had in mind a consistent set of properties to think of in the first place), second, by instructing them to write down the set of properties). This task represents phase 1 of the actual production of verbal description (see experiment 2). It was concerned with the first way. Such judgments of how easy or difficult to define a concept necessitate that they recognize and process the meaning of the stimulus to come up with a rating. This should presumably highlight any differences and correlation between reference-types and verbal encoding.

This task measures the ease of defining words to an informative level. In one study, for example, university students were tape-recorded while they orally defined particular test items (Reynolds and Paivio, 1968). The definitions for the abstract words involved more tendency for using verbal description, exemplifications, rephrases as well as more hesitations. They were also characterized by other speech dysfluencies (e.g., "ah" pauses). In a related study, O'Neill (1972) had university subjects to rate how easy or difficult it was to define the meaning of 277 nouns. Ease of definition shows higher correlation with rated imagery value compared to lower correlation with rated concreteness, which showed strong consistency with the Paivio's Dual Coding Theory on the contribution of the verbal system in the representation of abstract meaning.

5.7.1. Hypotheses

i. Verbal encoding is a good predictor of abstractness; the higher need for verbal encoding the higher abstractness the concept assumes
ii. Verbal encoding outrank the predictions familiarity, imageability and reference-type make on the nature of the content of abstract concepts

5.7.2. Task Design

This task addresses the contribution of language use to achieving the required informativeness level for the representation of abstract concepts. The instruction (translated into English) was as follows:

> ***This task has to do with what definition we have in mind for words' meaning. Verbal Encoding refers to how much explanations and rephrases you need to explain the meaning of such words as you think enough for the listener to understand them. Let's take the definition of words "repression" and "apple", you are to rate how definable an apple is by ticking a number on this 7-point Likert scale. You may tick ☒ 7 for "repression" which means that you think the item is highly definable as you think it requires more explanations and***

rephrases to define its meaning. ☒ 1-point means you feel that the word requires less definition for the listener to understand its meaning.

Hard to define **Easy to define**

Wind ☐7 ☐6 ☒5 ☐4 ☐3 ☐2 ☐1

5.7.3. Results and Discussion

The figures show that almost two groups of words are predominantly clustering in terms of the ease of recalling definitions for lexical concepts indexing reference-type: high definability requirement group (Total Mean=5.64), e.g., استرجاعredemption (6.26), فخر pride (6.13), فضيلة virtue (6.08) and so on , and low definability requirement group (Total Mean=1.96), e.g شاي tea (1.70), خزانة wardrobe (1.75), ممرضة nurse (1.90) etc.

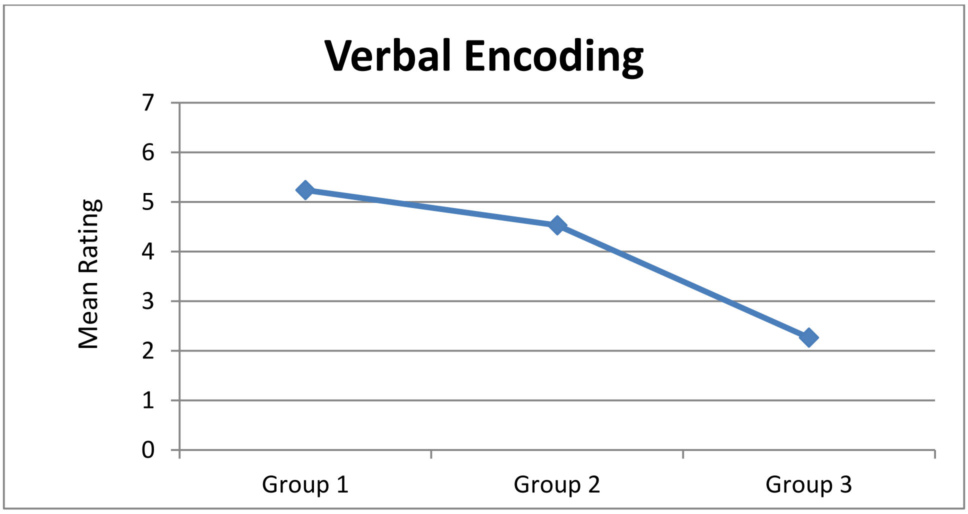


Figure 5.8: Verbal Coding Mean Rating

The variation of the level of between-participants shows very marginal differences as high verbal ability group and lower verbal ability group rated almost identically the three word groups in terms of their verbal encoding demands with the three word groups' being significantly variable (see Fig. 5. 9)

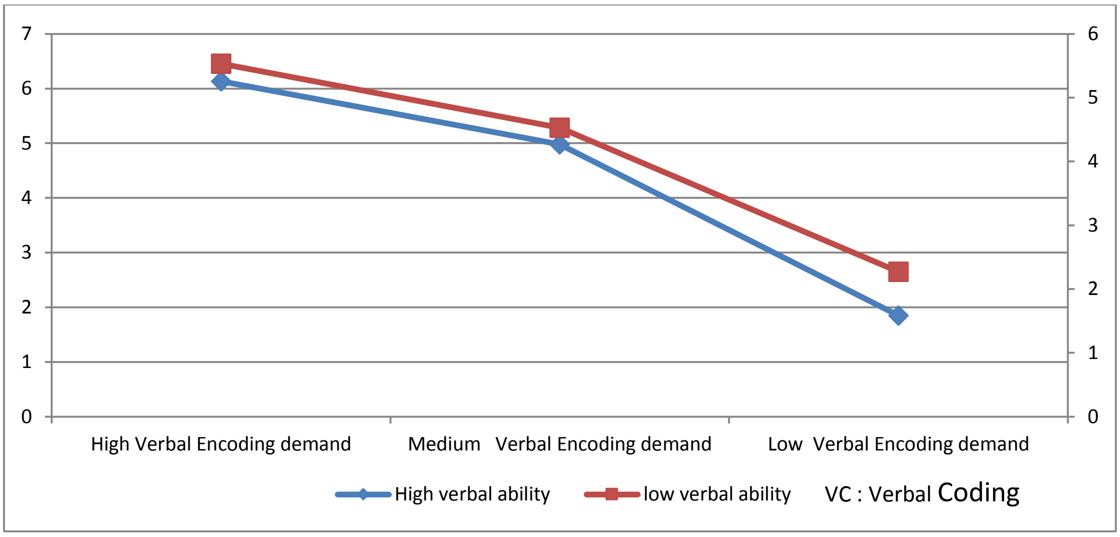


Figure 5.9: Verbal Encoding Demand (between-individuals variation)

Verbal encoding demand has shown to represent a better predictor of concrete-abstract distinction than imageability, possibly because they rely on their higher demand for features and content from other lexical concepts for better resolution. Secondly, the meaning of lexical concepts giving access to abstract concepts is predominantly acquired from their co-occurrences with other lexical concepts which give access to concrete knowledge. Verbal encoding may therefore makes a more fundamental contribution to the representation of abstract concepts. The individuals resort to such representational strategy as an indirect and meta-cognitive representational mechanism of grounding abstract concepts.

5.8. General Discussion

Four tasks: Familiarity, Imageability, Reference-type and Verbal encoding, were piloted to inspect their correlation with the heterogeneity and continuity of concepts in terms of their content. In terms of our assumption on the nature of human concepts in general and abstract concepts in particular as graded in their abstractness and heterogeneous in their psychological content, the rating results were very consistent. Despite the fact that these lexico-semantic measures (e.g., imageability, reference-type, and definability) constitute good predictors for concrete-abstract distinction; little research has systematically looked at the relation between heterogeneous and graded abstractness of concepts across domains. Variation could emerge in the representation and interpretation of concepts in religion, physical sciences and social science domains, including linguistics.

Familiarity correlates positively with recognition and is certainly linked to reference-type, imageability and definability; however, it give a very broad imprint of concepts' meaning. The measure of familiarity was consistent with the previously stated assumption about abstract concepts' Mode of Acquisition (Wauters, Tellings, Van Bon & Van Haaften, 2003). Familiarity relates intimately to the concept of Mode of Acquisition, which was first introduced by Wauters, Tellings, Van Bon & Van Haaften., and is grounded in the assumption that the meaning of a word can be acquired perceptually, linguistically or both. Moreover, familiarity measure is highly sensitive to the contextual frame in which the concept is acquired. For example a child born in the Muslim world will acquire the meaning of 'wine' through language, while a child living in western societies will more likely acquire its meaning through his senses. Consequently, familiarity could convey both internally high resolution content (both sensory-motor and linguistic) or only referentially low transparent content where the reflective reasoning on the word linguistic content and semantic structure is the main source of information.

The analyses have shown that lexical concepts indexing highly abstract entities (Reference-Type Mean scores between 6.91-4.49) were negatively correlated with familiarity scores. Similarly, familiarity scores correlate positively with imageability mean rating. The fewer images a lexical concept invokes, the less probable for the individual to experience the familiarity effect. Less familiar lexical concepts pose higher demand to verbally encode its content as the individuals is likely to think of all the relevant associations (contexts) they think are needed to define them. Concepts with denotational reference (highly concrete) assume a high probability of being familiar, higher imageability and lesser demand for more informative definition.

However, familiarity results can be quite unsettling as it provides rough means of determining whether or not the impressions of past occurrence (memory traces) were based on sensory-motor or linguistic content; whether the familiarity of an item signals an actual experience of an event or an indirectly acquired reflective experience with the help of language use. The relationship between familiarity and reference-type is far from being clear and cannot be regarded as viable. This leads us to the significant contribution of the non-isomorphic perspective that LCCM holds between the linguistic content conceptual content and the distinction between the symbolic and linguistic representations.

The experience of familiarity can take place on more than one level (see Figure 6.9). It is possible that the individual is familiar with the vehicle (phonological representation) with no memory traces of the linguistic and non-linguistic contents. For instance, a learner for whom English is a foreign language may be familiar with a vehicle but not the meaning or uses (phase 1).

The other possibility is that the individual may well know the vehicle and its linguistic content but has no conceptually transparent idea of what it actually means. For instance, the individual may know how to use a lexical concept but no idea of what it means (phase 2). This sense of familiarity with the intended gender arises from the inherent linguistic content associated with the symbolic units where gender is not explicit in the symbolic units. For instance coming across something like, “the British *soldiers* based in Basra”, it is very likely that conceptualizer will form a representation that mostly includes males rather more than females. The representation of gender is simulated while processing the knowledge accessed by the symbolic unit "soldiers". The gender representation could be explicitly represented by the grammatical properties of the symbolic unit, e.g., "*stewardess* was there for the scared passenger". In this case the familiarity arises from being familiar with the grammatical marking which is obviously linguistic.

Finally, the sense of familiarity is formed as a result of previously acquired knowledge which automatically activates once a symbolic unit is recognised and a lexical concept is retrieved together with the non-linguistic knowledge it affords access to (phase 3). For instance, not only could the individual experience the sense of being familiar with the concept of one's losing his/her job as a result of interpreting "over 140 workers being declared redundant"[19], but could simulate the deep and complex representation of rather abstract emotional states associated with job loss (Gernsbacher, Goldsmith & Robertson, 1992; Gygax, Garnham, & Oakhill, 2004).

LCCM as a model makes a definite depiction of the three phases absorbing the theoretical assumption of the models of the mental lexicon and memory. It distinguishes between the phonological form (vehicle), the lexical concept (linguistic knowledge) and the non-linguistic (conceptual knowledge). This makes its theoretical architecture general enough to discuss human knowledge and the sense of being familiar on more than one level or system of human cognition

[19] http://daily-mail.co.zm/blog/2013/03/28/state-to-revive-munali-nickel-mine/

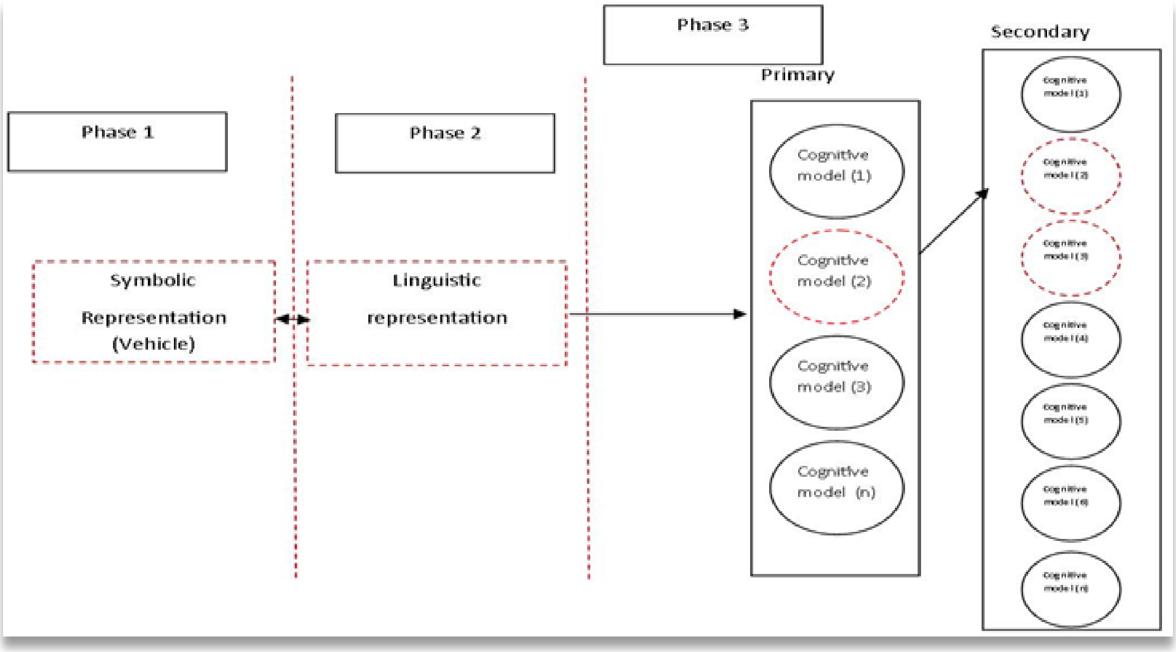


Figure 5.10: LCCM perspective on familiarity.

We consciously selected reference-type as one of the measures to constitute a benchmark for concept continuity. It explains how individuals track the referent for the lexical concepts they use. Even though lexical concepts could invoke images in the mind of the individuals, this does not make their referents traceable in the external world. We have mental images for spirits, angels but the actual referents are still untraceable. This means that images are different from the physically tracked referents.

Verbal coding measure was instrumentally chosen to underline contribution of linguistic content and frequency of co-occurrence of lexical concepts to the overall content of abstract concepts. The selection builds on the expectation that the results of this measure will justify the design of experiment 2. How easy is it, to define a lexical concept, reflects the availability of co-occurrence a lexical concept has with other lexical concepts, i.e., its semantic profile.

A grouping analysis based on Standard deviation (SD) and Standard Error (SE) was used to make conjectural rather than definitive categories on the concrete-abstract continuum according to the relationship between the role of imageability, reference-type and verbal encoding. Consequently, three sub-categories emerged from the overall data sample. Figure 5.11 illustrates the continuous distribution of the mean rating of the three measures in the area of the three word groups.

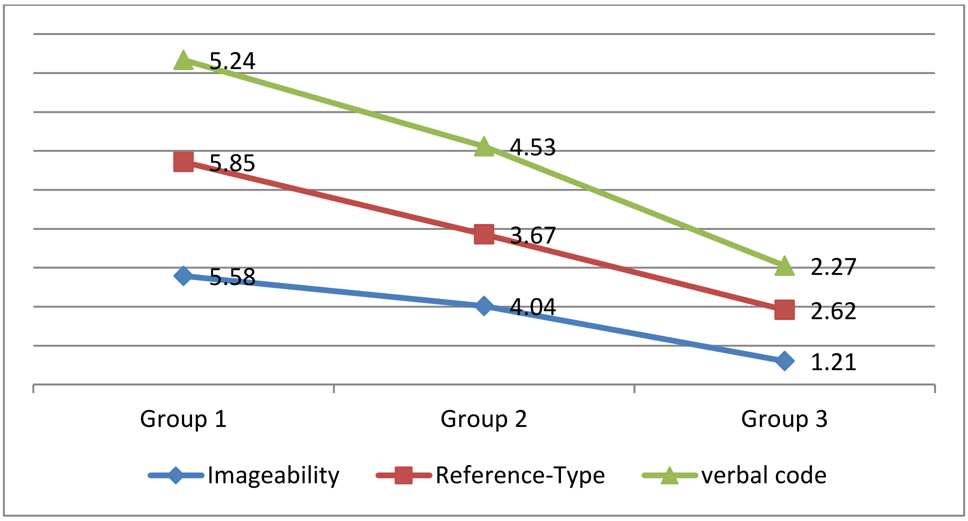


Figure 5.11: Mean values of the imageability, Reference-type and Verbal coding

The graded nature of human concepts, as it was suggested for all concepts, should extend to abstract concepts. A spectral cluster analysis, which organizes the data according to some clusters, is consistent with the aforementioned assumption (Fig. 5.12). Results of this analysis clearly show a continuum which can be divided into multiple groups. In Evans' (2009) categorisation of reference type, such clusters of concepts fall under lexical concepts which index denotational, imagined and cognitive entities (See Fig. 5.12).

Cognitive Entities	Imagnined Entities	Physical Entities
Low Physical properties	Medium Physical	High Physical properties

Figure 5.12: physical properties of entities

The abstractness continuum can be divided into continuous array: R^2 for imageability (R^2=0.6694), reference-type (R^2 = 0.9411) and demand for verbal code (R^2=0.7038) where R^2 is the proportion of variability in a data set that is accounted for by our multivariate model. Figure (5.13) below demonstrates the data points organized on a continuum. It is conceivable that the variables of imageability and verbal coding could be instrumental in delineate the boundaries of the possible sub-categories of abstractness.

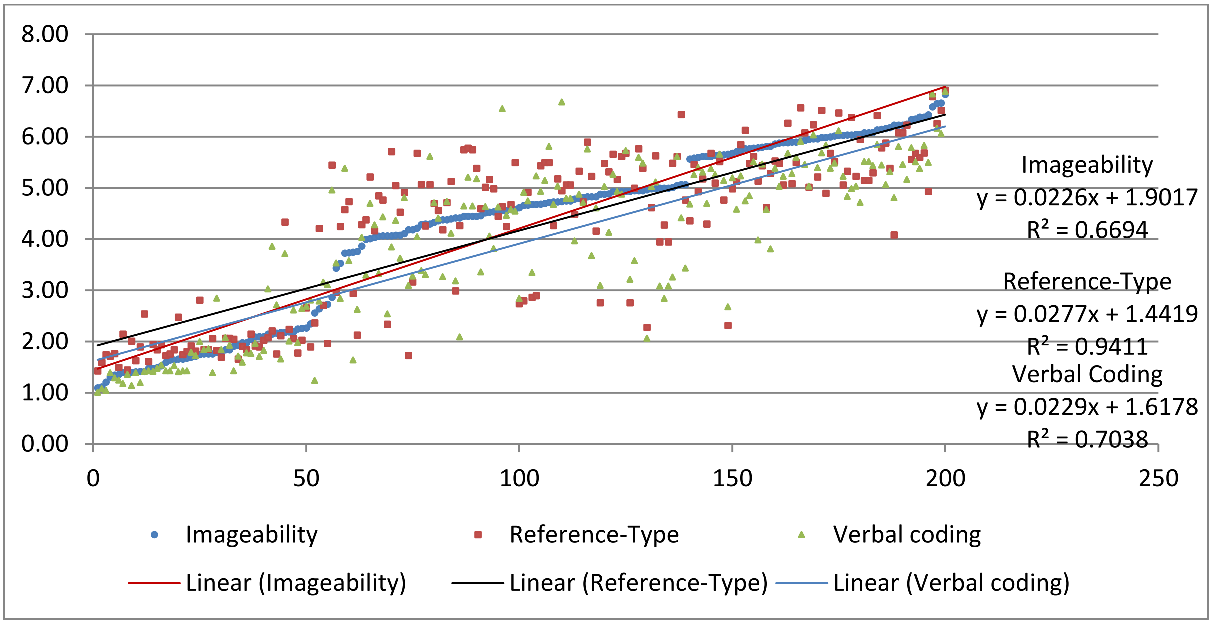


Figure 5.13: A spectral cluster analysis of the lexico-semantic measures

In a nutshell, our results propose that the contribution of verbal encoding surpasses the contribution of imageability in Word Group 1 and 2, where lexical concepts index more cognitive reference. Such outcomes show, to certain extent, that language use is more dominant in the representation and the understanding of abstract concepts, than imageability. This means that the meaning of abstract concepts can be more informative based on the language system. It also justifies, more specifically, the uses of metaphorical structures, which are determined by statistical co-occurrences in language rather than by multimodal properties. This leads us to question the strong thesis of cognitive metaphor which claims that metaphoric structures are in our thinking rather than in language per se. Metaphorically represented abstract concepts, in this sense, seem to be pre-structured by more concrete domains, and consequently have no conceptual content of their own (see the Versions of Metaphoric Representation; Murphy, 1996, 177). This matter will be discussed in details in chapter 8.

Chapter 6
Abstract concepts: knowledge-type and conceptual hierarchy

6.1. Introduction

In this experiment, two tasks were implemented: features generation and listing (Task 1) and features ranking (Task 2). They rock the core of the main theme of this work (the nature of conceptual structure of the abstract concepts). This chapter has more than one objective. The features listing task requires a verbal encoding of the associated concepts (local and global nodes connected within a conceptual network). The general implication of Task 1 is to find out the knowledge-type associated with the concept-types. This could be gained by classifying the produced features according to the knowledge type associated each feature (Task 1). The other objective is to measure the distance between those nodes or the conceptual hierarch by ranking the features according to significance (Task 2). The two tasks are very straightforward in illuminating the variation at the within-individuals and between-individuals levels.

We use symbolic units to explicate our subjective experiences, previously acquired knowledge, intentions, language experience and social as well as cultural beliefs. However, they are not one-to-one equivalents. Language is the most compelling means of efficiently encoding, decoding and negotiating such mental structures. During online and offline processing of the world (physical and mental), the mental structures are not retrieved individually but as an activation of a more distributed network of concepts without discrediting the role of the features and crude information. A bottom-up processing of features and crude information is more likely during deep-processing while shallow processing tends to require more top-down structures as cognitive shortcuts to make sense of the (physical and mental) world. This brings about Barsalou's

(1999) distinction between *shallow vs. deep levels of processing*[20] Deep processing is characterized by more deliberate processing that involves a higher hierarchy of knowledge structures. On the other hand, shallow processing involves the activation of less detailed knowledge structures. In other words, the distinction is based on the physical and mental information that the mind attends to during the process of conceptualization.

With language being in the middle, the feed-in information inputs through a battery of senses and from the previously acquired knowledge-base we keep in the memory interact constructively to make sense of our experience of the world. This interaction generates proliferating (complex) knowledge structures, as system outputs, with the help of the complex cognitive strategies during the conceptualisation process to select and fuse parts to construct the meanings which make sense. Previously acquired knowledge can be retrieved during the process of meaning construction, mostly in the form of top-down coherent templates rather than bottom-up features or information.

The conceptualisation process operates on more than one input during that interaction. At the perceptual level, interpreting the scene of a "sweating" individual, as the target, is more likely to be inferred as the experience of a rise in temperature of the place or the body. This is based on the previously acquired knowledge structure from the interaction of one's body with the external world. One's previously acquired knowledge structures vary according to experience at the individual, social and cultural level. At the individual level for instance, a simulation of the Daily Mail headline a *'dusty hell hole'* and how the weather feels for a soldier stationed in Iraq with a temperature recorded at 50C° is by no means invariably the same for those who did not serve there or for the normal British readers of the Daily Mail[21].

---

[20] See also Good-Enough processing approach of language processing, as proposed by Ferreira. Christianson & Hollingworth (2001) and Patson , Darowski , Moon & Ferreira (2009)

[21] http://www.dailymail.co.uk/news/article-2430067/TA-soldier-Jason-Smith-died-heatstroke-Iraq-50C-heat.html.

For those who served there, the headline reactivates memory traces of stored representation of bodily experience. For those who weren't, the output knowledge structures are highly subjective and perceptually less vivid. It could take a schematically impoverished form as language is the only source of the simulation (Sanford & Graesser, 2006).

This is when the meaning is looked at from the constructive perspective, yet there is another way, where it can be looked at from the destructive perspective. Instead of putting salt and water together to make salty water, salty water can be heated to collect water vapour and salt. To apply this physical process on concepts conceptual structure, conceptualized meaning can be disintegrated into features and knowledge-type.

The basic units of the previously acquired knowledge structure could assume, at least, a dyadic structure: a pair of concepts which are connected by some relation. It can be represented as a minimum cognitive network (Raaijmakers & Shiffrin, 1992; Shah, Kwak, Schmierbach & Zubric., 2004). Accordingly, the disintegration of this minimum network requires specifying the two concepts and identifying the relation which connects them and makes up some semantically coherent unit. What makes the basic unit of belief fundamental in the process of making sense of the world may not be the connected concepts but the very nature of the relation which connects them.

The above illustration represents a very simplistic conception of the nature of human knowledge. At the next level, Schema which Ungerer (2007: 997) broadly defined as a "superordinate concept, one which specifies the basic outline common to several, or many, more specific concepts". They often inform a higher order and more complex structures, i.e., frames. Schemas and frames assume a stand-alone status due to their coherence at their micro-level structure and more advanced functions. They constitute the higher filter of monitoring the coherence of other features, concepts and schemas (Clark, 2012). Not any new input could link to a frame, but only those which give rise to a semantically coherent output with no or minimum conflict (Noakes & Johnston, 2005). Frames could combine to make up cognitive models via a process of abstractions. These cognitive models could incorporate both processes of binding and prediction. Moreover, the act of producing verbal representations—verbal description and ranking tasks—require reflective thoughts and rational modes of thinking (Van Der Schaaf, Baartman, Prins, Oosterbaan & Schaap, 2011).

Cognitive models in the Evans sense are coherent bodies of multimodal, analogue representations that make available a descriptively powerful potential which allows for simulations. Cognitive models provide the access sites to an extensive network of world knowledge or a broad network of interrelated concepts. This means that disintegrating the knowledge implicates a complex list concepts and relations. It also implicates a sort of hierarchy according to superordinate and subordinate features. The ranking task represents this distinction by listing features according to their importance.
Individuals cannot understand an event, interpret linguistically coded concepts or iconized symbols without resorting to a system of knowledge structures that is, in part, subjectively formed and the rest is socially acquired to make sense of the world. Such system of cognitive structure act as cognitive shortcuts to cope with the multiplicity and dynamicity of the world contexts. In other words, they function as a predictive filters (models) to make sense of any given perceptual input. The inferences which we execute to make sense of concepts on the continuum (such as table, tree, carrot, fear, anger, betrayal, argument, theory, etc.) are claimed here to be arise from the interactions between knowledge-types acquired by means of different systems.

The processing of a word like “car”, depending on the features attended to, could activate various aspects such as shape, colour, transmission, fuel, accessories, speed, etc. This matter is governed by the mode of processing, the goals and the context. Taking the referent into our consideration, the symbolic unit “car” has the privilege of having a physical entity as a referent which it indexes. Other words, e.g., marriage, theory, doubt, legacy, etc. and many others in the middle of the proposed continuum have no such advantage. The same constructive nature of language in their meaning construction still affords the means to deconstruct the knowledge structures associated with them.

This experiment seeks to investigate the heterogeneity of the content of abstract concepts with more emphasis laid on testing whether the perceptual knowledge is inherent to the representation and interpretation of the abstract concepts (directness condition). The other question relates to whether or not the perceptual and imagistic representations are sufficient to constitute the inherent content of abstract concepts. In this case, it is important to know whether the presence of perceptual and imagistic representations are inevitably necessary for abstract concepts to maintain their conceptual content or otherwise represent an epiphenomenal part to their content (Meteyard and Vigliocco, 2008).

In short, the deconstructive property of language use is an effective means of expressing the meaning associated with particular lexical concepts. Using this property could lead individuals to execute deeper and more deliberate processing. Based on this ground, this property could be explicitly implemented by the verbal encoding task, i.e., by instructing the individuals to express, define or rephrase the meaning associated with particular stimulus. To make it a more controlled task, the individuals were required to deconstruct the meaning of the stimulus by generating what we call features, (i.e., a car is a vehicle, it runs fast and so on) and asked the participants to rank them according to relevance and significance to the meaning of that stimulus.

6.2. Hypotheses

The standard argument in this chapter assumes that one method for deconstructing concepts' constitutive and facilitative knowledge-type and hierarchy. The address of this argument necessitates the formulation and testing of a set of hypotheses about the diversity of the content of abstract concepts. The hypotheses are as follows:

i. Fine-grained classification of knowledge-type can be a good predictor for abstractness continuum of concepts,
ii. Higher abstractness concepts associate with greater amount of non-perceptual knowledge-type than perceptual,
iii. Ranking the extracted knowledge-types can be predictor for the indirectly associated perceptual knowledge content to the content of higher abstractness concepts
iv. Individuals' acquired knowledge for higher abstractness concepts is variable at the within-individual and between-individuals levels

6.3. Task Design

Features associated with concepts constitute the semantic structure that makes up concept meaning. This experiment involves producing and ranking the semantic features and values for a single-word concept. This may lead to seek answer as to why would some features be considered more default than others? The other key contribution in this task is that after deriving these features, how it becomes logical to conclude which knowledge-type is more predominant in the representation of a given concept. This would not be possible without finding an encoding classifier for encoding the generated features into their corresponding knowledge-types (Cree & McRae, 2003). Ranking task allows to test the variation at levels of within-individual and between-individuals, by looking at how accurate the generation and ranking of the features of a given lexical concept is at two points in time (two trials). Two trials of features generation and ranking by the same individual were used to underline their degree of accuracy. Features generation and ranking accuracy has many implications when concrete and abstract concepts are considered.

20 participants were involved in this task, but one participant was excluded due to failure to understand the task. Each participant was given 3 words for defining their content in terms of verbal description. Each one of the 3 words belonged to one of the three word groups. A matrix of 463 semantic features was built to those 60 words. Then, the features were normalized using BR

encodings, 10 knowledge-types for Brain Region scheme encoding, where a row in the matrix represents the semantic features of a word generated by different participants. The matrix encodes the semantic content of each word based on the distributed pattern of features and the underlying knowledge-types. For instance, a "table" concept assumes higher value in the visual-form knowledge type than sound or smell. In this task, knowledge types, rather than knowledge content, have been derived by encoding features using the BR feature norming scheme. In other words, it is more to do with whether "rose" is associated by default with visual colour property (colour) while the "earth" has much to do with its behaviour, e.g. it rotates around the sun. The scheme discriminates between "rose" and "earth" by the pattern distributed across different knowledge types, i.e., encodes word meaning at the level of knowledge types.

Participants will be instructed to give examples, single-words or short utterances, in the form of "X has Y, X does Y or X is Y" where X is one single-words concepts out of the 60 verbal stimuli. No more than 10 descriptions are required. They will be instructed to rank these examples in the order as they think of them from the most relevant (important) to the less relevant (important).

"If you are familiar with the concept given above, using single words and short utterances to describe its meaning" in the form of "X is Y" X has Y", or "X does Y", etc, as you have done in your training session. Example "heart"

1. It is a body organ
2. It is a red organ
3. Heart is part of the body
4. Heart is a cone shaped
5. It is made of muscles
6. Heart beats
7. Heart pumps blood
8. Heart is inside the chest
9. It has chambers
10. It beats automatically

In this analysis, we train a regression model which inspected how far the knowledge type vectors (explanatory variables) could account for the variation in concepts' conceptual content (response variable) across the three word groups. A regression model was trained for each of the 463 verbal descriptions. R^2 measures the amount of systematic variance explained by the model. It learns the mapping between features and meaning. The intermediate knowledge types associated with the meaning of each word are considered as the hidden layer contributing to the individuals' conceptual inventory.

6.4. Task 1: Verbal Encoding

The participants will list and rank a number of features associated with that stimulus. It represents a means for defining them via generating synonyms, rephrases and simple definitions., e.g., "fire engine" is a truck, has ladders, is red, etc. Verbal encoding, in our case, is meant to extract the abstract concepts' content and more specifically the network of links they have to other concepts. In other words, it explicitly reveals semantic potential via listing what associations are there for particular lexical concepts. The participants will do so by using short expressions that could be coded into single attributes. For example, "fire-engine is red", the concept "redness" is taken as one link in the conceptual structure network of fire-engine. With the aid of a systematic coding scheme, the knowledge type associated with each attribute can be derived, for instance, "red" is visual-sensory knowledge-type. Knowledge-types (visual, visual form, tactile, sound, smell, function, taxonomy) could be identified using Cree and McRae's (2003) brain region (BR) Coding Scheme. Ranking such coded features will give clues to the hierarchy of such features within the conceptual structure of the abstract concepts. The ranking accuracy will shed light on the variation at the within-individual level and between-individuals level.

Barsalou, Solomon and Wu (1998) used features listing technique by introducing a modifier word to a head word and instructing their subjects to produce the internal features associated with the new construction. The typical assumption predicts that the difference in the features of "half a watermelon" vs. a "whole watermelon" would be in the amount feature, i.e., the former is smaller than the latter. The results of their work elicited more internal features such as seeds.

6.4.1. Verbal Encoding and Knowledge-type

Verbal encoding in this task, as an indirect and meta-cognitive measure of the representational content-type for concepts, plays a more important role in the explication of the knowledge-type and semantic structures of abstract concepts. Such content can be unravelled by instructing individuals to produce as many features as they could think of upon viewing/hearing verbal stimuli in our case. To get a clear picture of the content, such features were encoded according to a systematic encoding scheme (classifier) that specifies the knowledge-type associated with a given feature.

Features analysis has been measured in several ways, using different labels: distinguishingness (Cree & McRae, 2003), distinctiveness (Garrard, Lambon Ralph, Hodges, & Patterson, 2001), and informativeness (Devlin, Gonnerman, Andersen, & Seidenberg, 1998). Distinctiveness is related to feature salience, i.e., how easily a feature "pops up" when thinking of a concept (Smith & Medin, 1981; e.g., "redness" of fire engine). Salient features have a particularly significant status in the semantic space of a given concept. Distinctiveness or "defaultness", as we prefer to call it in this work, refers to the readily accessed features by default. Following Evans (2009), features can be looked at as a continuum in which truly default features lie at one end and highly shared features at the other, for instance, "screen shield" is a shared feature of "fire engine".

As stated previously, such features can be normalized in terms of features normalisation scheme that serve as a classifier for the knowledge-types. Feature norming researches have been demonstrated to be appropriate for addressing semantic content (Hampton, 1997; McRae et al., 1999; Rosch & Mervis, 1975). Cree and McRae's (2003) examined participants' list of semantic features of 541 words from five domains (living objects, non-living objects, fruits, and vegetables). The features arise from a verbalization of actively recalled semantic knowledge of words. Due to their uncontrolled and free recall of the semantic features as they came to mind, they had to be coded to enable further analysis. Generally, to the best of my knowledge, there is more than one encoding scheme put forward for features norming, however Cree and McRae's brain region (BR) seems to be the most relevant to our case. Basically, its convenience came from its descriptive power and incorporation of the finding of both semantics and neurophysical researches.

Cree and McRae's brain region (BR) scheme, which builds on a knowledge taxonomy, adopts a modality-specific view of semantic knowledge. The semantic representation of an entity is supposed to be an activation of a number of distributed cortical areas related to sensory input and motor output (Ibid). Brain region scheme, then, classifies features according to their relations to some sensory/perceptual, e.g., knowledge for "a car is fast" would be encoded as visual-motion; "a car carries people" is function, and "a car is vehicle" as taxonomic in this scheme (see table 6.1).

One way to extract a more elaborate content underlying a single-word concept is to instruct individuals to produce verbally what features a particular concept brings to their minds. Initially, this task was to extract authentic and usable representative semantic content of abstract concepts, represented by a number of exemplars and psychologically salient features. Secondly, it was to determine which exemplars and features, the participants would perceive as important and implicitly characterize as direct/indirect by ranking them. Such exemplars and features take the form of defining words, phrases and short sentences.

Concept	Feature	BR Encoding
House	Made by humans	Encyclopedic
	Is expensive	Encyclopedic
	Used for living in	Function
	Used for shelter	Function
	Is warm	Tactile
	A house	Taxonomic
	Is large	Visual-form and surface properties
	Made of brick	Visual-form and surface properties
	Has rooms	Visual-form and surface properties
	Has bedrooms	Visual-form and surface properties
	Has bathrooms	Visual-form and surface properties
	Is small	Visual-form and surface properties
	Has doors	Visual-form and surface properties
	Has windows	Visual-form and surface properties
	Made of wood	Visual-form and surface properties
	Has a roof	Visual-form and surface properties
Cow	Lives on farms	Encyclopedic
	Is stupid	Encyclopedic
	Is domestic	Encyclopedic
	Eaten as meat	Function
	Eaten as beef	Function
	Used for producing milk	Function
	Is smelly	Smell
	Moos	Sound
	An animal	Taxonomic
	An mammal	Taxonomic
	Is white	Visual-color
	Is black	Visual-color
	Is brown	Visual-color
	Has 4 legs	Visual-form and surface properties
	Has an udder	Visual-form and surface properties
	Is large	Visual-form and surface properties
	Has legs	Visual-form and surface properties
	Has eyes	Visual-form and surface properties
	Produces milk	Visual-motion
	Eats grass	Visual-motion
	Produces manure	Visual-motion
	Eats	Visual-motion

Table 6.1: Normalizing schemes (Adapted from Cree and McRae, 2003)

In this task 3 groups of words have been chosen from the 200 words which were used in experiment 1. Each group is comprised of 20 words from each word group were selected according to their reference-type rating.

- Group 1: 20 single-word concepts with mean reference-type rating range (5.00-6.91)
- Group 2: 20 single-word concepts with mean reference-type rating range (2.74-4.99), and
- Group 3: 20 single-word concepts with mean reference-type rating range (1.45-2.71)

6.4.2. Results and Discussions

The trained regression model predicted the contribution of each factor and linearly conjoined the contribution of each factor to produce an estimate of the predominance of the stimulus' conceptual content. For instance, the conceptual content of the word "pen" may be different from that of "fear" in that Function knowledge-type (what it is used for) serves as the key factor which determines its conceptual content while Taxonomic and Encyclopaedic knowledge-types for "fear" is the key contribution in the identification of its conceptual content and a more significant part in determining its meaning, as depicted in Figure 6.1.

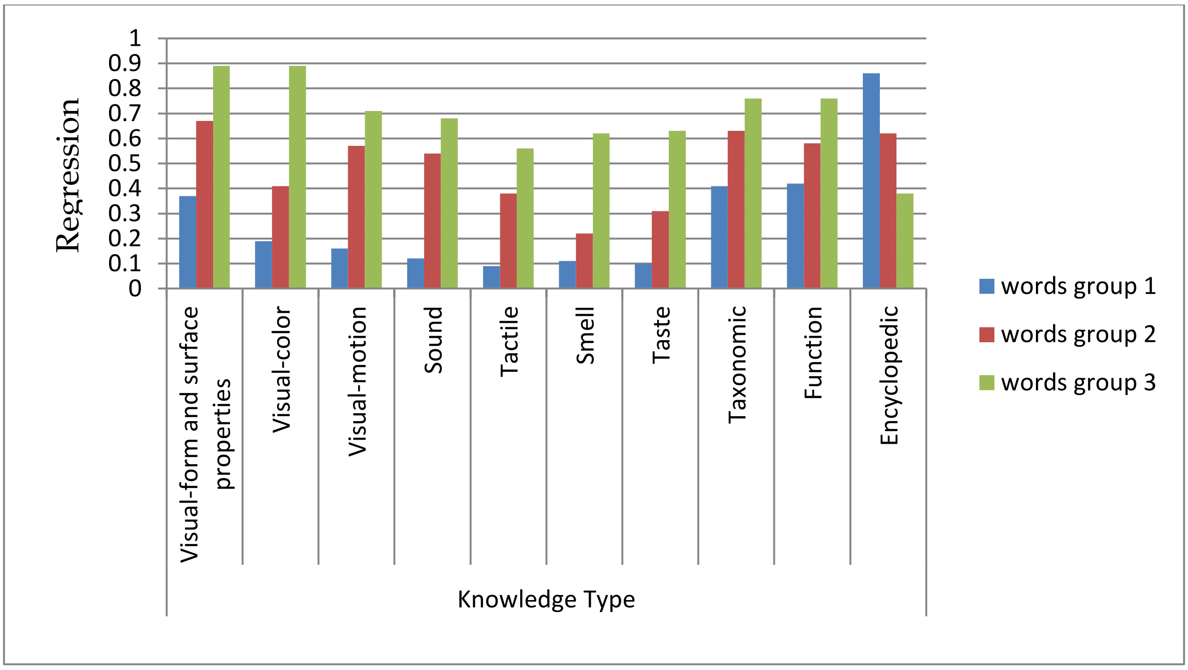


Figure 6.1: The regression model of knowledge-type distribution

Is it possible for the regression model to predict the gradability of the conceptual structure of abstract concepts as the participants perceive them? In other words, can the regression model generalize to make predictions for abstract concepts, given the values of the independent variables (the knowledge-type) that have been derived from features listing and ranking?

To check this question, all possible triads (1 word from each of the three word groups) were held out (one triad at a time), then a multivariate multiple linear regression model is trained for the 60 words, with knowledge types vectors (the BR encoding) as the explanatory variables. The projected regression weights were then worked out to produce the predicted conceptual content vector for the triad. Then, the observed knowledge type vector for the triad was identified with the word groups.

Generally, visual and sensory knowledge and functional types in word Groups 3 & 2 (with more denotational reference-type) outperformed the same knowledge types in word Group 1 (words indexing cognitive reference-type). Sensory and functional knowledge-types seemed to constitute the default knowledge-type associated with word Groups 3 & 2 which index the entities' physical properties. Word Group 1 appeared to be associated with less sensory-motor knowledge-type due to them indexing entities with non-physical properties. Function and Taxonomic knowledge-types serve the membership of one subordinate category to its superordinate category. The word Groups show almost equal distribution patterns in terms of these two knowledge types. This means that categorisation equally applies to all concepts. However, the encyclopaedic knowledge-type seems to be a key hidden component which characterizes Word Group 1 due to the relational knowledge content. Lexical concepts such as "idea, reason, etc.," derive their content from their relational association to other lexical concepts such as "ideas are in the *mind*", "ideas are *important*", "*people* need ideas", "ideas reflects on *knowledge*", "ideas build on *reasoning*", " ideas are *abstract*", "inferences make *new ideas*", "ideas are *creative*, etc.. The Encyclopaedic knowledge-type, as Cree and McRae (2003) glosses it, is more associated with frame-like structures where a complex of coherent knowledge structure is meshed together as one unit. The result as represented schematically by Figure 6.1 explains the variance in the knowledge types associated with concepts' underlying conceptual content in Word Groups 1, 2 and 3.

The weak point in this task is that it does not tell us, for instance, whether the sensory-motor knowledge-types associated with Word Group 1, such as possibility, knowledge, curse, etc., arise as default features or the subjects were thinking metaphorically. To address this point, Task 2 of this experiment models the ranking accuracy of the same stimuli by doing the same task of producing features and ranking them twice. The two output will be compared to find out whether the same individual ascribes the same features and hierarchy with no variation or not.

6.5. Task 2: Ranking Accuracy

This task took place a day after task 1 of this experiment. The participants were asked to repeat the verbal encoding task via features listing and ranking that they participated in the day before. They were given the same stimuli again. The subject was instructed to provide a verbal encoding of the underlined abstract concepts and rank the features according to importance. Ranking the features which are associated with the concept reveals the strength of association for that feature to the content of the concept (defaultness).

The rank accuracy is defined as the percentile rank of the correct class in this ordered output list. Classification analysis was performed separately for each participant, and the mean rank accuracy was computed over the participants (Mitchell et al. 2004). Since multiple classes of knowledge type were involved, rank accuracies are reported, i.e., the measure of the percentile rank of words' features is very likely to underline the within-individuals variation. In rank accuracy analysis, rank accuracy ranges from 0 to 1. Multivariate multiple linear regressions were run for each participant, using BR as explanatory classifier. Multivariate linear regressions are routinely used psychometrics to model the predictive relationships of multiple related responses on single or a set of predictors.

The information which can be abstracted from ranking the properties and features signifies not only the defaultness of the concept's semantic associations; rather it sheds light on the consistency of their hierarchy in the semantic space of a given concept. This could lead to derive the level of the within-individuals variation, i.e., the subject's conceptualisation at different points of time. Variation can be taken to assume that the attributed knowledge-type is facilitative rather than constitutive to the concept as a cognitive strategy to approximation the concept's meaning, such as thinking metaphorically.

6.5.1. Results and Discussions

The ranking accuracy task has shown that almost all participants were unable to produce the same features with the same hierarchy at two different points of time (*t_1 and t_2*). This is a natural outcome due to the fact that human knowledge evolves due to experience. However, a two-day span is not long enough to result in such significant variation, especially in the area of Word Groups 1 and 2. Group 3 shows insignificant Rank accuracy, with Mean accuracy 0.848. However, in the area of Word Groups 2 and 3 within-individual variations unravelled significant results, mean accuracy percentages of % 0.66 and 0.48 respectively. R^2 is higher for Word Group 3 for all 10 of the participants showing lower systematic variance (see Fig 6.2) this may be interpreted as follows: (R^2: 0,50) means that 51% of the variation in the response variable can be explained by the explanatory variables. On the other hand, the (R^2: 0.008) means that only 0.08 of the variation in the responses in the region of Word Group 1 can be explained by the explanatory variables.

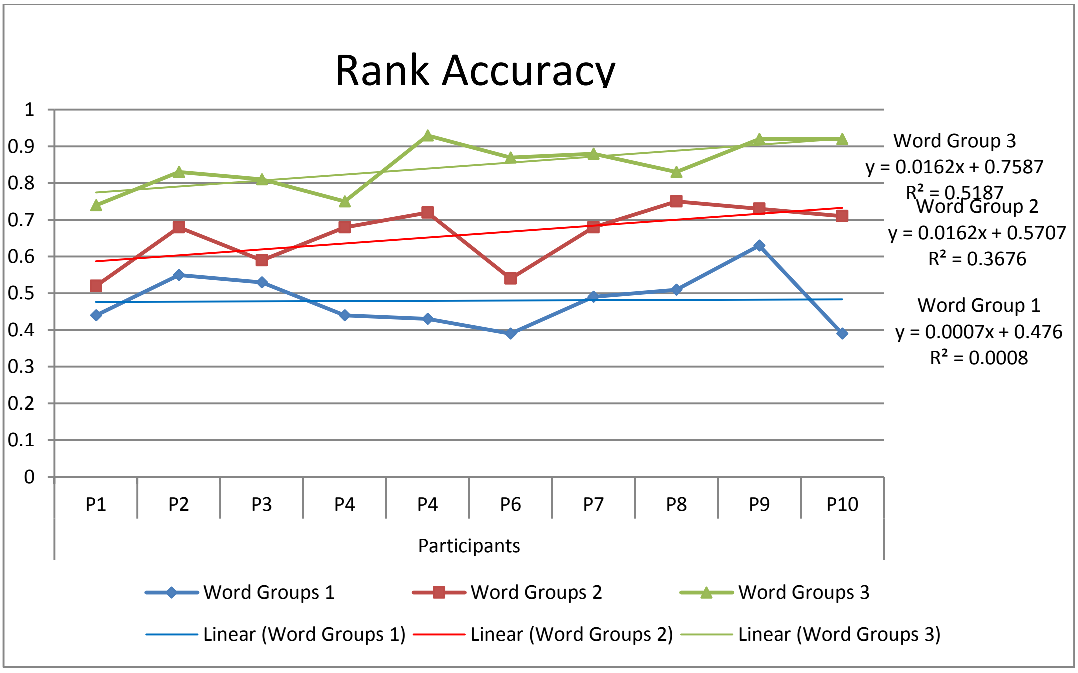


Figure 6.2: Within-individual variation in terms of Rank Accuracy

20 participants (10 undergraduate and 10 post graduate students from Basra University) were involved to unveil between-individuals variation. The results have shown that the features from the two participant groups in this task can be used in a regression model to explain a significant portion of the variance according to previously acquired knowledge. For the between-participants analysis, a regression model was developed from the data for low level verbal ability participants and high verbal ability participants in terms of ranking accuracy across the stimulus set. The regression model estimates the differences across subjects performance and learns to estimate the accuracy percentage of the producing and ranking features at different points of time (t_1, t_2 , …, t_n).

Low Verbal Ability group showed an average of 58% while for the group with higher verbal ability, achieved average accuracy, 82%. All accuracies percentages were significant ($p < 0.05$). To achieve valid generalisation of the acquired data, i.e., at 95% confidence interval, another 20 participants were recruited to respond for the same task.

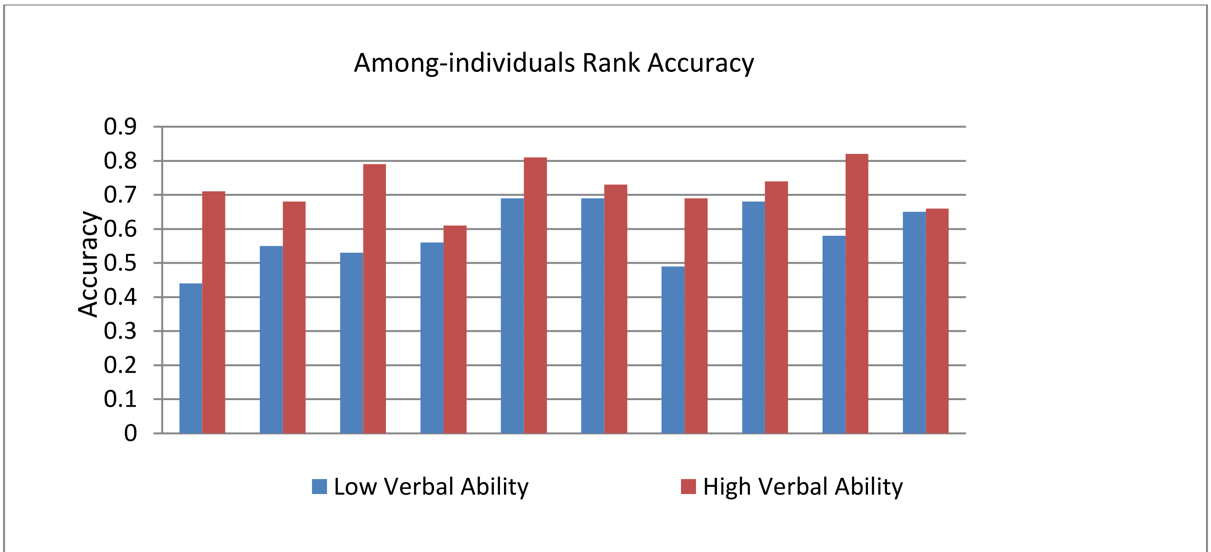


Figure 6.3: Between-individuals variation in terms of Rank Accuracy

The confidence interval is estimated by random sampling of the two datasets and subsequently computes the model performance. 95% confidence interval estimated by 523 bootstrapped samples. The accuracy percentile of the two subject groups were as shown in Table 6.2:

At 95% Confidence Interval	Low Verbal Ability	High Verbal Ability
Low Accuracy	%47.5	%68.6
Mean Accuracy	% 52.6	%73.5
High Accuracy	%57.7	%78.3

Table 6.2: Among-individuals Accuracy variation at 95% confidence interval

The table shows significant accuracy in the generation and hierarchy organisation of features across individuals with varying experience (linguistic and non-linguistic) varies significantly. The low verbal abilities participants performed poorly, achieving a mean rank accuracy of only 52%, and obtaining a significantly ($p < 0.05$) lower than the higher verbal abilities participants.

6.6. General Discussion

This experiment achieved very fundamental objective in taking the conclusions of Experiment 1 a step forward by specifying the predominant knowledge-type associated with lexical concepts that index denotational and cognitive reference-types. The result in Task 2 revealed that individuals vary in recruiting particular knowledge-types in their conceptions of concepts along the abstractness continuum. Specifying the knowledge-type wouldn't be possible without a systematic coding scheme that acts as a classifier. In our case, Cree and McRae's (2003) brain region (BR) was instrumental to specify the distribution of knowledge-type across concepts' continuum.

The generation of features, or attributes and values according to Evans' LCCM, was the key technique of deriving the data on the predominant knowledge-type. But, this in-between featural level which separates lexical and conceptual layers, as we perceive it, does not qualify to constitute a level on its own. Vigliocco and Vinson (2007: 209) state that:

> "conceptual features (…) are bound into a separate level of lexical semantic representations which serves to mediate between concepts and other linguistic information (syntax and word-form (…) organisation

> at this level arises through an unsupervised learning process (...) which sensitive to properties of the featural input"

Attributes can be derived either as the distributed, sensory-motor information that can be captured in the physical world as well as from the relational property of an entrenched body of structured knowledge (see the schematic representation of the lexical concept "ideas" in Fig 6.4. Values pertain to more primitive knowledge structures and information incorporated within the attributes. Evans refers to the notion as "aspects of a cognitive model, such as properties—and structural invariants— relations holding between attributes—of a given cognitive model" (P. 76). Features represent a higher level of semantic level, where higher order rational processes are applied to conceptual content in what (Evans, 2009) calls Back-stage cognition.

By dissociating conceptual and linguistic levels of knowledge representation, to easily fit the data and the emergent statistical results, LCCM offers a plausible account of the variation in the knowledge-type and among-individuals variations. The variation emerges from the nature of the encyclopaedic knowledge that each individual develops over time. Cognitive models are supposed to cover the sensory-motor part of knowledge-type. The function knowledge-type is covered by the schematic structure associated with lexical concepts. For instance, "كرسي" (chair), the relationship between the object and the user was ranked high by the cohort. The schematic relation is represented by the implicit phonological vehicle [NP sitFINITE on chair] and the lexical concept [يجلس] [X SITS on CHAIR]. Evans (2009: 83) states that "there is now compelling evidence that perceptual experiences, for instance, are reactivated or simulated" to perform "integrated simulations" (Evans 2009: 205).

The mode of acquisition of the encyclopaedic knowledge is fundamental to effortless and smooth simulation the way LCCM envisages it during the process of meaning construction. In the case of abstract concepts, the mode of acquisition seems to be principally lexical which means that our understanding of [DOUBTS] comes from activating the various cognitive model profiles associated with other lexical concepts with more modal attributes and values. This motivates the initiation of searches for lexical concepts which often co-occur in language use to safeguard more grounding. Semantic composition becomes a requirement strategy to attain more grounding and sense-making.

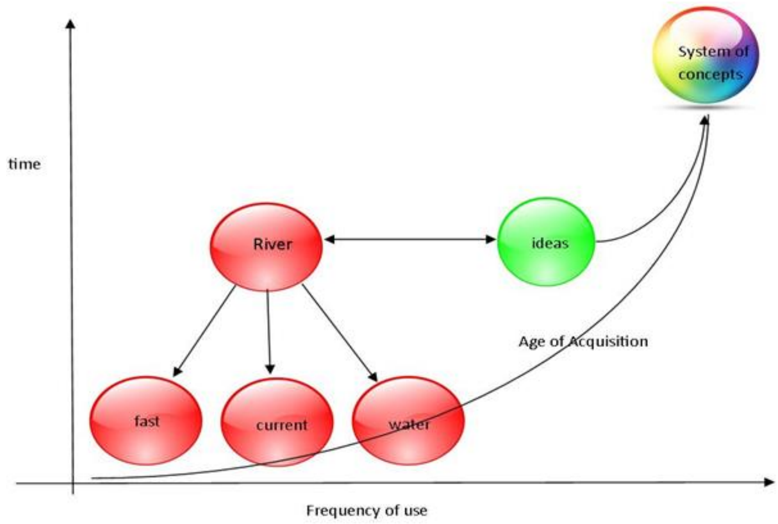


Figure 6.4: Schematic representation of the development of the conceptual content of "ideas"

The between-individuals variation seems to be determined by the experience acquired over time. The nature of this acquired experience is subsequently determined by domain experience (undergraduate versus postgraduate candidates of Arabic language). The nature of variation in the information deposited in the data samples from these two verbal abilities groups is determined exclusively by their overall experiences and acquired encyclopaedic knowledge. Human encyclopaedic knowledge is a

> "highly detailed, extensive, and structured knowledge we as humans appear to have access to in order to categorize the situations, events, and entities we encounter in our everyday lives and in the world, and the knowledge we draw upon in order to perform a range of other higher cognitive operations including conceptualization, inference, reason, choice, and the knowledge which language appears to rely upon" (Evans 2009: 17).

Such detailed and highly structured knowledge is a vector which could predict the between-individuals variation. The non-linguistic knowledge accessed by the lexical concepts [IDEAS], [DOUBT] and [DEATH] seems to evolve into richer and richer content over time based on actual experience and language use. A Two-day span is not enough for any significant knowledge growth. Rather, it seems that the variable recall of language use at different point of time is what matters most for the explanation of between-individuals variation.

Language use plays a vital role in enriching the concept's content and compensates for its lack of more grounded content. The more frequently a lexical concept is used over time, the richer it gets in terms of knowledge-type. In other words, through the evolving metaphorical structures, its conceptual content becomes partly determined by language-use and partly by communicative intention.

A list of single words as a verbal stimulus does activate content ascribed to language use, yet very little is told about the role of communicative intention which can be explicated more by an utterance than single lexical concepts. Utterances afford relatively more information for successful simulations in Barsalou's sense. Experiment 3 will address the conceptual content and structures of abstract concepts at the level of utterances.

Chapter 7
Compositionality: Simulation of Abstract Concepts

7.1. Introduction

Experiment 2 verbally encoded the associated concepts (nodes) or knowledge-type without actually identifying the relation between the nodes or the interdependency between the knowledge-types. Experiment 3 derives the subjects' judgments on the nature of the relations between the nodes in terms of *Informative Optimality* and *Plausibility*. Informational optimality reflects the subjects' judgment on what is sufficient for the interpreter to get a grip of the intended meaning. Plausibility condition reveals their judgments as to whether the expressed meaning matches the real world or the previously acquired belief-systems about that world.

In chapter 6, the contents of a single-word stimuli were deconstructed into more basic features by engaging the potential of language as a reflective means. Such potential allows the analysability or the psychological deconstructive perspective of interpreters on the knowledge structures single-words afford access to. For a top-down analysis, the verbal encoding task was purposefully deployed.

The knowledge structures (schemas, frames, cognitive model, etc.) which activate in the mind are mostly prototypical, i.e., others assume variable salience at different points of time and contexts. Since our concern is the concept rather than the knowledge in general, we will set up a top-down perspective on abstract concepts. To start with, let's consider indexing our beliefs on concrete entity, for instance "big elephant", we rely on the qualitative characteristics of the recollected knowledge structures which, in this case, are highly vivid for the available perceptual information associated with the "elephant". One's beliefs about "an elephant" and "size" or "elephant" and "shape", will be easily remembered and retrieved to make up an informationally optimal interpretation. Such vivid perceptual information allows the formation of plausible beliefs based on such semantically coherent relation between (elephant-big). For instance, the interpretation of a joke like:

7.1

- Q: How do you know there are three elephants in your refrigerator?
- A: You can't close the door.

The individuals easily understand the joke because their basic belief about the relation between the two concepts is perceptually vivid and allows faster processing. Physical properties are salient enough to be attended. Based on the model of *Spreading Activation*, it is more likely for the adjacent conceptual structures (modality-specific effects) to be directly accessed (beliefs' accessibility) based on their beliefs' weight (activation strength). Pecher, Zeelenberg & Barsalou, (2004) explain how easy to retrieve elephant-size simply because the experience of the actual concepts "elephant" and "size" are both visual, so their adjacency allows faster accessibility and faster retrieval: "Responses were faster and more accurate on same-modality trials than on different modality trials" (p.164). According to this view, modality-specific beliefs bias the retrieval of knowledge, increasing their accessibility (Zeelenberg Pecher, Shiffrin & Raaijmakers, 2003).

Another view, *Compatibility Model* , assumes that not only the adjacent beliefs are activated during the processes of accessing the basic beliefs, but even the irrelevant remotely connected concepts are also filtered out for their compatibility (Bonanno & Nehring, 2000). Beliefs are still non-deterministic; rather there may be two or more beliefs for the same reality. Compatibility judgment model assumes that routine testing of relevance threshold is also applied to remotely interconnected concepts during filtering the semantic coherence of their connectedness.

The marriage of the spreading activation and compatibility models could have more feasible consequences to evade simplistic explanation of the former and the lack of any clear explanation of how the compatibility filtering takes place in the latter. The resulting hybrid account outstretches to bring to the scene the importance of schemata and frames as a measure of filtering any input information (Dell, 1986). The activation of multiple routes (direct and indirect) to the distinct beliefs structures gives a plausible explanation for how polysemous, metonymical, metaphorical structures assume higher chances to receive optimal interpretations. Due to the limited canvas working memory, it follows that some activation sites are likely to deactivate due to failure to reach the required activation threshold. Coherent structures are brought to the working memory instantaneously for their match (Ibid). The schema "elephant is big" is activated first as a minimum basic belief. When the higher complexity beliefs schemas are activated in relation to given context, the spreading activation routes extend to cues from the context to achieve sematic coherence, especially when the concept of "refrigerator" and "the door not closing" are included in the examples in 7.1. Baden & De Vreese (2008) suggested that more than one frame is also activated in processing one single intended frame, a response which needs a more or less deliberate judgment on how coherent each one to the speaker's intention and the situation in question. In all cases, the starting point of activation is our concept of the "elephant" due to its vivid perceptual information that we have already acquired. It is not our concept of the "elephant" which marks the within-individual or between-individuals variation, but the retrieval of the other information from the schemas and frames across more global networks.

By virtue of their integration, complex language units usually cue the weighing of beliefs. First of all, inconsistencies in semantic relatedness as well as evaluative loads must be resolved. Weighing a set of beliefs must inevitably be guided by the consciously reflective reasoning and judgments (Katz, Goodman, Kersting, Kemp & Tenenbaum, 2008). Reflective reasoning is a reductive act which does not fully rely on the propositions expressed in language use but on the information that constitutes the individual preferences, goals, attitudes and perspective. Their contribution lies in predicting, detecting and resolving conflicts during the process of filtering the communicated proposition (van Dijk, 1985).

The first source of belief is the self in that the individual makes judgment as whether the retrieved belief is something really experienced or whether it is a product of one's thoughts, counterfactuals, imagination or even dreams (Robin & Moscovitch, 2013). Robin & Moscovitch found out that the imagined beliefs were suspected of being caused by sensory vividness but mediated by one's familiarity with the contextual cues for the imagined event.

The other source of beliefs is the internal states such as emotions (fear, pain, jealous, etc.) Such source are very powerful in biasing the processing of other beliefs. (Mathews and MacLeod 2002). Biased by one's internal state, the individual might miss a lot of the available information as well as the reason-certified information of the event and solely base his/her processing on post-event biased belief. Such mode of processing is prone to errors, distorted belief and ill-actions which they may later become able to re-evaluate and possibly re-organize. The people experiencing post-traumatic stress disorder, fear, threat, hatred had their actions conditioned. There is no space here for reviewing the available research on the conditioning effect of post-traumatic stress disorder, fear, threat, hatred, etc. on information processing and meaning interpretation (McNeil, Tucker, Miranda, Lewin, and Nordgren 1999). The actions of paedophiles, sex-offenders and racists are products of their beliefs which are characterized by particularly emotional, cognitive, sexual, and social contents (see, Wessel, Meeren, Peeters, Arntz & Merckelbach 2001).

Concepts with more abstract referents such as "electricity", "learning", "condensation" are acquired through rational processing. Basic beliefs emerge from underlining the relation rather than the connected concepts. For instance, our belief of the existence of a referent for "electricity" emerges from the causal relation between source "generator" and the "generated". In other words, it is the effect of the relation which matters most. The same can be said about the concept "learning". For instance, the lexical entity "betrayal" could invoke different knowledge structures in the mind of the same individual at different points of time and the minds of different people. Betrayal could involve (self, friends, spouse, country, etc.) and implicates (disappointment, failure, trust, affairs, treason, etc.).

The integration and construction of meaning with the help of beliefs mapping onto the attended information wouldn't be possible without the fundamental contribution of language use in the process of belief acquisition, formation and processing. At the group level, language represents a powerful means of beliefs sharing via language use in explicating unfamiliar concepts or making new relations to familiar ones. Belief can be expressed by propositional meaning that language use expresses. However, the propositional meanings expressed by language use do not necessarily equate the speakers' beliefs. Therefore, meaning can not only be defined as what the individual decodes from a text, but what matches that the individual possibly may find to be mapped onto the text. In the interpreter's mind, the expressed beliefs may not at all what is present in uttered symbolic units but may be constructed along their processing with the help of previously acquired belief-systems (Schaap, Renckstorf et al., 2005). So, the belief-systems are present in the production and interpretation of the symbolic units (Ibid).

The analysed and encoded meanings accept high variability and open choices. Limiting such choices is possible by incorporating higher compositional structures such as combinations, utterances and discourses. The producer role is manifested in the selection of the compositional structure which he/she assumes informationally optimal for the interpreter to fetch (sufficient enough to be interpreted successfully and represent a plausible model of the external and mental world).

The claim to be tested in this chapter is that the representation and interpretation of the abstract require more deliberate interaction and judgments to determine the sufficiency of the available information for achieving informationally optimal interpretations and the compatibility of such interpretations with the previously acquired beliefs (plausibility). The former judgment is modelled by the informational optimality as a dependent variable while the other is modelled by the plausibility as another dependent variable. The second claim is that there should be a significant correlation between the two dependent variables and compositionality as an independent condition.

7.2. Compositionality

Compositionality, as discussed previously, is perceived as another factor which modulates human processing, conceptualisation and judgments on meaning. It brings to the foreground the interface between the linguistic and conceptual systems by involving automatic search, matching and alignment of the semantic properties of the components in combinations to attest to their meaning acceptability. Judgements on semantic acceptability in this case are to recognize whether the information that given components of a combination give access to is adequate to constitute an acceptable simulation of its overall meaning. Adopting Costello's (2004) position, acceptability arises from three constraints, namely, diagnosticity, plausibility and informativeness, by which the listener shares negotiable meanings of a concept as intended by the speaker. Both are simultaneously active in the communicative act.

Situated simulations seem to be modulated by sufficiency of information and processing time (Louwerse and Jeuniaux, 2008). In this experiment, the time that the subject takes for constructing a situated simulation of the meaning of multi-word conceptual combinations with abstract meaning will be calculated. In short, compositionality in this experiment was introduced as a factor for the understanding of the representation and interpretation of abstract concepts from a compositional perspective.

The mechanism of constructing a mental simulation requires the individual to initiate and maintain situated re-enactment of the sensory-motor content derived from previous experiences as cued by the linguistic content (Barsalou, 1999; Glenberg and Kaschak, 2002). On the basis of this, detailed inferences are construed around the situational content of utterances (Bergen, 2007). According to Barsalou's proposition, then, how do we understand lexical concepts which encode reference to non-physical entities for which none or very scarce physical properties can be fetched in the environment with the available senses?

The other issue is that sensory-motor information constitutes a considerable part of our belief-systems. In other words, what we see is what we believe in. The plausibility of any meaning is governed by how far it matches our beliefs. It is intuitively implausible that "an elephant could fly". Then, how do we capture those references with our mind even if they do not meet the plausibility condition imposed by our belief-systems, as in cases like "ghost hunter"? In what way could compositionality contribute to enhancing the semantic resolution of such concepts? How do we solve the clash between plausibility and acceptability in the case of figurative language, i.e., "I catch your point".

At the level of the informational content of combinations, the components' semantic contributions to the compositional units need to form acceptable interpretations (optimal informational characterization) as the producer intends them to be, otherwise the producer shouldn't have chosen them in the first place. Integration and interpretation require reflection on how semantically compatible the components are to form optimal informational characterization. This should involve the assessment of two variables: how compatible the simulation to the speaker's communicative intent (informativeness) as well as how compatible the outcome meaning of the combination would be with belief-systems or what is often referred to as "plausibility".

The plausibility rating relates to the subjects beliefs and judgment as whether the meaning of a combination is conceived congruent with one's beliefs or not? Or whether or not the result is a good match to what they have experienced in the past, either directly or vicariously? Plausibility judgment is used by individuals as an efficient cognitive shortcut as a less costly alternative than direct retrieval from long-term memory (Reder, Wible, & Martin, 1986) and avoids extra effort for tedious compatibility processing.

Here, we search for an experimentally plausible foundation for the effect of human belief-systems on language processing. We seek to characterize the role that human beliefs system plays in the understanding of abstract concepts.

Although lexical concept might facilitate access to a potentially large number of associations which comprises its semantic potential; however, only a small subset of knowledge structures is typically activated at a threshold level during the interpretation of "God word". The interpretation of this combination arises at the substrate of the conceptual system by referring to the theoretical constructs, cognitive models. The two components prompt for ordered and principled simulations. The interpretation is primarily constrained by the unpacking and integration of linguistic content first. The word in "God's word" designates two different sorts of sensory experience, "acoustic entity" and "Jesus". Both provides a schematic meaning that can be instantiated by the expression "word", which can be simulated for more optimal characterisation. The cognitive models to which a lexical concept "word" facilitates access are not simple; rather, a network of directly and indirectly accessed cognitive models.

It has been claimed that situated and embodied information could only obtain deliberate activation when language is deeply processed (Louwerse and Jeuniaux, 2008). This endorses Barsalou's, (1999) distinction between shallow vs. deep levels of processing[22]. Deep processing is characterized by more deliberate processing that involves higher hierarchy of knowledge structures. On the other hand, shallow processing involves the activation of less detailed knowledge structures. In Evans' LCCM terms, lexical concepts might give access to a limited number of primary cognitive models with no

---

[22] See also Good-Enough processing approach of language processing, as proposed by Ferreira et al. (2002, 2009)

access to the higher level secondary cognitive models. Access to the secondary cognitive models is a characteristic of deep processing.

The secondary cognitive model profile of a lexical concept, to the best of my knowledge, relates to knowledge that is not directly associated with a given lexical concept, as it does not form part of a lexical concept's access site. As such, the secondary cognitive model profile constitutes a very large semantic potential available for search. The *Principle of Ordered Search* ensures that the search in the secondary cognitive model profile proceeds in a coherent way. That is, the secondary cognitive models are searched to facilitate a match based on their conceptual coherence (Ibid: 626)

According to LCCM, multi-word combinations which give access to implausible cognitive models at one level (primary cognitive models) may still be rated as acceptable as they result in plausibility at higher level (secondary cognitive models), for instance "you lost me here". Plausibility at the secondary cognitive models gives rise to metaphoricity where interpretation arises after conceptual implausibility in the primary cognitive model profiles subject to matching. The conceptual implausibility arises from zero to insufficient cost-demand flow between the components which licences ordered searches at the secondary cognitive models to achieve schematic coherence and bypass zero or insufficient flow at the primary cognitive models. The ordered search is imposed by the integration of two lexical concepts due to a demand from one side to the cost from the other in a process of matching and fusion for more optimal interpretation. The *Minimum Cost Flow* (MCF) paradigm by Lin (1999) is quite helpful to visually illustrate Cost Flow: direction and weight of the demand-supply profile assigned to each component in the multi-word combination. The search is a voyage in search for conceptual coherence (The *Principle of Conceptual Coherence*). Virtually, this will explain the weight of activation routes and semantic distance among the primary and secondary cognitive models underlying the combined abstract concepts.

The Processing time is only one way to figure out the ordered search into the primary and secondary cognitive models for acceptability. It is reasonable to question the time for processing (Response Time "RT") of both concrete and abstract concepts (The car is running) vs. (Time is running).

Abstract concepts are a special case where the qualitative and quantitive balance between cost-demand seems to be unique as most of them invoke less or at least indirectly associated sensory-motor information. It is often taken to involve the conceptualisation of one concept in terms of another according to some relations which can bind the two (cost-demand relation we suggest here). In a combination such as "God's word", each of the two lexical concepts is characteristically associated with multiple association areas in the conceptual space. The RT, that the processing takes, is the time spent on the search and test of such multiple association areas for more acceptable meaning. This is contingent on the nature of the processing of the linguistic representations and the nature of events evoked by them (e.g., the processing of the multiple association areas of [WORD] upon reading/hearing the phonological vehicle).

7.3. The Hypotheses

We can simplify this discussion of the contribution of compositional complexity to chiefly enhancing referential and conceptual transparency, more particularly enhancing informational optimality and plausibility, and open it to empirical test by summarizing these arguments in terms of three specific hypotheses:

i. The compositional complexity correlates positively with informational optimality of abstract concepts during the process of representation and interpretations.
ii. The compositional complexity correlates positively with referential and conceptual plausibility of abstract concepts during the process of representation and interpretations.
iii. Informational optimality of the compositional unit correlates positively with the plausibility of its meaning.

7.4. Paradigm: lexical decisions

The lexical decision task is a commonly used task in psycholinguistics. It is frequently employed to study how knowledge is retrieved during the processing of lexical items (e.g., Rueckl & Aicher, 2008) and directly taps the process of lexical access, lexical decision responses and acceptability judgments. A basic assumption of the lexical decision task is that the time and accuracy of response to a stimulus requires access to a corresponding mental representation of that stimulus (both linguistic and non-linguistic). The composition is one of the factors that appears to affect lexical decision responses and could enhance meaning judgments. This chapter provides evidence in a lexical decision task that the representation and interpretation of the abstract concepts are dependent on compositional complexity of the symbolic units that the subjects use or interpret in the process of meaning construction of abstract thoughts (Bleasdale, 1987; Whaley, 1978). In a series of experiments, Klein and Murphy (2001, 2002) used a sense-making judgement on polysemous words where individuals were instructed to judge whether given combinations (words preceded by a modifier) make sense, by pressing one of two buttons.

7.4.1. The Stimuli

In this task, 288 multi-word combinations (2-word, 4-word and 6 word utterances) were extracted from 68 online articles from http://www.kitabat.com/ar/. The selection of the sentences was based on finding the words that match the three word groups in these articles. The task has two sub-tasks embedded in it, as each quad-condition is presented in two pages: one for informational optimality (two utterances) and the other for plausibility judgment (two utterances). 288 words were selected as target lexical concepts, filler words, (144) filler words make up the plausible meaning/implausible meaning, (144) filler words constitute informationally optimal/ informationally non-optimal meaning). The distribution of the utterances according to conditions and reference types is shown in Table (7.1).

This lexical decision task or sensibility task which is based on informational optimality and plausibility semantic matching conditions requires the participants to replace a source lexical concept (underlined within the utterances) with target lexical concept (filler words) given between parentheses, e.g.,

7.1:

بنيت <u>اساس</u> وجودها على القمع والاضطهاد والاستبداد[23]

1. Their existence <u>foundation</u> (base)was built on suppression and tyranny
   ☐(Plausible)   ☐(Implausible)
2. Their existence <u>foundation</u> (cosmetic)was built on suppression and tyranny
   ☐(Plausible)   ☐(Implausible)
3. Their existence <u>foundation</u> (mean) was built on suppression and tyranny
   ☐(Informationally Optimal)   (Informationally Non-optimal)
4. Their existence <u>foundation</u> (steel) was built on suppression and tyranny
   ☐(Informationally Optimal)   ☐(Informationally Non-optimal)

The aim of the experiment was to conclude whether the symbolic compositional complexity (compositionality) of the target stimuli affects the semantic judgment and processing time of concrete and abstract events. Participants read utterances with the underlined lexical concept encoding specific concrete and abstract references on laptop screen. They were to judge, by ticking ☒plausible, ☐implausible in the plausibility pages, and ☒ informationally optimal or ☐non-informationally optimal in the pages of informational optimality. Such judgments were conditioned by replacing the *target lexical concepts* between brackets with the underlined source lexical concept. The *source lexical concepts*, which give access to abstract or concrete knowledge, were always embedded within combinations.

The participants' task was to make sensibility judgements on the meaning of the target lexical concepts stimuli in the presence of multi-word combinations with different symbolic complexity. Such symbolic complexity is manifested by the recruitment of 2-word combination, e.g. golden part, 4-word

[23] http://www.kitabat.com/index.html?mod=page&author=2183

combination, e.g., golden part of life, and 6-word and more utterances (see Table 7.2). The stimuli were presented in a randomised manner to every participant. The proportion of combinations in the four matching Conditions and the two reference-type conditions was kept fixed throughout each experimental session. To put it differently, every participant was exposed to an equal number of utterance-lengths (2-word, 4-word and 6-word). This was to avoid block effects (list effects). None of the referents of the source lexical concepts was ambiguous in terms of abstractness.

Subjects were first offered an instruction screen. They were instructed to read the utterances on the screen and their attention was brought to the underlined lexical concept and the target lexical concept in parentheses. They were required to tick "☒" one of the options to judge the meaning arising from replacing the target lexical concept between brackets with the source, underlined source lexical concept, what kind of meaning results. They pressed the SPACE key to move to the following test item. They pressed the "FINISH" button or when they ended the test session.

Judgment Type		Reference Type					
		2-word utterance		4-word utterance		6-word utterance	
		Denotational Reference	Cognitive Reference	Denotational Reference	Cognitive Reference	Denotational Reference	Cognitive Reference
Plausibility condition	Conceptually Plausible	12	12	12	12	12	12
	Conceptually Implausible	12	12	12	12	12	12
Informational Optimality	Informationally optimal	12	12	12	12	12	12
	Informationally Non-optimal	12	12	12	12	12	12
Total		48	48	48	48	48	48

Table 7.1: The distribution of stimuli according to semantic conditions

Combinations symbolic complexity	Examples
2-word combination	اساس وجودها existence foundation
4-word combination	بني اساس وجودها Their existence foundation (base)was built
8-word combination and more	بني اساس وجودها على القمع والاضطهاد والاستبداد[24] Their existence foundation (base)was built on suppression and tyranny

Table 7.2: a prototype of the stimuli

7.4.2. Participants

63 students from the Basra University, Faculty of Arts, Department of Arabic Language, joined for 20000 ID (£6) bonus (Mean age: 25.5, Age range: 23–36; 22 female and 41 male participants). All participants were native Arabic speakers with adequate computer skills. Subjects were informed that they were taking part in a study in which tested how words meaning could match or mismatch according to the overall meaning of the utterance was. Each subject was trial tested individually in one session, lasting approximately 10 minutes, to get them acquainted with the procedure and objectives of the experiment. A trial session consists of four utterances and two target lexical concepts with (plausible meanings, implausible meanings, informationally optimal and informationally non-optimal) conditions. The sentence appeared on the right of the computer screen with the match condition on the left. The stimuli were shown one after the other with a fixation plus appearing between items for 1000 Msec. The target lexical concepts were presented visually and continuously until the subject responded by ticking and NEXT. There was no limit on response time, i.e., subjects could spend as much time processing the meaning and making their lexical decision as they wished: however, subjects

[24] http://www.kitabat.com/index.html?mod=page&author=2183

were asked to respond to the task as quickly as possible. The trial items were left out from the analyses as were the incorrect trials.

7.4.3. Results and discussions

The claim of the simulation theory was that conceptualizers construct multimodal simulations: from the content of the external as well as the internal experiences, cued by language use. Based on the situational information that the utterances afford, these simulations and situational models evolve over time (Barsalou, 1999; Bergen, 2007).What was not acceptable one day, e.g., "video-conferencing", a model of people attending virtual conference, becomes part of our knowledge base as totally plausible.

The Mean RT was first examined in a subject-based 2*4 mixed ANOVA model with reference-type (two levels) and semantic condition (four levels: plausibility, implausibility, informational optimality and informational non-optimality) as within-individuals factors. The figures showed a significant effect of reference Type, $F(1, 288)= 93.154$, $p < 0.001$ and a significant main effect of semantic Condition, $F (1,282)= 76.584$, $p <0.001$. The interaction (2-reference type* 4-semantic condition) was also significant, $F(1.282) = 69.125$, $p < 0.005$.

To investigate the two sub-sets individually, univariate analyses were implemented to quiz the distinction between the lexical concept encoding denotational reference-type and those with cognitive reference-type in terms of the 4 semantic conditions. For the sub-sample of the lexical concept with denotational reference-type, the main effect of plausibility condition showed higher significance, $F(1.142) = 68.971$, $p = 0.001$, than the abstract subsample. On the other hand, in the sub-sample of lexical concepts with cognitive reference-type, the results showed a less significant effect of plausibility conditions, $F(2, 146) = 12.952)$, $p = 0.005$. Prominently, the plausibility vs. implausibility comparisons did not show remarkably significant differences in the contexts of lexical concepts with cognitive reference-type. The informational optimality comparison showed high significance ($p =0.026$).

Conversely, the informational optimality conditions yielded higher significance in the case of abstract concepts F(4, 73) = 51.874, p = 0.01, compared to no significant effect for concrete concepts F(3, 73) = 0.943, p = 0.001. The significant slow-down in processing abstract concepts under the informational optimality conditions confirms the individual's need for longer time to involve more relational information, frames and scenarios to attain more optimal conceptions. Implausibility condition seems to be of less significance for conceptualizers of non-physical entities, it could impede them from making faster judgment as it infringe their deeply-rooted belief-systems about how their world ought to be. For instance, حصان طائر Flying Horse" took longer RT than ملك يمشي, "walking angel" (see Fig. 6.17).

Incongruous with our primary assumptions, the subjects' responses to sensibility judgments on stimuli indexing cognitive reference-type showed insignificant results in correlation with plausibility conditions (hypothesis iii). The interpretation of such results can be attributed to the high weight (strength) of the activation of linguistic content that outperformed the activation of more rich and complex sensory-motor information. Language uses that represent abstract concepts tend to be highly lexicalized (fossilized) over time, just like "big deal" which does not activate the sensory-motor information underlying the concepts "BIG" or "DEAL".

With respect to abstract concepts, our results showed that RT is longer for metaphorical combinations, such as 'red line". The scenario need not be simulated along with the verbal stimuli, as event described by the phrase is irrelevant to the literal meaning. In other words, the activation of higher secondary cognitive models is required for conflict resolution. This entails longer processing time to maintain more optimal informational characterization. The mesh of the linguistic contents seems to play a more fundamental role than the more basic perceptual information denoted by the phrase during the simulation. This is obviously incongruent with the strong embodiment approach (Lakoff and Johnson, 1980, 1999) where informationally optimal conception is assumed to be inescapably taking place beyond the automatically activated perceptual symbols of "red" and "line". In the case of the metaphorical representation of abstract meanings, there is a shift from comparison processes that are predominant in simulating concrete meaning to introspection as the brain will directly register a conceptual conflict that needs to be resolved.

In regard to the compositionality condition, a further model was developed using repeated-measures one-way ANOVAs on the stimuli: the subsamples of lexical concepts with denotational and cognitive reference-type as far as the effect of compositionality condition on the judgment of plausibility and informational optimality conditions.

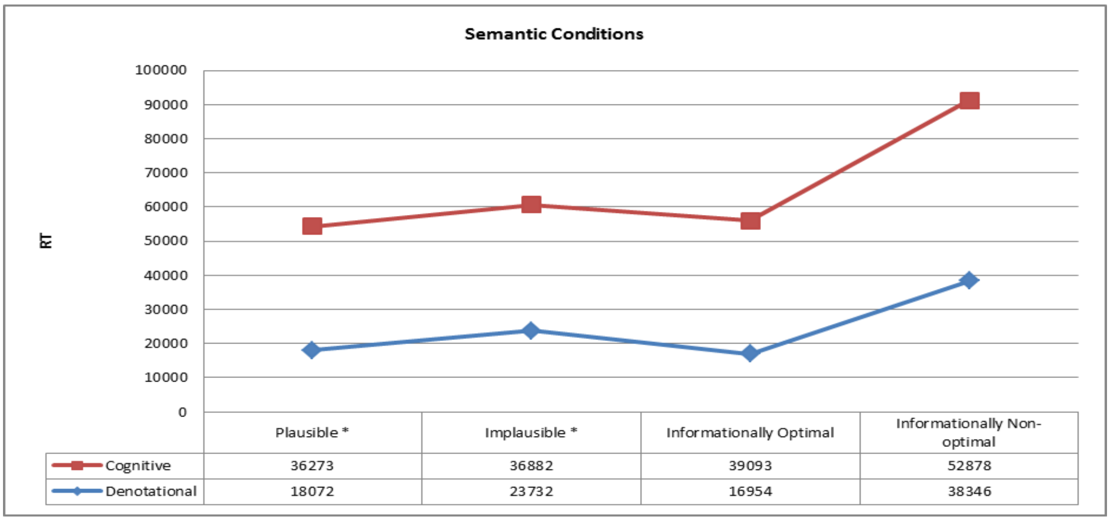


Figure 7.1: the correlation between RT of reference-type and Semantic Conditions judgment

With the concrete subsample, the correlation between RT and plausibility condition at the level of 2-word (utterance length) was remarkably significant in comparison to higher compositionality levels in the hierarchy (4 words and 8-words levels), $F=2.619$, $p< 0.056$. Most importantly, the correlation between the effect of compositionality at the level of 2-word combinations in terms of plausibility condition showed marginal significance, $F=2.90$, $p <0.319$. However, there was a minor difference between RT of the lexical concepts combinations in the plausible and the implausible conditions ($p = 0.946$). This means that symbolic complexity of units plays a more significant role in deciding the RT of plausibility judgements.

In a nutshell, from the results in the sub-sample of lexical concepts with denotational reference, the mismatch between the processed meaning and the previously acquired belief-systems facilitates inhibition process within shorter RT. However, for the informationally non-optimal meaning, inhibition takes place after a longer time of processing, F=38.12, p <0.005.

The tests revealed that the comparison of the informational optimality (Mean: 19760, SD: 169.5) to the informational non-optimality (Mean: 10710 msec, SD: 143.84) was noticeably significant (F= 11.6215, p < 0.005). This implicates that the inhibition processing during the processing of the informationally non-optimal meanings requires a longer time relative to informational optimality condition. Lexical concepts combinations with unsuccessful interpretations distract the individual's mind irrespective of the plausibility of the stimulus. The RT in the informational optimality condition (Mean: 12650 msec, SD: 316.12) was shorter relative to processing in the informationally non-optimal condition (Mean: 31448 msec, SD: 179.43). This may implicate that primarily non-optimal interpretations could initiate multiple search attempts as a mental strategy for seeking minimal similarity or coherence at higher level cognitive models (secondary cognitive models).

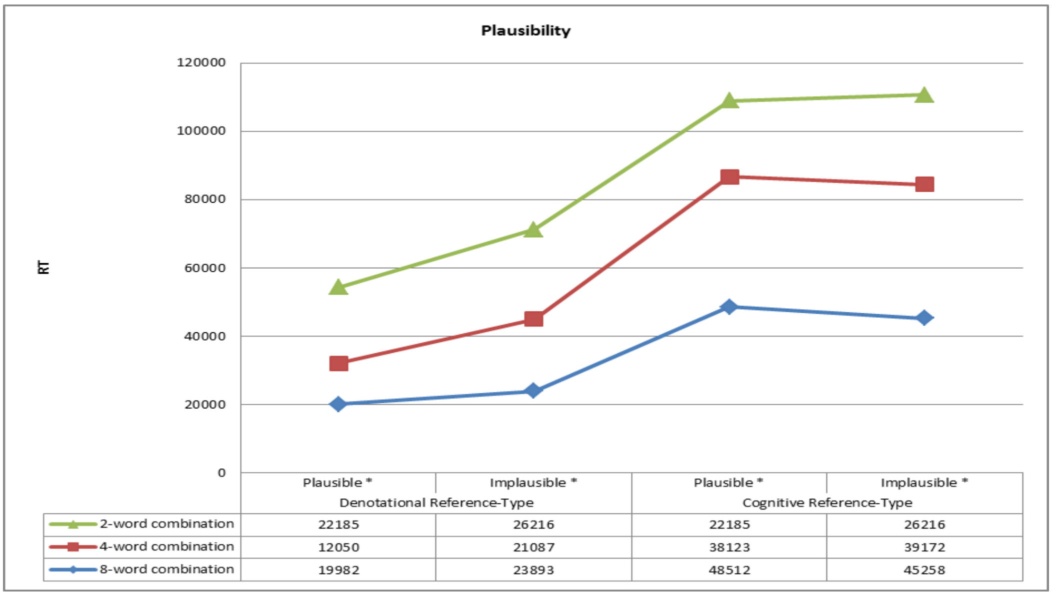
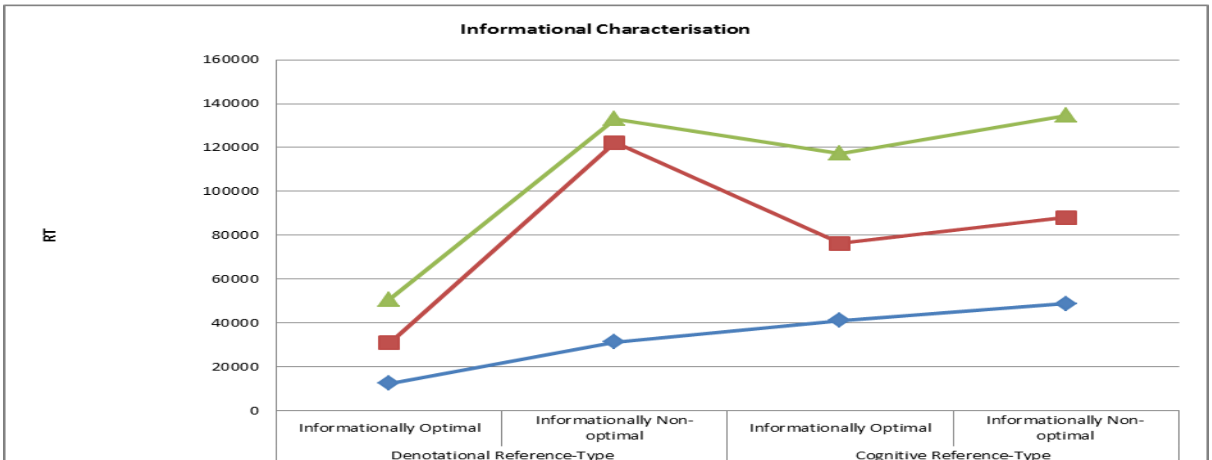


Figure 7.2: The Correlation of reference-type and plausibility Semantic Conditions

For the abstract sub-samples, a significant correlation in respect to RT where they take longer to process than the concrete sub-set. Compared to 2-word level compositionality in relation to plausibility condition, there was a less significant effect at the region of 4-word and 8-word level, F= 2.898, p < 0.002), and F=2.251, p < 0.005, respectively.

The comparisons of informational optimality – informational optimal (p = 0.008) and the non-optimal (p = 0.021) were marginally significant: For 2-word, under the informational optimality condition (Mean: 35189 msec), the individuals took almost similar processing time to 4-word and 8-word utterances (Mean: 40890 msec) and (Mean 41201) respectively.

With reference to informational non-optimality, the two reference-types did not appear significantly divergent (Mean: 44346 msec, SD: 33976.23) and (Mean: 44878msec, SD: 4169.43) respectively. So, the inhibitory effect on all compositionality complexity levels caused by informational non-optimality seemed to have posed a fundamental impact on the duration of processing especially in the regions of the 2-word and 4-word.



	Denotational Reference-Type: Informationally Optimal	Denotational Reference-Type: Informationally Non-optimal	Cognitive Reference-Type: Informationally Optimal	Cognitive Reference-Type: Informationally Non-optimal
2-word combination	19760	10710	40890	46510
4-word combination	18454	90880	35189	39155
8-word combination	12650	31448	41201	48969

Fig 7.3: The Correlation of reference-type and Informational optimality Semantic Conditions

7.5. General Discussion

In this task, the main emphasis was to underline the correlation between compositionality and the semantic conditions of plausibility and informativeness in determining the content of abstract concepts. It is also concerned with the contribution of human belief-systems and encyclopaedic knowledge in the principled selection and fusion of linguistic and multimodal contents during making the interpretation.

The fundamental outcome of this experiment is that the length of processing time in relation to the semantic conditions, for the sub-sets at all compositionality levels, supports the conclusion that compositionality levels do steer processing depth for further searches and matching processes until a match/mismatch and successful/unsuccessful interpretation (informational characterization) is arrived at by the individual. Inhibition effect is experienced faster under plausibility condition than informational optimality condition.

The inhibition implicates that the semantic conditions guide lexical processing by the activation of semantic categories, frames and cognitive models (primary and secondary) allowing further goal-motivated searches, matching and alignment for more coherent and compatible simulations. Such simulations are cued by our previously acquired belief-systems. Consistent with Evans' distinction of primary/secondary cognitive models, the results also revealed that the processing time depends on the hierarchy of knowledge structure, activation routes and principled searches in more distributed access sites

It has been found that the complexity of the linguistic structure (2-word, 4-word and 6-word) contributes significantly to the interpretation of abstract concepts. The integration of the linguistic content from two or more lexical concepts via the multimodal content they afford access to, help to situate and ground the meaning of the lexical concept with abstract meaning in more perceptual and relational content. This gives higher resolution to their content either by making structural alignment and matching to the previously acquired experiences, reducing clashes of resolution or endorsing zero matches (inhibition). However, all of the above require primary simulations and RT.

In the examples shown in (table 7.3), the rating percentage and RT varies according to the semantic conditions: قيمة الدينار (Iraqi Dinar value), it was rated higher and faster قيمة مالية (money value), in terms of both judgments: plausibility and informational optimality conditions due to their reference-type, as the participants seemed to recall directly the image and scenarios for the currency (Dinar) than for the more abstract concept مال (Money). They even found it informationally sufficient to construct simulation of the referent as it stands in the outside world, especially with the knowledge accessed by the lexical concept دينار عراقي (Iraqi). However, the subjects remarkably converged and took longer time to judge whether the expression would be adequate (relatively informationally non-optimal) to construct sensible simulation. Unlike lexical concept دينار (Dinar), the lexical concept قيمة (value) seemed to impose more demand for higher resolution for itself than the cost (attributes) it adds to مال (money). In قيم الطفل الصغير (child's value), immediate inhibitory effects emerged, whereby RTs were faster, as the conceptualisation of (value) lacks the minimum informational characterisation requirement during the match to the common beliefs as children are too young to develop any sort of values.

Even though the metaphorical expressions, "اذن اليقظة" (waking ears) and اذن الاحلام (dream ears), had a considerable extent of resolution clash as dreams and waking do not normally have ears , the conceptualisation of achieved higher percentage of plausibility and informational characterisation, 99.2% and 93.89% respectively. However, the RT for "اذن اليقظة" (waking ears) has shown to be longer when the phrase introduced alone, but it took the participants shorter RT when it was presented as a part of longer utterance. قد تسمع في اذن الاحلام اكثر مما تسمعه في اذن اليقظة (You may hear with your dreaming ears more than with waking ears). In terms of Evans' conceptions of metaphorical meaning, it is very plausible to explain that although the apparent clash takes place at the level of the more general and modal-specific knowledge structure (primary cognitive models) that the lexical concepts, (ears and waking) and (ears and dreams), give access to, the lack of coherence necessitated executing ordered searches in the memory for any frames and scenarios that could incorporate the combination. More than one activation route could be initiated in the form of highly distributed conceptual networks of access sites, to even more detailed and rich bodies of knowledge structure (secondary cognitive models) to find at least the minimum coherence and similarities. This justifies the duration that the responses take.

Another observation is that informational optimality judgments took longer times than plausibility judgments. This is consistent with the view that plausibility judgment is used by individuals as a less costly and efficient cognitive shortcut for matching and alignment by resorting to the activation of more entrenched encyclopaedic knowledge as an alternative to more detailed retrieval from the higher level of long-term memory (Lemaire & Fayol, 1995; Reder, Wible, & Martin, 1986).

Example	Plausibility	Implausible	Informationally Optimal	Informationally Non-optimal
دينار عراقي (Iraqi Dinar)	99.21% 745452.36	0.71% 892654.12	98.74% 108021.62	1.26% 954128.28
قيمة مالية (money value)	87.56% 165845.48	12.44% 212202.1	71.81% 232102.66	28.19% 183521.09
قيم الطفل الصغير (Values of small child)	5.11% 176653.69	94.89 105462.22	2.25% 107858.56	97.75% 222254.81
اذن اليقظة (waking ear)	71.82% 296612.34	20.18% 319856.10	61% 375552.42	40% 410096.38
قد تسمع في اذن الاحلام اكثر مما تسمعه في اذن اليقظة[25] (You may hear with your dreaming ears more than with waking ears)	99.2% 169232.0	0.80% 223387.51	93.89% 259969.37	6.11% 312887.44

[25] This stimulus were taken from http://www.kitabat.com/index.html?mod=page&author=255.

Table 7.3: Examples of the role of compositionality

Chapter 8
Abstract Concepts: necessity and directness Conditions

8.1. Introduction

The fourth experiment, as will be discussed in this chapter, sought to detach the verbal from the nonverbal representation of concepts. Body movements and postures represent one of the basic forms of representation of human conceptual structures (Tomasino, Lotto, Sarlo, Civai, Rumiati & Rumiati, 2013).

Cognitive metaphor theorists and simulations proponents assume that concepts are embodied in the sense that they are grounded in our bodily and sensory-motor knowledge. This could take either a radical version of the embodiment (Kövecses, 2002; Lakoff and Johnson, 1980, 1999) which adopts the position that language understanding is directly grounded in bodily and situated sensory-motor experiences where individuals necessarily resort to for the grounding effect. Such situated sensory-motor experiences are automatically activated during the understanding of language use. On the other end, the weaker thesis of embodiment view claims that our bodily and sensory-motor knowledge is insufficient (necessity condition) and contribute indirectly (directness condition) to the semantic profile of the simulated meanings (Meteyard & Vigliocco, 2008).

According to Meteyard & Vigliocco (2008), sensory-motor activations are distinct from the activation of linguistic content. However, the former is fundamental to fully grounding the latter. One level of meaning incorporates implicit sensory-motor information invoked by the word, while the other level of meaning is decided by the lexico-semantic information imposed by language use. The two “meanings” are represented in two distinct, but interacting systems in the brain. Evans (2009) offers a systematic distinction between the two systems and principled interface between the two.

Metaphorical structures are one way of linking the two systems, especially in the case of abstract thoughts, where information from the source domain (concrete) is mapped onto the target domain (abstract). LCCM offers a realistic account of figurative language understanding, by making available “a programmatic account” which could explain the way conceptual metaphors are integrated with linguistic knowledge. It elaborates the way in which language configures and interfaces with the activation of non-linguistic knowledge structures. Evans requires “an account that is concerned with the role of linguistic prompts and linguistic processes of semantic composition in figurative language understanding.” (2010: 603)

This chapter is an attempt to test the applicability of the embodied thesis on the representation and interpretation of abstract concepts. It addresses the question of whether the embodied non-verbal representation is necessary and sufficient to such understanding or not and whether such representations constitute inherent parts of the content of abstract concepts and directly linked to them.

Under normal representation and interpreting conditions, individuals do not need a deep, complex representation of rather abstract thoughts, but they simply resort to more concrete forms of conceptual structures sharing to be incorporated in the process of meaning construction. Such intersubjective form can be defined as a shallow or underspecified representation of explicitly negotiated conceptual structures, yet is often perfectly acceptable. There is undeniable supporting evidence of traces of the individuals' body posture/movement which supplement other modes of representations (Sebanz, Bekkering & Knoblich, 2006).

Semiotics and embodied cognition theories have explicitly stated in favour of the integration of the body posture/movement into conceptual models. In this way, conceptual structures can be in part or entirely represented by the underlying body-based mental structure and explicitly by body postures and movements. Individuals process such body postures and movements for which they reactivate distributed knowledge structures derived from the multiple perceptual and motor modalities that the brain has previously abstracted from the interaction of the body and its battery of senses with the world. Embodied framework predicts that such abstracted knowledge structures are routinely retrieved during the recognition and processing of body postures and movements (Anquetil & Jeannerod 2007).

The design in this chapter represents an attempt to bring forth language use (non-verbal representation in this case) into a more real-world intersubjective context of representing and interpreting of human abstract concepts. This brings forth the issue of ecological cues in meaning construction research. The design employs single words or higher compositional complexity as experimental stimuli which allows meaning construction to be experienced in the real world. Dialogue Protocols task is used to achieve this end.

8.2. Hypotheses

i. The sufficiency of perceptual and embodied representational content correlates negatively with the degree of abstractness of concepts,
ii. The perceptual and embodied representational is insufficient to be a constitutive content for abstract concepts,
iii. The perceptual and embodied representational content are indirectly associated with the inherent content of abstract concepts, and
iv. The facilitative function of the perceptual and embodied representational content correlates positively with their structures' compositional complexity.

8.3. Task Design

Dialogue protocol is only one mode of social interaction and a fundamental trait of human beings. It involves transferring a mental conceptual contents and intentional needs and gets the participants' minds connected. Gestural representations, however, constitute the frontline for the semantic interpretation of the non-verbal representations.

In this task, we tweaked the social game "Charades" to investigate the embodied basis of abstract concepts' content and structure by having individuals produce and interpret meaningful body gestures and postures while their RT and accuracy are being measured using video-taping technique. The charade game is played one-to-many. Charades were clearly controlled by strict rules, where, one individual must act out a written verbal stimulus while the other must make guesses about the meaning of such stimulus. Words that make up a 'clue phrase' are given to the actor on flashcards to represent non-verbally (ex: hands expressions and body language) to a group of individuals facing the actor. The audience were allowed to interpret the actor's non-verbal representations verbally, guessing the words and phrases aloud. However, the audience's non-verbal representations were also monitored.

8.3.1. Dialogue Protocols

The general purpose of the dialogue protocols as a task is primarily to explore the representation al interpretation of concepts in intersubjective social contexts in which more than one individual was involved. It offers a more natural means to address the intersubjective aspect of conceptualising the joint understanding of the content of abstract thoughts. In our case, One-to-Many dialogue protocols were used, where a volunteered subject was instructed to share his conceptualisations with others (Gentilucci, Gianelli, Campione & Ferri, 2012; Quaeghebeur, 2012; Sambre, 2012).

This task is being twisted a bit by asking one party of the dialogue protocol to use their body language only while the other parties are allowed to give feedbacks and interact using both verbal and non-verbal representations. The charade game is a unique task to make explicit the intersubjective effect of the meaning construction of abstract thoughts and most importantly the embodied aspects of such thoughts.

Constraining the channel of representation of the first party to the nonverbal channel will make them obliged to externalize the embodied aspects and resort to their purely embodied mental representations and make them informational enough to achieve mutual understanding. The other part will compensate for this restriction by giving more feedback at the verbal level. The audience's nonverbal representations will be a very interesting aspect of such interaction as they are optional rather than compulsory. Participants will sometimes lack a shared consensus on their subjective conceptualisation which may force them to give arguments, to clarify steps of their thinking processes.

8.3.2. Participants

24 participants who volunteered for the actor role and 18 preferred the guessing role in this task. The participants freely consented to participating in the study by signing an informed consent. The actors will be addressed as

ACT-1, ACT-2, ACT-3, etc., and Guessers will be addressed as GUS-1, GUS-2, GUS-3, etc. 4 hours of data were collected, containing relevant gestures. The analysis of how the participants' gestural usage successfully represents concrete and abstract concepts highlights the effectiveness (necessity and directness) of non-verbal representations. The moment the audience makes a successful guess, we call this point an "informativeness point". The audio-visual data was examined at the micro-level, frame-by-frame analysis of the audio-visual episodes.

The lexical concepts, which the volunteered individual needed to represent non-verbally, were given as single words (1-word) or an underlined word as part of 2-word combination, 4-word or 6-word utterances. The individuals were to represent the underlined word only unless the adjacent words would help to make a successful informativeness point.

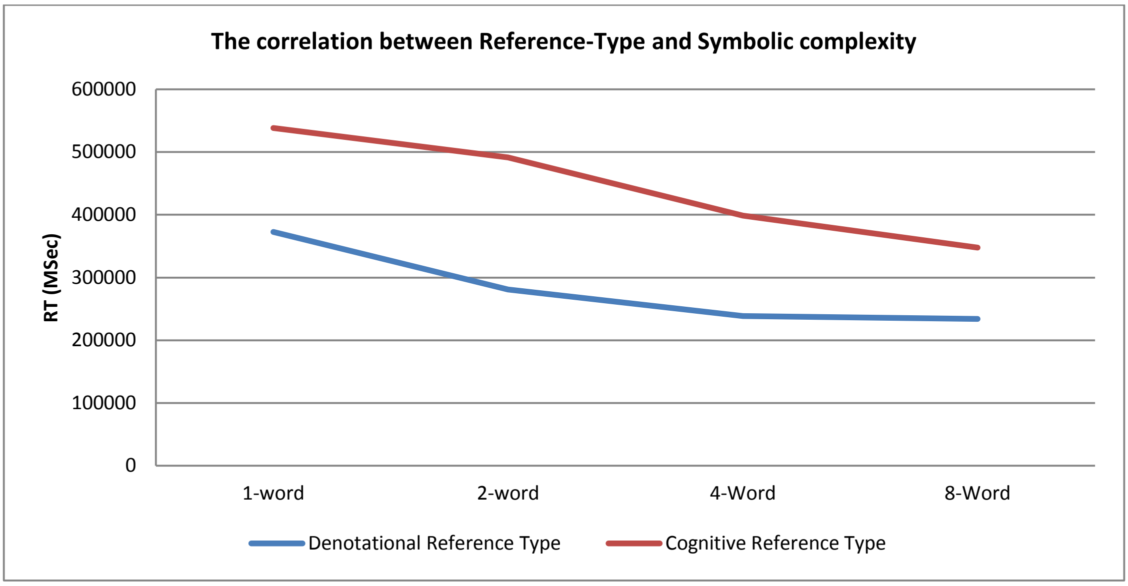
Each volunteering actor was required to represent the content of the flashcards within 10 minutes session and did a maximum of 4 consequent trials for each reference type unless informativeness point is achieved. Each session is dedicated to addressing one Reference Type condition and one Symbolic compositional complexity). The content of the flashcards was distributed as illustrated in Table 8.1:

Reference Type	Symbolic complexity			
	1-word	2-word	4-Word	6-Word
Denotational	12	12	12	12
Cognitive	12	12	12	12

Table 8.1: The distribution of the stimuli on the flashcards

8.4. Results and Discussions

The mean time to target for the two reference-types were as illustrated in Fig 8.1. Feeding the RT data to 2*4 repeated measures ANOVA; the two reference-type factors, (lexical concepts with denotational reference-type and Cognitive Reference Types) and 4 symbolic complexity groups (1-word, 2-word, 4-word and 6-word constructions), the results showed the difference between the two reference-type factors is statistically significant $F(3,80)= 2.375783$ P value <0.07. The variance between the effect of the symbolic complexity groups has shown high significance, $F(3,80)=4.441082869$, P value < 0.006.



8.1: The correlation of stimuli symbolic complexity of nonverbal representation of reference-type.

Primarily, 25 trials were left with unsuccessful "informativeness point" in the case of abstract concepts against 3 trials were not guessed successfully with the expressions in flashcard indexing concrete referents. Informativeness point is used here to refer to when the audience make successful guesses building on the non-verbal representations. This led to the conclusion that non-verbal representations were insufficient for the representation and interpretation of abstract concepts. In terms of RT, the results appeared consistent with our assumption in that, unlike the lexical concepts indexing referents with fetchable physical properties, lexical concepts encoding cognitive reference-type (abstract concepts) take a long time to achieve their informativeness point.

13 trials failed to achieve informativeness point in the first three trials (1-word, and 2-word) but achieved a successful guess in the area of 4-word and 6-word symbolic complexity. The participants first represented non-verbally one of the non-underlined lexical concepts, which lead to a successful guess, then returned to the underlined ones. That helped the audience to make a

successful guess. With "ضمير" (conscience), for instance, the ACT-9 failed to achieve successful trial within 10 minutes, the allowable time. The significant effect of the interaction between the reference-type and symbolic complexity clearly implies that the linguistic context (combinations, phrases and utterances) serve to make situated simulations by adding more contextual cues.

8.5. General Discussion

This experiment illuminates the validity of the assumption that within the area of 1-word symbolic complexity, lexical concepts encoding reference-types vary in the time that the individuals required to achieve informativeness point. The regression analysis of 1-word RT variance in the case of the lexical concepts with denotational reference-type and cognitive reference-type revealed significant difference (F=0.599788075, *P*-value 0.003, R^2 = 0.056584912). The individuals needed the movement of the hands that mimicked the movement of steering wheel in driving act (ACT-2). The wrong guesses weren't many in that case.

By taking the concrete sub-sample alone, out of 48 trials, 45 yielded successful guesses within the allowed 10 minutes for each trial: جزر (carrot) and سقالة (scaffold) and (blog), this means that % 6.25 of the denotational sub-sample was left with no definite guesses, compared to 93.75%. On the other hand, only 23 out of 48 of the lexical concepts with cognitive reference-type (abstract concepts), yielded successful guesses. This means that 52.11 % of the sub-sample of verbal stimuli yielded successful guesses against 47.91% with unsuccessful guesses. This means that non-verbal representations were impoverished and ambiguous enough to represent the content of only slightly more than half of the abstract concepts we used as stimuli.

Through the co-construction of nonverbal representations, together the volunteered participant and the audience reached mutual consensus on the informativeness points and more successful interpretation of the lexical concepts with denotational reference. It seemed that they were easier to represent nonverbally with a high percentage of successful guesses. To the best of our understanding, even though a high percentage was achieved; embodied and situated non-verbal representations proved significantly insufficient in their content for the representation and interpretation of abstract concepts, especially when failure rate is compared against the size of the stimuli used in this task. 3 failed trials out of 48 means that out of 1000 stimuli items 62 could be failed trials and this rate increases when considering the total number of a given language lexicon.

On the other hand, 23 out of 48 means 479 out of 1000 lexical concepts with cognitive reference could be a failed trial. This reflects the variable necessity of nonverbal representations to the understanding of concept type. But, how direct is such representation-type to their understanding?

Let's take, for instance, ACT-11 who was handed a flashcard with the lexical concept "carrot" written on it.

Figure 8.2: ACT-11 made a gesture of the size of the referent "carrot" with left hand index finger close to the body and the right hand index finger shifting away to represent a prototype of carrot size

ACT-11 struggled with non-verbally representing the meaning of "carrot", despite producing a range of hand gestures such as the size of the referent (Figure 8.2). Even though the action of biting was acted successfully, with guess coming from the audience as follows: eating, biting, bread, chocolate bar,... , etc, no informativeness point was achieved on the item. But when ACT-11 made the very interesting gestural representation of two parallel index fingers on his head, followed by enacting biting action, the right guess came about. The representation of a rabbit came as an indirect representation (secondary cognitive model) to make sense of the primary cognitive model, biting a carrot. In short, even though, a carrot has very characteristic physical features, embodied and situated non-verbal simulations were impoverished enough to give multitude of wrong guesses. This underlines the contribution of the linguistic content in tracking reference successfully, giving rise to informational characterization and conception.

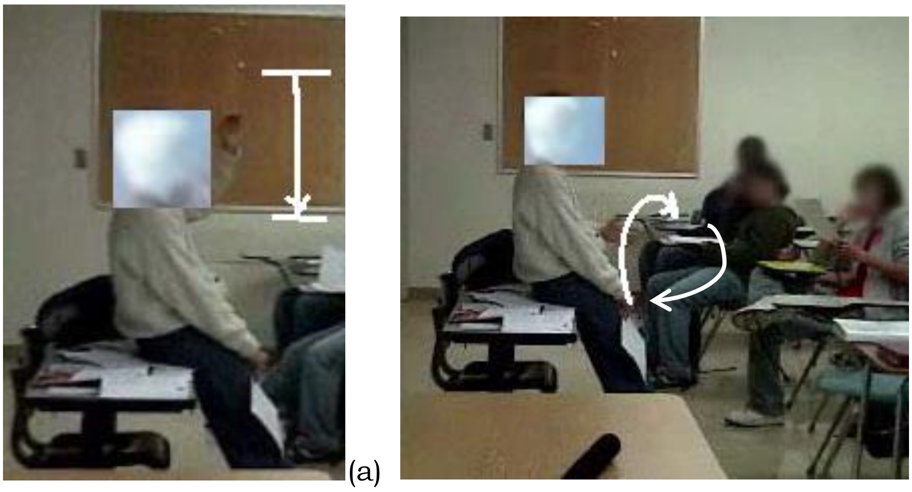
One other interesting observation, which emerged during the task, was ACT's-2 attempts to represent "heaven", the participant put the left hand above the head, and then performed a curved hand movement above the head. The representation depicted the concept of a roof. It is worth mentioning here that the conception of Arabic language native speakers for heaven does not equate the meaning of sky. The researcher made an intentional intervention at this point and handed over another flashcard with the word "over". The same individual performed the same hand movement. So, "heaven" and "over" based on the shape of the individual's hand movement, provide similar semantic contribution related to covering sense or occlusion (See Evans 2010). As prepositional lexical concept associated with prepositions, "over", a closed-class form, could only encode linguistic content that does not serve as access sites to conceptual content alone. Yet, the shape of the hand movement ascribed some conceptual content to it which can only be justified by it co-occurrence with other lexical concepts such as "heaven", "roof", and "sky", for instance.

Figure 8.3: ACT2 making a curved left-hand movement over the head

It took ACT-5 62188.10 msec. to nonverbally enact “trust”. Both hands were shifted towards the body and placed them one on the top of the other on the left-hand side of the body (chest), with the head tilted towards the left (figure 8. 4). This was followed by the participant pointing to the audience.
However, such representations gave rise to a number of guesses (abstract concepts), love, care, frustration, and stroke.

Figure 8. 4: ACT-9 puts two hands on the left hand side of the chest then shifts the right hand pointing to the audience.

In the case of “development”, two flashboards were given to ACT-9, “argument development” and “work development”, and different responses were derived. With the first sense, downward-movement gesture to designate the development of a theme in any logical arguments, propositions, premises and conclusion as depicted in the different hand positions of the hand where the top position of the hand represented the preposition or main question (static), the middle position (dynamic movement between two points) and a transition to a third hand position, a static flat hand facing the ground (Figure 8.5 A). The second stimulus was enacted differently, with the hand fingers folded except the index fingers stretched and moving in a spiral shape away from the body to depict progression and future perspective Fig. 8.5 b.



(a) b

Figure 8. 5: Horizontal vs. spiral continuation of development nonverbally represented by ACT-9

To wrap up this discussion, it has become evident at this stage that despite the importance of the nonverbal representation in achieving the communicative intent (intended meaning); yet, they are far too impoverished and insufficient to meet the need for informativeness and intersubjectivity. Given their relatively direct link to the knowledge structures being given access by lexical concepts indexing denotational reference-type, nonverbal representations are insufficient to represent a considerable array of abstract concepts and even concepts which were already categorised as concrete ones. This questions the strong thesis of embodiment and shifts the focus onto the weaker version. This is consistent with LCCM which assumes a fundamental role for the linguistic content in giving access and sanctioning the intended non-linguistic knowledge structures. It also underlines that the vast amount of such role emerges from language use, i.e., the frequency of co-occurrence of a given lexical concept with other lexical concepts. Such co-occurrences take place as according to a principled integration and interpretation.

Chapter 9
Summary and Conclusion

This chapter offers a concise summary of this dissertation by highlighting the research mission that the researcher embarked on, the mission targets, route and results. Furthermore, it mentions several directions for future research. The mission of this work commenced with a very general question about the nature of human concepts. Abstract concepts, such as life, culture, values, truth, etc., represent a special case, simply because they have no physically identified referents in the external world. Yet, humans think, talk and bring them to the table for discussion.

Abstract concepts constitute a core part of human cognition and make humans what they really are. Human beings, unlike the most intelligent animals, are capable of thinking of and talking about highly abstract thought consciously and unconsciously. Often, abstract concepts have been understood in terms of concrete concepts by looking at how fast both concept types can be conceptualized (recalled, remembered, memorized, and integrated). But, not much has been said about what is in them, their content and structures. In fact, still, there were no definite answers about their content and structures.

This dissertation also offers four key assumptions on the nature of abstract concepts. First, it proposes that human concepts can be viewed on a continuum of abstractness rather than a bipolar classification. Second, the embodied and situated knowledge structures associated with abstract concepts are non-constitutive elements that serve a facilitative function for their understanding rather than being an inherent part of their content. Third, the significance of the role language plays in the representation and interpretation of concepts correlates with the compositional complexity of its structures. Last, variance at the within-individuals and between-individuals levels in the representation and interpretation of the content of concepts is bound to the level of concepts' abstractness level.

Apart from the main empirical focus of this work, it starts with some critical theoretical discussions on sets of diverse theoretical issues, dimensions, perspectives and models of the nature of abstract concepts. In three consecutive chapters, very detailed discussions on the definitions and literature reviews were made on the nature of abstract concepts to develop the first argument. The other lines of discussion were made to advance the second argument, i.e., the role of conceptual combinations (compositional complexity) in the representation and interpretation of abstract concepts. The third argument was to frame the two previously outlined arguments within one of the seminal theoretical models within cognitive linguistics. The present dissertation adopts Evans (2009) Lexical Concepts and Cognitive models (LCCM), a seminal model which develops a new perspective on the conceptions of the recent trends of cognitive sciences. The discussions were made to advance the arguments further to justify the need for a quantitive research to support the assumptions that the present work glosses on the content and structures of abstract concepts.

The quantitative study did capture some important generalizations. It showed very clearly that the figures were consistent in the main assumptions about the content and structures of abstract concepts. One clear difficulty in this study is trying to link the quantitative analysis with the qualitative as the latter need an adequately plausible theoretical framework and sets of terms that could explain the above assumptions and relate them the quantitive analysis results.

The goal of the empirical part was to investigate the validity of a number of predictions and test some formulated sets of hypotheses. In Experiment 1, a data sample of 200 words was extracted and used to test the first argument (heterogeneous, gradable and continuous nature of abstract concepts). The individual's subjective responses upon the encounter of the data items were analysed in terms of a number of lexico-semantic features, namely familiarity, imageability, reference-type and verbal encoding. Familiarity reflects whether the participants were familiar with the stimuli to reduce error level for the remaining experiments; words with mean familiarity scores ≤1.63 were excluded. The Imageability task was concerned with the images an item invokes in the mind of the individual. Reference-type was intended to figure out whether the individuals could track a referent for the items in the external world. Verbal encoding task was meant to figure out how easy is it to define the meaning of the item in terms of other words.

In terms of these lexico-semantic features, the results revealed that the relationship between concrete and abstract concepts can be expounded typologically by means of a proposed approximate continuum of abstractness. The spectral cluster analyses in terms of the aforementioned lexico-sematic features present us very clear statistically derived illustration of the continuity of human concepts. The placement of concepts within the proposed groups was made purposefully to gain typologically fine-grained groups for analytical purposes. Such idealisation was motivated by the objective to dissolve the dualism of concepts into concrete and abstract concepts. The results showed that despite their aggregations, a level of gradation and continuity is very clear in terms of all of the above lexico-semantic features.

To elaborate in depth this early conclusion, I have developed an empirical approach which builds on production and interpretation of verbal and nonverbal stimuli as input for statistical models. A linguistically motivated framework was adopted to learn the role of the multimodality specific, linguistic and introspective (relational) knowledge-content in the understanding of abstract concepts.

Experiment 2 investigated the possible content-type associated with the abstract concepts. This has been done by unpacking the verbal encoding task of experiment 1, via introducing the task of features listing and ranking. This experiment has very important methodological implications. One implication is to figure out the hidden layer between the meaning and verbal stimuli. The features were classified according to a systematic encoding scheme (Brain regions), devised by (Cree & McRae, 2003) into the underlying knowledge-types. Second, ranking the generated features according to importance and relevance implies a hierarchy for the content of abstract concepts. The other implication is that it allows underlining the within-individual and between-individuals variation by computing the rank accuracy.

The results illustrate the dominance of particular knowledge-type associated with abstract concepts, i.e., encyclopaedic knowledge-type rather than sensory-motor. It is characteristic of the encyclopaedic knowledge-type that it reflects the diverse associations with other knowledge structures. Together, with the Mode of Acquisition proposed by Wauters, Tellings, Van Bon & Van Haaften (2003), it is very logical to assume that abstract concepts are more likely to be acquired by language use, simply because there are no definite referents in the external world to fetch by our senses. In short this reflects the role of language in the mediation of the content of abstract concepts. The ranking accuracy reflected significant variance at the within-individual and between-individuals levels. This is consistent with our assumption that experiencing abstract thought at a point in time is determined by the kind of linguistic content retrieved at that point of time. Moreover, it signifies the type of linguistic experience of the individual in comparison to others. LCCM underlines the variation during the construction of meaning at both levels, the within-individual and between-individuals. The variation lies at the core of the processes of selection and fusion.

In Experiment 3, we investigated the same questions as in the preceding experiment, but this time with a fine-grained target, i.e., aiming at the correlation between compositionality and two important semantic conditions: informativeness and plausibility in featuring the core of human belief-systems. The availability of information for a successful interpretation of concepts under different levels compositional complexity reflects the underlying judgments on their information characterization. In other words, the subjects utilize a special class of semantic judgments on whether the information that the lexical conceptual units mediate is sufficient to constitute a referentially and conceptually transparent interpretation. The other class of judgments focuses on interpretation's plausibility. This requires a match of the constructed meaning with the knowledge structures which are highly entrenched knowledge structures. This requires a process of matching of the constructed meaning with the previously acquired knowledge structures or what is commonly known as belief-systems. The results revealed a very fundamental role for compositionality in determining how compatible the meaning of a stimulus is with the previously acquired belief-systems and the informativeness of language use.

LCCM marks the difference between the two classes of judgments by designating two types of processes being embedded within the semantic compositionality: integration and interpretation. The integration is intimately related to the informativeness of abstract concepts' meaning while interpretation relates to plausibility. Interpretation seeks a situated reading of the integrated lexical conceptual units. Plausibility is a key component of such reading.

Finally, Experiment 4 was a unique attempt to separate the non-verbal representation from the verbal representations via employing single-channel dialogue protocols technique, the charades. Unlike the previous experimental techniques which addressed the subjective and socio-cultural judgments, this task addresses the underlying intersubjective dynamics of meaning construction where individuals maintain agreement on the communicative intents. However, this time through very highly embodied representations, i.e., nonverbal body representation. The results revealed that the fail rates in the nonverbal representation of both abstract and concrete concepts underline the validity of the "Necessity" and "Directness" conditions. It tests whether the embodied representations are sufficient and directly linked to the content of abstract concepts or not. Such rates made it clear that such representation type is impoverished and could only be linked indirectly to the content of abstract meaning. The other point which this task made was that compositionality facilitates the representation and interpretation of abstract concepts at the subjective and intersubjective levels.

To conclude, the results of this dissertation illustrate the importance of considering a new typological classification of concepts in terms of their abstractness rather than concreteness effect as it is common practice in previous research. Abstractness is conceived in this study as an emergent property of concepts which arises from the complexity of the relational interconnectivity of diverse knowledge-types. Even those concepts which were categorised as concrete, a degree of abstractness is ascribed to their content. The approximate continuum and groups serve as a more convenient approach to the understanding of abstract concepts. Abstract concepts are gradable and assume heterogeneous conceptual content. The results also showed clearly that the compositional nature of language plays an unparalleled role in enunciating the diverse and complex inherent conceptual structures of abstract concepts to achieve referential and conceptual transparency.

These various results in many ways can be interpreted in terms of LCCM model perspective. First of all, the relevance of LCCM embarks on unprecedented systematic and principled dynamics of the interface of the linguistic and conceptual systems, i.e., the unequivocal distinction between the lexical forms (words) and the conceptual forms (concepts). This non-isomorphism of structure draws the roadmap for us to understand human concepts. It could well incorporate the heterogeneity of the content of abstract concepts. Besides, the quantitive findings of this dissertation affirm that semantic compositionality facilitates the acquisition and understanding of such concept type.

Finally, during the undertaking of this work, a number of interesting questions have arisen. They can be projects for further research. I would like to briefly indicate how some could be carried out to advance the understanding of human abstract concept. One interesting research venture is the concept of "cultural models": members of the same socio-cultural background may take their culture and language with them in their conceptualisation and lexicalization of abstract concepts. Definitely, eastern cultural perception of the concepts boyfriend, honour, generosity, martyrdom, etc., differs from western cultures, this can be framed within the differences in their cultural models.

The concept of the embodied representation of abstract concepts can also be affected by culture. In other words, the interaction between embodied experiences and cultural models may assume a cross-cultural variation at the organization of mental structures, the conceptualizations and lexicalizing concepts. Embodiment and culture form a foundation for possible substructures for conceptual patterns (Sinha, 1988, 2005; Sinha and Rodríguez 2008).

Another direction is to study abstract concepts within a particular domain, such as politics, science, religion, etc. This can be done by selecting data from domain-specific texts, episodes, speeches, discussions, etc, (Santos et al. 2011). Station-based tasks whereby a stimulus is presented on screen at controlled timing may not reflect the distinction between deep/shallow modes of conceptual processing as they occur in real life. Real life social interaction may come up with very different effects on the representation and interpretation of abstract concepts at the intersubjective level.

In the middle of the way to this part, it became evident that the representational content and format of concepts such as "*truth, paradigm, coefficient, privacy, etc.*" differ from mental states abstract concepts such as "*fear, pain, love, etc.*" However, more highlights should be allocated to the distinction between *factive* and *fictive* or imagined referential content of abstract concepts. By saying "this is Daniel Radcliffe" or "This is Harry Potter", what difference in the referential content of the two utterances do we induce apart from pointing to the same a young British Londoner? The clearest answer lies in the head of J. K. Rowling, the author of Harry Potter more than in any other head. Thing become more complicated when reference is made to angels, unicorn, and fairies as there is no clear referents despite the imagined physical properties.

Linguistically, this research needs to be taken further to explore the ordered integration of binomial pairs such as "peace and quiet", "health and safety" not "safety and health", "law and order", "vice and virtue", "sick and tired", "short and sweet", "ups and downs", "odds and sods", "ifs and buts", "loud and clear", "back and forth", "by and large", "far and wide", "sooner or later", "more or less", "step by step" and many others. The conceptual structure of these binomials need to be tested against LCCM's principles of ordered integration and ordered search. The can be compared to "walk and talk", "hide and seek", "bread and butter" and see how the physical properties of the lexical concepts in such binomials contribute to fast and informationally optimal interpretation.

Bibliography

Abbott J., J. Austerweil & T. Griffiths. 2012. Human memory search as a random walk in a semantic network". *Advances in Neural Information Processing Systems*, 25, 3050-3058.

Adorni R. & A. M. Proverbio. 2012. The neural manifestation of the word concreteness effect: an electrical neuroimaging study. *Neuropsychologia*, 50, 5, 880-91.

Altarriba J. & L. Bauer. 2004. The Distinctiveness of Emotion Concepts: A Comparison between Emotion, Abstract, and Concrete Words. *The American Journal of Psychology*, 117, 389-410.

Altarriba J., L. Bauer & C. Benvenuto. 1999. Concreteness, context availability, and imageability ratings and word associations for abstract, concrete, and emotion words. *Behaviour Research Methods, Instruments, & Computer*s, 31, 578-602.

Ambler B. & R. Proctor. 1976. Rod involvement in peripheral colour processing. *Scandinavian Journal of Psychology*, 17, 142-148.

Anderson J. R. 1995. *Learning and Memory*, New York, Wiley.

Andrews S., B. Miller, & K. Rayner, 2004. Eye movements and morphological segmentation of compound words: There is a mouse in mousetrap. *European Journal of Cognitive Psychology*, 16, 285–311.

Anquetil T., & M., Jeannerod. 2007. Simulated actions in the first and in the third person perspectives share common representations. *Brain Research*, 1130, 125-129.

Asher N. 2011. *Lexical Meaning in Context: A Web of Words*, Cambridge, Cambridge University Press.

Aziz-Zadeh L., S. Wilson, G. Rizzolatti & M. Iacoboni. 2006. Congruent Embodied Representations for Visually Presented Actions and Linguistic Phrases Describing Actions. *Current biology* 19, 16, 1818-1823.

Baddeley A. D. 1997. Working memory and language processing. *Japanese Society of Aphasiology Journal*, 17, 189-200.

Baden C. & C. H., de Vreese. 2008. Making sense: A reconstruction of people's understandings of the European constitutional referendum in the Netherlands. *Communications* 33, 117-146

Balota D., M. Cortese, S. Sergent-Marshall, D. Spieler, & M. Yap. 2004. Visual word recognition of single-syllable words General. *Journal of Experimental Psychology*, 133, 2, 283-316.

Barber H. A., L. J. Otten, S. T. Kousta, & G. Vigliocco. 2013. Concreteness in word processing: ERP and behavioral effects in a lexical decision task. *Brain & Language*, 125, 47-53.

Barsalou L. 1985. Ideals, central tendency, and frequency of instantiation as determinants of graded structure in categories. *Journal of Experimental Psychology: Learning, Memory, and Cognition,* 11**,** 629- 54.

Barsalou L. W. 1999. Perceptual symbol systems. *Behavioural and Brain Sciences,* 22**,** 577-609.

Barsalou L. W. 2003a. Situated simulation in the human conceptual system. *Language and Cognitive Processes*, 18, 513-562.

Barsalou L. W. 2003b. Abstraction in perceptual symbol systems. *Philosophical Transactions of the Royal Society: Bio.Sci.*, 358, 1177-87.

Barsalou L. W. 2005a. Continuity of the conceptual system across species. *Trends in Cognitive Sciences,* 9, 309-311.

Barsalou L. W. 2005b. Situated Conceptualization. In: H. C. Lefebvre (ed.) *Handbook of Categorisation in Cognitive Science*. Amsterdam: Elsevier.

Barsalou L. W. 2008. Grounded cognition. *Annual Review Psychology*, 59, 617-45.

Barsalou L. W. 2009. Simulation, situated conceptualization, and prediction. *Philosophical transactions of the Royal Society of London: Biological sciences*, 364, 1281-1289.

Barsalou L. W. 2010. Grounded Cognition: Past, Present, and Future. *Topics in Cognitive Science*, 2, 716-724.

Barsalou L. W. & D. Billman. 1989. Systematicity and semantic ambiguity. In: D. Gorfein (ed.) *Resolving semantic ambiguity*. New York: pringer-Verlag.

Barsalou L. W., A. Santos, W. Simmons & C. Wilson. 2008. Language and Simulation in Conceptual Processing. In Manuel de Vega, A. Glenberg & A. Graesser (eds) *Symbols and Embodiment: Debates on meaning and cognition.* Oxford University Press, 245-283.

Barsalou L. W., K. Simmons, A. K. Barbey & C. D. Wilson. 2003. Grounding conceptual knowledge in modality-specific systems. *Trends in Cognitive Sciences*, 7, 84-91.

Barsalou L., K. Solomon. & L. WU. 1999. Perceptual Simulation in Conceptual Tasks. *In:* M. K. Hiraga, C. Sinha, & S. Wilcox (eds). *Cultural, Typological and Psychological Perspectives in Cognitive Linguistics: The Proceedings of the 4th Conference of the International Cognitive Linguistics Association*, Amsterdam. John Benjamins, 209–228.

Barsalou L.W., Yeh, W., Luka, B.J., Olseth, K.L., Mix, K.S., & Wu, L. (1993). Concepts and meaning. In K. Beals, G. Cooke, D. Kathman, K.E. McCullough, S. Kita, & D. Testen (eds.), Chicago Linguistics Society 29: *Papers from the parasession on conceptual representations.* University of Chicago: Chicago Linguistics Society, pp. 23-61.

Barsalou L. W. & K. Wiemer-Hastings. 2005. Situating abstract concepts. In: D. Pecher & R. Zwaan (eds.) *Grounding cognition: The role of perception and action in memory, language, and thinking*. Cambridge: Cambridge University Press.

Bartlett F. C. 1995. *Remembering: A Study in Experimental and Social Psychology, Cambridge*. Cambridge University Press.

Becchio C., A. Cavallo, C. Begliomini, L. Sartori, G. Feltrin & U. Castiello. 2012. Social grasping: from mirroring to mentalizing. *Neuroimage*, 61, 240-8.

Begg I & A. Paivio. 1969. Concreteness and imagery in sentence meaning. *Journal of verbal learning and verbal behaviour*, 8, 821-827.

Benacerraf P. 1973. Mathematical truth. *Journal of Philosophy*, 70:661–80. *Reprinted* in Paul Benacerraf and Hilary Putnam, Philosophy of Mathematics.

Benacerraf P. and Putnam, H., editors 1983. Philosophy of Mathematics. Cambridge University Press, Cambridge, second edition.

Bergen B. 2007. Experimental methods for simulation semantics. *Methods in cognitive linguistics*, 18, 277-301.

Bergen B., L. Shane, T. Matlock & S. Narayanan. 2007. Spatial and linguistic aspects of visual imagery in sentence comprehension. *Cognitive Science*, 31, 733-764.

Bergen B., N. Chang & S. Narayan 2004. Simulated action in an embodied construction grammar. *Proceedings of the Twenty-Sixth Annual Conference of the Cognitive Science Society*, 108-13.

Bergen B. & K. Wheeler 2010. Grammatical aspect and mental simulation. *Brain and Language*, 112, 150-158.

Berinsky A. J., & D. R. Kinder. 2006. Making sense of issues through media frames: Understanding the Kosovo crisis. *The Journal of Politics*, 86, 640-656.

Binder J. R., J. A. Frost, A. Thomas, W. Robert, M. Stephen & P. Thomas. 1997. Human Brain Language Areas Identified by Functional Magnetic Resonance Imaging. *The Journal of Neuroscience*, 17, 1, 353-362.

Binder J. R., C. F. Westbury, E. T. Possing, K. A. McKiernan & D. A. Medler. 2005. Distinct brain systems for processing concrete and abstract concepts. *Journal of Cognitive Neuroscience*; 17: 905--917

Bleasdale F.A. 1987. Concreteness-dependent associative priming: Separate lexical organization for concrete and abstract words. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 13, 582-594.

Blutner R. 2004. Pragmatics and the lexicon. In L. Horn & G. Ward (eds) *Handbook of Pragmatics*, Oxford: Blackwell.

Blutner R. 2010. Some Experimental Aspects of Optimality-Theoretic Pragmatics. In: N. Eniko, & K. Bibok (eds.) *The Role of Data at the Semantics-pragmatics Interface*. De Gruyter Mouton.

Blutner R. 2013. Pragmatics in Optimality Theory. In: F. A. Liedtke & C. Schulze (eds.) *Beyond the Words: Content, context, and inference*. De Gruyter Mouton.

Bock J. S. & C. JR. Clifton. 2000. The role of salience in conceptual combination. *Memory & Cognition*, 28, 1378-1386.

Bonanno Giacomo and Klaus Nehring. 1999. How to make sense of the common prior assumption under incomplete information. *International Journal of Game Theory*, 28, 409-434.

Bonda E, M. Petrides, D. Ostry & A. Evans (1996) Specific involvement of human parietal systems and the amygdala in the perception of biological motion. *Journal of Neuroscience* 16:3737–3744.

Borg E. 2010. Minimalism and the content of the lexicon. In: L. Baptista, & E. Rast, (eds.) *Meaning and Context*. Bern: Peter Lang.

Borghi A. M. 2004. Putting words in perspective. *Memory & Cognition,* 32, 6, 863-873.

Borghi A. M. & D. Pecher. 2011. Introduction to the special topic embodied and grounded cognition. *Frontiers in Psychology*, 2, 187.

Boroditsky L. 2000. Metaphoric structuring: understanding time through spatial metaphors. *Cognition*, 75, 1-28.

Boroditsky L., O. Fuhrman, & K. McCormick. 2011. Do English and Mandarin speakers think about time differently? *Cognition*, 118, 123-9.

Boyle M. & M. Schmierbach. 2009. Implications of perceived fairness and issue importance for mediated and interpersonal information seeking. *Paper presented at the Association for Education and Journalism in Mass Communication (AEJMC) annual conference*: Boston, MA.

Brooks B. E. & E. E. Cooper 2006. What types of visual recognition tasks are mediated by the neural subsystem that subserves face recognition? *Journal of Experimental Psychology: Learning Memory Cognition*, 32, 684-98.

Brown J.S. & Duguid, P. 1998, Organizing knowledge, *California Management Review*, Vol. 40, 3, 90-111.

Brown-schmidt S. & M. K. Tanenhaus. 2008. Real-time investigation of referential domains in unscripted conversation: a targeted language game approach. *Cognitive Science*, 32, 643-684.

Caggiano V., L. Fogassi, G. Rizzolatti, A. Casile, M. Giese & P. Their. 2012. Mirror neurons encode the subjective value of an observed action. *Proceedings National Academy of Sciences* (PNAS), 109, 11848-53.

Calvo-Merino B., D. E. Glaser, J Grezes., R. Passingham, & P. Haggard,. 2005 Action observation and acquired motor skills: an fMRI study with expert dancers. *Cereb. Cortex*, 15, 1243–1249

Cappa S. F., D. Perani, T. Schnur, M. Tettamanti & F. Fazio. 1998. The effects of semantic category and knowledge type on lexical-semantic access: A PET study. *Neuroimage*, 8 (4): 350–359.

Carston R. 2010. Lexical pragmatics, ad hoc concepts and metaphor: from a relevance theory perspective. *Italian Journal of Linguistics* 22(1), 153-180

Casasanto D. 2009. Embodiment of Abstract Concepts: Good and bad in right- and left-handers. *Journal of Experimental Psychology: General*, 138, 351-367.

Casasanto D. & K. Dijkstra, 2010. Motor action and emotional memory. *Cognition*, 115, 179-185.

Casasanto D. & E. Chrysikou. 2011. When Left is "Right": Motor fluency shapes abstract concepts. *Psychological Science*, 22, 419-422.

Chapman H., D. Kim, J. Susskind & A. Anderson. 2009. In bad taste: evidence for the oral origins of moral disgust. *Science*, 323, 1222-6.

Chen J. Y. 2007. Do Chinese and English speakers think about time differently? Failure of replicating Boroditsky (2001). *Cognition*, 104, 427-36.

Chen M. & J. A. Bargh. 1999. Nonconscious approach and avoidance behavioral consequences of the automatic evaluation effect. *Personality and Social Psychology Bulletin*, 25, 215-224.

Chong D. & J. Druckman. 2007. Framing Theory. *Annual Review of Political Science*, 10, 103-126.

Chowdhury S. & F. Gibb. 2009. Relationship among activities and problems causing uncertainty in information seeking and retrieval. *Journal of Documentation*, 65, 470 - 499.

Christianson K., S. G. Luke & F. Ferreira. 2010. Effects of plausibility on structural priming. *Journal of Experimental Psychology: Learning Memory and Cognition*, 36, 538-44.

Citron F. M. 2012. Neural correlates of written emotion word processing: a review of recent electrophysiological and hemodynamic neuroimaging studies. *Brain and Language*, 122, 211-26.

Clark A. 2005. Beyond the flesh: some lessons from a mole cricket. *Artificial Life*, 11, 233-44.

Clark H. H. & E.V. Clark, 1977. Psychology and language: An introduction to psycholinguistics. New York: Harcourt Brace Jovanovich.

Clark E. V. & B. F. Hecht, 1982. Learning to coin agent and instrument nouns. *Cognition*, 12, 1-24.

Clark S. E. & S. D. Gronlund. 1996. Global matching models of recognition memory: How the models match the data. *Psychonomic Bulletin and Review*, 3, 37-60.

Clark A. & Grush, R. 1999. Towards Cognitive Robotics, *Adaptive Behaviour* 7, 1, 5-16.

Coltheart M. 1981. MRC Psycholinguistic Database. *Quarterly Journal of Experimental Psychology*, 33A, 497-505.

Connell L. & D. Lynott. 2012. Strength of perceptual experience predicts word processing performance better than concreteness or imageability. *Cognition*, 125, 452-65.

Corcoran R. 1999. Autonoetic awareness, executive social skills, and the appreciation of intention: figurative reasoning in amnesia, confabulation, and schizophrenia. *Cognitive Neuropsychiatry*, 4, 55-80.

Costello F. J. & M. T. Keane, 1997. Polysemy in Conceptual Combination: Testing the Constraint Theory of Combination. In: M. G. Shafto, & P. Langley (eds.) *Proceedings of the Nineteenth Annual Conference of the Cognitive Science Society*. Hillsdale, NJ: Lawrence Erlbaum Associates.

Costello F. J. & M. T. Keane. 2001. Testing two theories of conceptual combination: alignment versus diagnosticity in the comprehension and production of combined concepts. *Journal of Experimental Psychology: Learning Memory Cognition*, 27, 255-71.

Costello F. & M. T. Keane. 2005. Compositionality as a Constraint in Conceptual Combination In: M. Werning, E. Machery, & G. Schurz, (eds.) *Compositionality of meaning and content (Vol. II: Applications to Linguistics, Psychology and Neuroscience*). Frankfurt: Ontos Verlag.

Costello F. J. & M. T. Keane. 2000. Efficient creativity: constraint-guided conceptual combination. *Cognitive Science*, 24, 299-349.

Coulson S. 2001. Semantic Leaps: Frame-Shifting and Conceptual Blending in Meaning Construction, Cambridge University Press.

Cree G. S. & K. Mcrae. 2003. Analyzing the factors underlying the structure and computation of the meaning of chipmunk, cherry, chisel, cheese, and cello (and many other such concrete nouns). *Journal of Experimental Psychology: Learning Memory Cognition*, 132, 163-201.

Croft W. 1998. Linguistic evidence and mental representations. *Cognitive Linguistics,* 9, 51-73.

Croft W. 2002. Radical Construction Grammar: syntactic theory in Typological perspective. Oxford: Oxford University Press.

Croft W. & D. A. Cruse. 2004. Cognitive Linguistics. Cambridge: Cambridge University Press.

Cruse D. A. 1985. Lexical Semantics, Cambridge: Cambridge University Press.

Cruse D. A. (2000). Aspects of the micro-structure of word meanings. In Y. Ravin and C. Leacock (eds.). *Polysemy: Theoretical and Computational Approaches*, 30–51.

Crutch S. J. 2006. Qualitatively different semantic representations for abstract and concrete words: Further evidence from the semantic reading errors of deep dyslexic patients. *Neurocase.* 12, 91-97.

Crutch S. J., S. Connell & E. K. Warrington. 2009. The different representational frameworks underpinning abstract and concrete knowledge:

evidence from odd-one-out judgements. *Quarterly journal of experimental psychology* (Hove), 62, 1377-88, 1388-90.

Crutch S. J., B. H. Ridha & E. K. Warrington. 2006. The different frameworks underlying abstract and concrete knowledge: evidence from a bilingual patient with a semantic refractory access dysphasia. *Neurocase*, 12, 151-63.

Crutch S. J. & E. K. Warrington. 2005. Abstract and concrete concepts have structurally different representational frameworks. *Brain*, 128, 615-27.

Crutch S. J., & E. K. Warrington. 2007. Contrasting effects of semantic priming and interference in processing abstract and concrete words. Brain Lang. 103, 88–89.

Crutch S. J. & E. K. Warrington. 2010. The differential dependence of abstract and concrete words upon associative and similarity-based information: Complementary semantic interference and facilitation effects. *Cognitive Neuropsychology*, 27, 46-71.

Crystal D. 1987. The Cambridge encyclopaedia of language. Cambridge, England: Cambridge University.

Damasio A. 1989. The brain binds entities and events by multiregional activation from convergence zones. *Neural Computation*, 1, 123-132.

Damasio A. 1994. Descartes' Error: Emotion, Reason, and the Human Brain, Harper Perennial.

Damasio A. 1995. Review: Toward a Neurobiology of Emotion and Feeling: Operational Concepts and Hypotheses. *The Neuroscientist*, 1, 19-25.

Damasio A. 2000. The Feeling of what Happens: Body and Emotion in the Making of Consciousness, Harcourt Incorporated.

Damasio A. 2003. Looking for Spinoza: Joy, Sorrow and the Feeling Brain, New York: Harcourt.

Damasio H., D. Tranel, T. Grabowski, R. Adolphs, & A. Damasio. 2004. Neural systems behind word and concept retrieval. *Cognition*, 92, 179-229.

De Groot A. 1989. Representational aspects of word imageability and word frequency as assessed through word association. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 15, 824-845.

De Groot A. & R. Keijzer. 2000. What hard to learn is easy to forget: The roles of word concreteness, cognate status, and word frequency in foreign language learning and forgetting. *Language Learning*, 50, 1-56

Decety J, & J. Grèzes 2006. The power of simulation: Imagining one's own and other's behavior. *Brain Research* 1079, 4–14.

Decety J., M. Jeannerod, M. Germain & J. Pastene. 1991. Vegetative response during imagined movement is proportional to mental effort. *Behavioural Brain Research* , 42, 1-5.

Dell G. S. 1986. A spreading activation theory of retrieval in language production. *Psychological Review*, 93, 283–321

Dennett D. 1986. Content and Consciousness, Routledge & Kegan Paul.

Denzin N. & Y. Lincoln. 2003. Strategies of Qualitative Inquiry, SAGE Publications.

Desrochers, A. & G. L. Thompson. 2009. Subjective frequency and imageability ratings for 3,600 French nouns. *Behavioural Research Methods*, 41, 546-57.

Devlin J. T., L. M. Gonnerman, E. S. Andersen & M. S. Seidenberg. 1998. Category-specific semantic deficits in focal and widespread brain damage: A computational account. *Journal of Cognitive Neuro-science*, 10, 77–94.

Doise W., A. Clémence & F. Lorenzi-Cioldi. 1993. The Quantitative analysis of social representations. London: Harvester Wheatsheaf.

Dolezal F. 2013. Synonymy and Sameness of Meaning: An Introductory Note. *International Journal of Lexicography*, 26, 255-259.

Dominiek S. 1998. What linguists can and can't tell you about the human mind: A reply to Croft. *Cognitive Linguistics, 9, 361-378.*

Duñabeitia J., A. Avilés, O. Afonso, C. Scheepers & M. Carreiras. 2009. Qualitative differences in the representation of abstract versus concrete words: Evidence from the visual-world paradigm. *Cognition*, 110, 284-292.

Edwards K. 2010. Concept Referentialism and the role of empty concepts. *Mind & Language*, 25, 89-118.

Elman J., M. Hare & K. McRae. 2005. Cues, constraints, and competition in sentence processing. In M. Tomasello and D. Slobin (eds.) *Beyond Nature-Nurture: Essays in Honor of Elizabeth Bates*. Mahwah, NJ: Lawrence Erlbaum Associates.

Estes Z., M. Verges & L. W. Barsalou. 2008. Head up, foot down: Object words orient attention to the object's typical location. *Psychological Sci.*, 19, 93-97.

Evans V. 2007. Towards a Cognitive Compositional Semantics: An Overview of LCCM Theory. In: U. Magnusson, H. Kardela & A. Glaz (eds.) *Further Insights into Semantics and Lexicography*. Lublin: Wydawnictwo Uniwersytetu Marii Curie-Sklodowskiej.

Evans V. 2009. How Words Mean: Lexical Concepts, Cognitive Models, and Meaning Construction, Oxford: Oxford University Press.

Evans V. 2009a. Semantic representation in LCCM Theory. In: V. Evans & S. Pourcel (eds.) *New Directions in Cognitive Linguistics*. Amsterdam: John Benjamins.

Evans V. 2009b. Semantic structure versus conceptual structure: The nature of lexical concepts in a simulation-based account of language understanding. *Unpublished technical report.*

Evans V. 2010a. On the nature of lexical concepts. *Belgrade Journal of English Linguistics and Literature Studies II.*

Evans V. 2010b. Figurative language understanding in LCCM Theory. *Cognitive Linguistics*, 21, 4, 601-662.

Evans V. 2013. Metaphor, lexical concepts and figurative meaning construction. *Cognitive Semiotics*, 1, 2, 73-107.

Evans V. *forthcoming*. What's in a concept? Analogue versus parametric concepts in LCCM Theory. In: E. Margolis & S. Laurence (eds.) *Concepts: New Directions*. Cambridge, MA: MIT Press.

Evans V. & M. Green. 2006. Cognitive Linguistics: An Introduction, Lawrence Erlbaum Associates.

Evans V. & A. Tyler. 2001. The Relation between experience, conceptual structure and meaning: Non-temporal uses of tense and language teaching. . In: M. Puetz, S. Niemeier, & R. Dirven (eds.) *Applied Cognitive Linguistics I: Theory and Language Acquisition*. Berlin: Mouton de Gruyter.

Fauconnier G. 1994. Mental Spaces, New York, Cambridge University Press.

Fauconnier G. & M. Turner, 1998. Conceptual integration networks. *Cognitive Science*, 22, 133-187.

Fauconnier G. & M. Turner. 1999. A mechanism of creativity. Poetics Today, 20, 397-418.

Fauconnier G. & M. Turner. 2000. Compression and global insight. *Cognitive Linguistics*, 11, 283-304.

Fauconnier G. & M. Turner. 2008. The Way We Think: Conceptual Blending and the Mind's Hidden Complexities, Basic Books.

Ferreira F., K. Christianson & A. Hollingworth. 2001. Misinterpretations of garden-path sentences: implications for models of sentence processing and reanalysis. *Journal of Psycholinguistic Research*, 30, 3-20.

Ferreira F., & C. Clifton. 1986. The independence of syntactic processing. *Journal of Memory and Language*, 25, 348–368.

Fillmore C. J. 1978. On the organization of semantic information in the lexicon. In: D. Frakas, W. Jacobsen, & K. Todrys (eds.) *Papers from the Parasession on the Lexicon*. Chicago: Chicago Linguistic Society.

Fillmore C. J. 1985. Frames and the semantics of understanding. *Quaderni di Semantica*, 6, 222-254.

Fillmore C. J. 2006. Frame Semantics. In: K. Brown (ed.) *Encyclopaedia of Language & Linguistics (2nd* Edition). Oxford: Elsevier.

Fillmore C. J., P. Kay, & M. O'Connor, 1988. Regularity and idiomaticity in grammatical constructions. *Language*, 64, 3, 501-538.

Fincher-Kierfer R. & P. D'Agostino. 2004. The role of visuo-spatial resources in generating predictive and bridging inferences. *Discourse Processes*, 37, 205-224.

Fischer M. & R. Zwaan. 2008. Embodied language. A review of the role of the motor system in language comprehension, *Quarterly journal of experimental psychology (Hove)*, 61, 825-850.

Fitousi D. & M. J. Wenger. 2011. Processing capacity under perceptual and cognitive load: a closer look at load theory. *The Journal of Experimental Psychology: Human Perception and Performance*, 37, 781-798.

Fodor J. A. 1975. Language of thought, New York, T. Y. Crowell.

Fodor J. 1987. Psychosemantics: The Problem of Meaning in the Philosophy of Mind, Cambridge, MA, MIT Press.

Fodor J. A. 1998. Concepts: Where Cognitive Science Went Wrong, Clarendon Press.

Fodor J. A. 2008a. Against Darwinism. *Mind & Language*, 23, 1, 1-24.

Fodor J. A. 2008b. LOT 2: The Language of Thought Revisited: The Language of Thought Revisited. Oxford: Oxford University Press.

Fogassi L., V. Gallese, G. Buccino, L. Craighero, L. Fadiga & G. Rizzolatti. 2001. Cortical mechanism for the visual guidance of hand grasping movements in the monkey: A reversible inactivation study. *Brain*, 124, 571-86.

Foroni F. & G. Semin. 2009. Language that puts you in touch with your bodily feelings: the multimodal responsiveness of affective expressions. *Psychological Science*, 20, 974-980.

Frawley W. 2005. The expression of modality. Berlin: Mouton de Gruyter.

Frazier L. & C., Jr. Clifton. 1996. Construal. Cambridge, MA: MIT Press.

Fried I., A. Katz, G. McCarthy, K. Sass, P. Williamson, S. Spencer & D. Spencer. 1991. Functional organization of human supplementary motor cortex studied by electrical stimulation. *Journal of Neuroscience*, 11, 3656-66.

Gagné C. L. & T. L. Spalding. 2004. Effect of discourse context and modifier relation frequency on conceptual combination. *Journal of Memory and Language*, 50, 444-455.

Gainotti G. 2013. Why are different the right and left hemisphere conceptual representations? *Behavioural Neurology* [Epub ahead of print], DOI - 10.3233/BEN-130356. http://iospress.metapress.com/content/BP867651688K8383.

Gallese V. 2003. The manifold nature of interpersonal relations: the quest for a common mechanism. *Philosophical Transaction of Royal Society London: Biological Science*, 358, 517-528.

Gallese V. 2003. The roots of empathy: the shared manifold hypothesis and the neural basis of intersubjectivity. *Psychopathology*, 36, 171-180.

Gallese V. 2006. Intentional attunement: a neurophysiological perspective on social cognition and its disruption in autism. *Brain Research*, 1079, 15-24.

Gallese V. 2007. Before and below 'theory of mind': embodied simulation and the neural correlates of social cognition. Philosophical Transaction of Royal Society London: *Biological Science*, 362, 659-669.

Gallese V. & G. Lakoff. 2005. The Brain's concepts: the role of the Sensory-motor system in conceptual knowledge. *Cognitive Neuropsy.*, 22, 455-479.

Garrard P, R. Lambon, J. R Hodges, K. Patterson. 2001. Prototypicality, distinctiveness, and intercorrelation: Analyses of the semantic attributes of living and nonliving concepts. *Cognitive Neuropsychology*, 18, 2, 125–174.

Geeraerts D. 2010. Theories of Lexical Semantics, New York, Oxford University Press Inc.

Gentilucci M., C. Gianelli, G. C. Campione & F. Ferri. 2012. Intersubjectivity and Embodied Communication Systems. *Journal of Cognitive Semiotics*, IV(1), 125-138.

Gentner D. 1982. Why nouns are learned before verbs: Linguistic relativity versus natural partitioning. In: S. Kuczaj (ed.) *Language development: Language, cognition, and culture.* Hillsdale, NJ: Erlbaum.

Gentner D. & A. B. Markman. 1994. Structural alignment in comparison: No difference without similarity. *Psychological Science*, 5, 152–158.

Gentner D. & A. B. Markman. 1997. Structure mapping in analogy and similarity. *American Psychologist*, 52, 45–56.

Gentner D. & P. Wolff. 1997. Alignment in the processing of metaphor. *Journal of Memory and Language*, 137, 331–355.

Gernsbacher M. A., H. H. Goldsmith & R. R. W. Robertson. 1992. Do readers mentally represent fictional characters' emotional states? *Cognition & Emotion*, 6, 89-111.

Ghio M. & M. Tettamanti. 2010. Semantic domain-specific functional integration for action-related vs. abstract concepts. *Brain and Language*, 112, 223-232.

Gibbs R. W. 2006. Metaphor Interpretation as Embodied Simulation. *Mind & Language*, 21, 434-458.

Gibbs R. W. & E. Berg. 2002. Finding the body in mental imagery. *Journal of Mental Imagery*, 26, 82-108.

Glenberg A. & M. Kaschak. 2002. Grounding language in action. *Psychonomic Bulletin & Review*, 9, 558-565.

Glenberg A. & D. Robertson. 2000. Symbol Grounding and Meaning: A Comparison of High-Dimensional and Embodied Theories of Meaning. *Journal of Memory and Language*, 43, 379-401.

Glock H. 2009. Concepts: Where Subjectivism Goes Wrong. *Philosophy*, 84, 5-29.

Goldin-Meadow S. 2003. Hearing Gesture: How Our Hands Help Us Think, Cambridge, MA, Belknap of Harvard University Press.

Goodman N. 1972. Seven strictures on Similarity. In: N. Goodman (ed.) *Problems and Projects*. New York: The Bobbs-Merrill Co.

Goodwyn S. & L. Acredolo. 1998. Encouraging symbolic gestures: a new perspective on the relationship between gesture and speech. *New directions for child development*, 61-73.

Grady J. 2005. Primary metaphors as inputs to conceptual integration. *Journal of Pragmatics*, 37, 1595-1614.

Grady J., T. Oakley & S. Coulson. 1999. Blending and metaphor. In: W. Raymond, J. Gibbs & G. J. Steen (eds.) *Metaphor in Cognitive Linguistics*. Amsterdam: John Benjamin.

Grush R. 2003. In defence of some 'Cartesian' assumptions concerning the brain and its operation. *Biology and Philosophy* 18, 53-93.

Guarino N. & P. Giaretta. 1995. Ontologies and knowledge bases: towards a terminological clarification. In: N. Mars (ed.) *Towards Very Large Knowledge Bases: Knowledge Building and Knowledge Sharing*. Amsterdam: IOS Press

Guilford J. P. 1967. The nature of human intelligence, McGraw-Hill.

Gygax P., A. Garnham & J. Oakhill. 2003. Inferring characters' emotional states: Can readers infer specific emotions? *Language and Cognitive Processes*, Vol 19(5), Oct 2004, 613-639.

Gygax P., Garnham, A., & J. Oakhill. 2004. Inferring characters' emotional states: Can readers infer specific emotions? *Language and Cognitive Processes*, 19, 5, 613-638.

Hahn U. & N. Chater. 1997. Concepts and Similarity. In K. Lamberts & D. Shanks (eds.) *Knowledge, Concepts and Categories*, 43-92. Hove, England: Psychology Press

Haidt J. & J. Graham 2007. When morality opposes justice: Conservatives have moral intuitions that liberals may not recognize. *Social Justice Research*, 20, 98-116.

Halff H. M., A. Ortony & R. Anderson. 1976. A context-sensitive representation of word meanings. *Memory & Cognition*, 4, 378-383.

Halpern D. F. 1996. Thought and knowledge: an introduction to critical thinking (3rd ed.). Mahwah, NJ: L. Erlbaum Associates.

Hampe B. & J. E. Grady. 2005. From perception to meaning: Image schemas in cognitive linguistics, Mouton de Gruyter.

Hampton J. A. 1981. An investigation into the nature of abstract concepts. *Memory & Cognition*, 12, 151-1664.

Hampton J. A. 1987. Inheritance of attributes in natural concept conjunctions. *Memory & Cognition*, 15, 55-71.

Hampton J. A. 1988. Overextension of conjunctive concepts: Evidence for a unitary model of concept typicality and class inclusion. *Journal of Experimental Psychology: Learning, Memory and Cognition*, 14, 12-32.

Hampton J. A. 1989. Concepts and correct thinking. *Mind and Language*, 4, 35-41.

Hampton J. A. 1995. Testing the prototype theory of concepts. *Journal of Memory and Language*, 34, 686-708.

Hampton J. A. 1991. The combination of prototype concepts. In: P. Schwanenflugel, (ed.) *The psychology of word meanings*. Hillsdale, NJ: Erlbaum.

Hampton J.A. 1997. Psychological representations of concepts. In M. A. Conway (ed.) *Cognitive models of memory*, 81-110. Hove: Psychology Press.

Hampton J.A., & M.M. Gardiner. 1983. Measures of Internal Category Structure: a correlational analysis of normative data. *British Journal of Psychology*, 74, 491-516.

Hart J. & B. Gordon. 1992. Neural Subsystems for object knowledge. *Nature*, 359, 60–64

Hauk O., I. Johnsrude & F. Pulvermüller. 2004. Somatotopic Representation of Action Words in Human Motor and Premotor Cortex. *Neuron*, 41, 301-307.

Heim I. & A. Kratzer: Semantics in Generative Grammar. Oxford (Basil Blackwell), 1998.

Hesslow G. 2002. Conscious thought as simulation of behaviour and perception. *Trends in Cognitive Sciences*, 6, 242-247.

Hill E. L. 1998. A dyspraxic deficit in specific language impairment and developmental coordination disorder: Evidence from hand and arm movements. *Developmental Medicine and Child Neurology*, 40, 388–395.

Hoffman P., G. A. Evans & M. A. Lambon-Ralph. 2013. The anterior temporal lobes are critically involved in acquiring new conceptual knowledge: Evidence for impaired feature integration in semantic dementia. *Cortex*, 1-13.

Hofmeister P., L. Casasanto & I. A. Sag. In press. Islands in the Grammar? Standards of Evidence. In: J. Sprouse, & N. Hornstein (eds.) *Experimental Syntax and the Islands Debate*. Cambridge: Cambridge University Press.

Holland D. & N. Quinn. 1987. Cultural Models in Language and Thought. Cambridge: Cambridge University Press.

Horsey R.2000.Meaning postulates and deference. http://cogprints.org/3257/

Horsey R. 2006. The content and acquisition of lexical concepts. PhD Thesis, University of London.

Hothersall D. 2004. History of Psychology, Boston, McGraw-Hill.

Hutchins E. 1980. Culture and Inference: A Trobriand Case Study. Cambridge, MA: Harvard University Press.

Hutchins E. 2005. Material anchors for conceptual blends. *Journal of Pragmatics 37, 1555–1577.*

Intili R. 2011. Borderline personality disorder and emotion information processing. *Unpublished PhD Dissertation*, University of Birmingham.

Iverson J. & E. Thelen. 1999. Hand, Mouth and Brain: The Dynamic Emergence of Speech and Gesture. *J. of Consciousness Studies*, 6, 19–40.

Iyengar S. 2010. Framing: The next steps. In: B. Schaffner & P. Sellers (eds.) *Winning with words: The origins and impact of political framing*. New York: Routledge.

Jackendoff R. 1983. Semantics and Cognition. Cambridge, Massachusetts: MIT Press.

Jackendoff R. 2002. Foundations of Language: Brain, Meaning, Grammar, Evolution, Oxford University Press.

Jackson P., A. Meltzoff & J. Decety. 2005. How do we perceive the pain of others? A window into the neural processes involved in empathy. *Neuroimage*, 24, 771-779.

Jannsen T. 1997. Compositionality. In: van Benthem J & ter Meulen A. (eds.) *Handbook of Logic and Language*. Amsterdam: Elsevier, 417–473.

January D. & E. Kako. 2006. Re-evaluating evidence for linguistic relativity: Reply to Boroditsky (2001). *Cognition, 104(2), 417-426.*

Iverson J. M. & S. Goldin-Meadow. 1998. Why people gesture when they speak. *Nature*, 396, 228.

Johannsen K. & J. P. Ruiter. 2013. Reference frame selection in dialog: priming or preference? *Frontiers of Human Neuroscience*, 7, 667.

Johnson E. & A. Tversky. 1983. Affect, generalization, and the perception of risk. *Journal of Personality and Social Psychology*, 45, 20-31.

Johnson K. 2004. From impossible words to conceptual structure: The role of structure and processes in the lexicon. *Mind & Language*, 19, 334-358.

Johnson M. 1990. The Body in the Mind: The Bodily Basis of Meaning, Imagination, and Reason, University of Chicago Press.

Johnson-Laird P. N. & K. Oatley. 1989. The language of emotions: An analysis of a semantic field. *Cognition and Emotion*, 3, 81-123.

Juhasz B. J., M. J. Yap, J. Dicke, S. C. Taylor & M. M. Gullick. 2011. Tangible words are recognized faster: the grounding of meaning in sensory and perceptual systems. *Quarterly journal of experimental psychology* (Hove), 64, 1683-91.

Kaplan D. 1989. After-thoughts. In: J. Almog, J. Perry & H. Wettstein (eds.) *Themes from Kaplan.* New York: Oxford University Press.

Kaschak M., C. Madden, D. Therriault, , R. Yaxley, , M. Aveyard, , A. Blanchard & R. Zwaan. 2005. Perception of motion affects language processing. *Cognitio*n, 94, B79-89.

Katz Y., N. D. Goodman, K. Kersting, C. Kemp & J. B. Tenenbaum. 2008. Modeling semantic cognition as logical dimensionality reduction. *Proceedings of the Thirtieth Annual Conference of the Cognitive Science Society*.

Kecskes I. 2013. Intercultural Pragmatics, Oxford University Press USA.

Kemmerer D., D. Rudrauf, K. Manzel & D. Tranel. 2012. Behavioral patterns and lesion sites associated with impaired processing of lexical and conceptual knowledge of actions. *Cortex*, 48, 826-48.

Kerzel D., & Bekkering, H. 2000. Motor activation from visible speech: Evidence from stimulus response compatibility. *Journal of Experimental Psychology: Human Perception and Performance*. 26, 2, 634-647.

Keysar B. & B. Bly. 1995. Intuitions about the transparency of idioms: can one keep a secret by spilling the beans? *Journal of Memory and Language*, 34, 89–109.

Kieras D. E. 1978. Beyond pictures and words: Alternative information-processing models for imagery effects in verbal memory. *Psychological Bulletin*, 85, 532-554.

Kilner J. M., Y. Paulignan & S-J. Blakemore.2003. An interference effect of observed biological movement on action. *Current Biology*, 13, 6, 522-525.

Kintsch W. 1988. The role of knowledge in discourse comprehension construction-integration model. *Psychological Review*, 95, 163-182.

Kintsch W. 2008. Symbol systems and perceptual representations. In: M. De Vega, A. Glenberg & A. Graesser, (eds.) *Symbols and Embodiment.* Oxford: Oxford University Press, 145-164.

Klein D. E., & G. L. Murphy. 2001. The representation of polysemous words. *Journal of Memory and Language*, 45, 259–282.

Klein D. E., & G. L. Murphy. 2002. Paper has been my ruin: Conceptual relations of polysemous senses. *Journal of Memory and Language*, 47, 548-570.

Kounios J. 2007. Functional modularity of semantic memory revealed by event-related brain potentials. J. Hart & M. Kraut (eds.) *Neural basis of semantic memory.* Cambridge, U.K: Cambridge University Press.

Kounios J. & P. J. Holcomb. 1994. Concreteness effects in semantic processing: ERP evidence supporting dual-coding theory. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 20, 804-823.

Kousta S., D. Vinson & G. Vigliocco. 2009. Emotion words, regardless of polarity, have a processing advantage over neutral words. *Cognition*, 112, 473-81.

Kousta S., G. Vigliocco, D. Vinson, M. Andrews & E. Del Campo. 2011. The representation of abstract words: why emotion matters. *Journal of Experimental Psychology General*, 140(1):14-34.

Kovecses Z. 2002. Metaphor: A Practical Introduction. York: Oxford University Press.

Kövecses Z. 2010. A new look at metaphorical creativity in cognitive linguistics. *Cognitive Linguistics*, 21, 4, 655-690.

Krams M., M. Rushworth, M. Deiber, R. Frackowiak, & R. Passingham, 1998. The preparation, execution and suppression of copied movements in the human brain. *Experimental Brain Research*, 120, 386-98.

Krauss R. M. 1987. The role of the listener: Addressee influences on message formulation. *Journal of Language and Social Psychology*, 6, 81-98

Krauss R. M. & S. R. Fussell 1991. Perspective-taking in communication: Representations of others' knowledge in reference. *Social Cognition*, 9, 2-24.

Kroll J. & J. Merves. 1986. Lexical access for concrete and abstract words. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 12, 92-107.

Lakoff G. 1987. Women, fire, and dangerous things: what categories reveal about the mind, University of Chicago Press.

Lakoff G. 1993. The Contemporary theory of Metaphor. A. Ortony (ed.) *Metaphor and Thought*. New York: Cambridge University Press.

Lakoff G. & M. Johnson 1980. Metaphors We Live By, University Of Chicago Press.

Lakoff G. & M. Johnson 1999. Philosophy in the Flesh: The Embodied Mind and Its Challenge to Western Thought, Basic Books.

Langacker R. W. 1986. An Introduction to Cognitive Grammar. *Cognitive Science*, 10, 1-40.

Langacker R. W. 1987. Foundations of Cognitive Grammar: Theoretical prerequisites, Stanford University Press.

Langacker R. W. 1993. Grammatical traces of some 'invisible' semantic constructs. Language Sciences, 15, 323-355.

Langacker R. W. 1999. Grammar and Conceptualization, Berlin, Mouton de Gruyter.

Lantolf J. P., & S. L Thorne. 2006. Sociocultural theory and second language acquisition. In: B. van Patten, & J. Williams (Eds.), *Theories in second language acquisition*, Mahwah, NJ: Erlbaum, 201-224.

Larsen R. & Z. Prizmic-Larsen. 2006. Measuring emotions: Implications of a multimethod perspective. In: M. Eid, & E. Diener, (eds.) *Handbook of*

Multimethod Measurement in Psychology Washington, DC: American Psychological Association.

Lemaire B., V. Robinet & S. Portrat. 2012. Compression mechanisms in working memory. *Mathematics and Social Sciences*, 3, 71-84.

Lewis D. 1986. On the Plurality of Worlds, Oxford: Blackwell.

Liberman A. M. & I. G. Mattingly. 1985. The motor theory of speech perception revised. *Cognition*, 21, 1-36.

Liddell S. K. 2003. Grammar, Gesture, and Meaning in American Sign Language, New York: Cambridge University Press.

Liggins D. 2010. Epistemological Objections to Platonism. *Philosophy Compass*, 5.1, 67–77.

Lin D. 1998. Automatic retrieval and clustering of similar words. *Proceedings of the 17th international conference on Computational linguistics - Volume 2*. Montreal, Quebec, Canada: Association for Computational Linguistics.

Lin D. 1999. Automatic identification of non-compositional phrases. *Proceedings of the 37th annual meeting of the Association for Computational Linguistics on Computational Linguistics*. College Park, Maryland: Association for Computational Linguistics.

Louwerse M. M. & P. Jeuniaux. 2010. The linguistic and embodied nature of conceptual processing. *Cognition*, 114, 96-104.

Lupyan G. & M. Spivey. 2008. Perceptual processing is facilitated by ascribing meaning to novel stimuli. *Current biology*, 18, R410-R412.

Lynott D. & L. Connell. 2010. Embodied Conceptual Combination. *Frontiers in Psychology*, 1, 212, 1-14.

Lyons J. 1968. Introduction to Theoretical Linguistics, Cambridge University Press.

Lyons J. 1981. Language and linguistics: An introduction. Cambridge, England: Cambridge University.

Ma, W., R. M.Golinkoff, K. Hirsh-Pasek, C. McDonough, & T. Tardif, 2009. Imageability predicts the age of acquisition of verbs in Chinese children. *Journal of Child Language*, 36, 405-23.

Macwhinney B. 2005. The emergence of Grammar from perspective. In: D. Pecher & R. A. Zwaan (eds.) *Grounding Cognition: The Role of Perception and Action in Memory, Language, and Thinking*. Cambridge: Cambridge University Press.

Mahon B. & A. Caramazza. 2008. A critical look at the embodied cognition hypothesis and a new proposal for grounding conceptual content. *Journal of Physiology (Paris)*, 102, 59-70.

Majid A., J. S. Boster, & M. Bowerman 2008. The cross-linguistic categorisation of everyday events: A study of cutting and breaking. *Cognition*, 109 235–250.

Mandler J. M. 2004. The foundations of mind: origins of conceptual thought, Oxford, Oxford University Press.

Mandler J. M. 2008. On the Birth and Growth of Concepts. *Philosophical Psychology*, 21, 207-230.

Mandler J. M. 2012. On the spatial foundations of the conceptual system and its enrichment. *Cognitive Science*, 36, 421-51.

Marghetis T. & R. Núñez. 2010. Dynamic construals, static formalisms: Evidence from co-speech gesture during mathematical proving. *Center for Research in Language Technical Reports*. Center for Research in Language, University of California, San Diego, 22, 1, 3–9.

Margolis E. & S. Laurence. 2007. Creations of the Mind: Theories of Artifacts and their Representation, Oxford: Oxford University Press.

Marinellie S. A. & Y. L. Chan. 2006. The effect of word frequency on noun and verb definitions: a developmental study. *Journal of Speech, Language, and Hearing Research*, 49, 1001-21.

Marino B., P. Gough, V. Gallese, L. Riggio & G. Buccino. 2013. How the motor system handles nouns: a behavioral study. *Journal Psychological Research*, 77, 64-73.

Markman A. B. & D. Gentner. 1993. Structural alignment during similarity comparisons. *Cognitive Psychology*, 25, 4, 431-467.

Markman A. B. & E. J. Wisniewski. 1997. Same and different: The differentiation of basic-level categories. *Journal of Experimental Psychology: Language, Memory & Cognition*, 23, 54-70.

Martin A. 2007. The representation of object concepts in the brain. *Annual Review of Psychology*, 58, 25-45.

Martínez-Manrique F. 2010. On the Distinction between Semantic and Conceptual Representation. *Dialectica*, 64, 57-78.

Mashal N., R. Gavrieli, & G. Kave. 2011. Age-related changes in the appreciation of novel metaphoric semantic relations. *Aging, Neuropsychology, and Cognition*, 18, 527-43.

Mason-Baughman M. B. & S. E. Wallace. 2013. The role of commonality, distinctiveness and importance of semantic features in persons with aphasia. *Brain Injury*, 27, 399-407.

Matthes J. 2007. Beyond accessibility? Toward an on-line and memory-based model of framing effects. *Communications: The European Journal of Communication Research*, 32, 1, 51-78.

Matthes J. & M. Kohring. 2008. The content analysis of media frames: toward improving reliability and validity. *Journal of Communication*, 58, 258-279.

Mathews A., & C. MacLeod. 2002. Induced processing biases have causal effects on anxiety. *Cognition & Emotion*, 16, 331–354.

McCarthy D., J. Carroll & J. Preiss. 2001. Disambiguating noun and verb senses using automatically acquired selectional preferences. *Proceedings of the SENSEVAL-2 Workshop at ACL/EACL'01*, Toulouse, France. 119-122.

McConnell-Ginet, S. 2008. Words in the World: How and Why Meanings Can Matter. *Language*, 84, 3, 497-527.

McDonough C., L. Song, K. Hirsh-Pasek, R. M. Golinkoff, & R. Lannon. 2011. An image is worth a thousand words: why nouns tend to dominate verbs in early word learning. *Developmental Sciences*, 14, 181-9.

McGlone M. S. 2007. What is the explanatory value of a conceptual metaphor? *Language & Communication*, 27, 109-126.

McGlone M. S. & D. Manfredi. 2001. Topic-vehicle interaction in metaphor comprehension. *Memory and Cognition*, 29, 1209-19.

McNeill D. 2008. Gesture and Thought, University of Chicago Press.

McNeil D. W., P. Tucker, R. Miranda, M. R. Lewin, & J. Nordgren. 1999. Response to depression and anxiety Stroop stimuli in posttraumatic stress disorder, obsessive-compulsive disorder, and major depressive disorder. *Journal of Nervous and Mental Disease*, 187, 8, 512–516

McCrae R. R., P. T. Costa, M. P. Lima, A. Simoes, F. Ostendorf & A. Angleitner. 1999. Age differences in personality across the adult life span: Parallels in five cultures. *Developmental Psychology*, 35, 466 – 477.

McRae K., G. Cree, M. Seidenberg & C. McNorgan. 2005. Semantic feature production norms for a large set. *Behaviour Research Methods, Instruments, & Computers*, 37, 547-559.

Meier B., D. Hauser, M. Robinson, C. Friesen & K. Schjeldahl. 2007. What's "up" with God? Vertical space as a representation of the divine. *Journal of Personal and Social Psychology*, 93, 699-710.

Meier B., A. Rey-Mermet, N. Rothen, & P. Graf. 2013. Recognition memory across the lifespan: the impact of word frequency and study-test interval on estimates of familiarity and recollection. *Front Psychology*, 4, 787.

Meier B., S. Schnall, N. Schwarz & J. Bargh. 2012. Embodiment in Social Psychology. *Topics in Cognitive Science*, 4, 705-716.

Meier B., M. Sellbom & D. Wygant. 2007. Failing to take the moral high ground: Psychopathy and the vertical representation of morality. *Personality and Individual Differences*, 43, 757-767.

Melinger A. & W. Levelt. 2004. Gesture and the communicative intention of the speaker. *Gesture*, 4, 2, 119-141.

Meteyard, L. & G. Vigliocco. 2008. The role of sensory and motor information in semantic representation: A review. In: P. Calvo, & A. Gomila (eds.) *Handbook of Cognitive Sciences: An Embodied Approach*. Amsterdam: Elsevier.

Minsky M. 1975. A framework for representing knowledge. In: P. Winston (ed.) *The Psychology of Computer Vision*. New York: McGraw-Hill.

Mitchell T., R. Hutchinson, R.S. Niculescu, F. Pereira, X. Wang, M.A. Just & S.D Newman. 2004. Learning to decode cognitive states from brain images. *Machine Learning*, 57, 145–175.

Mittelberg I. 2002. The Visual Memory of Grammar: Iconographical and Metaphorical Insights. Metaphorik.de, 2, 69-89.

Mittelberg I. 2008. Peircean semiotics meets conceptual metaphor: Iconic modes in gestural representations of grammar. A. J. Cienki & C. Müller, (eds.) *Metaphor and Gesture*. Amsterdam: John Benjamins Publishing.

Mizraji E., A. Pomi & J. Valle-Lisboa. 2009. Dynamic searching in the brain. Cognitive *Neurodynamics*, 3, 401-414.

Möller R. 1999. Perception through Anticipation. A Behaviour-Based Approach to Visual Perception. A. Riegler, M. Peschl & A. Stein, (eds.) *Understanding Representation in the Cognitive Sciences*. Springer.

Mostofsky S. & D. Simmonds. 2008. Response inhibition and response selection: two sides of the same coin. *Journal of Cognitive Neuroscience*, 20, 751-61.

Murphy G. L. 1982. Cue validity and levels of categorisation. *Psychological Bulletin*, 91, 174-177.

Murphy G. L. 1988. Comprehending Complex Concepts. *Cognitive Science*, 12, 529-562.

Murphy G. L.1990. Noun phrase interpretation and conceptual combination. *Journal of Memory and Language*, 29, 259-288.

Murphy G. L. 1996. On metaphoric representation. *Cognition*, 60, 173-204.

Murphy G. L. 2002. The Big Book of Concepts, Cambridge, MA, MIT Press.

Murphy G. L. 2005. Conceptual approaches: an overview. In: D.A. Cruse, F. Hundsnurscher, M. Job & P.R. Lutzeier (eds.). *Lexicology. An international handbook of the nature and structure of words and vocabularies*. Berlin, New York: Mouton de Gruyter. 269-275.

Negueruela E. J., J. P. Lantolf, S. R. Jordan, & J. Gelabert. 2004. The Private Function" of Gesture in Second Language Communicative Activity: A Study on Motion Verbs and Gesturing in English and Spanish. *International Journal of Applied Linguistics* 14: 113-147.

Neininger B. & F. Pulvermuller. 2001. The right hemisphere's role in action word processing: a double case study. *Neurocase*, 7, 303-317.

Nelson D. L., & T. A.Schreiber. 1992. Word concreteness and word structure as independent determinants of recall. *Journal of Memory and Language*, 31, 237-260.

Neuliep J. W. 2009. Intercultural communication: A contextual approach, Los Angeles, CA, Sage.

Nittono H., M. Suehiro & T. Hori. 2002. Word imageability and N400 in an incidental memory paradigm. *International Journal of Psychophysiology*, 44, 3, 261-262.

Nunez, R. & E. Sweetser. 2006. With the future behind them: convergent evidence from Aymara language and gesture in the cross-linguistic comparison of spatial construals of time. *Cogntive Science*, 30, 401-450.

Nusbaum H. C, D. B. Pisoni & C. K. Davis,.1984. Sizing up the Hoosier mental lexicon: Measuring the familiarity of 20,000 words. *Research on speech perception* (Prog. Rep. No.10, 357-376).

Oberauer K., H. Süß, O. Wilhelm & N. Sander, 2007. Individual differences in working memory capacity and reasoning ability. A. Conway, C. Jarrold, M. Kane, A. Miyake & J. Towse , (eds.) *Variation in working memory*. Oxford: Oxford University Press.

Ojemann G. 1984. Common cortical and thalamic mechanisms for language and motor functions. *American Journal Physiology*, 246, R901-903.

O'Neill B. 1972. Defineability as an index of word meaning. *Journal of Psycholinguistic Research*, 1, 287-98.

Ortells J., C. Vellido, M. T. Daza & C. Noguera 2006. Semantic priming effects from conscious and unconsciously perceived words. *Psicológica*, 225-242.

Osherson D. N. & E. E. Smith. 1981. On the adequacy of prototype theory as a theory of concepts. *Cognition*, 9, 35-58.

Oatley K., & Johnson-Laird, P. N. 1987. Towards a cognitive theory of emotions. Cognition & Emotion, 1, 29-50.

Pado U., M. W. Crocker & F. Keller. 2009. A probabilistic model of semantic plausibility in sentence processing. *Cognitive Science,* 33, 794-838.

Paivio A. 1965. Abstractness, imagery, and meaningfulness in paired-associate learning. *Journal of Verbal Learning and Verbal Behavior*, 4, 32-38.

Paivio A., J. 1968. Concreteness, imagery, and meaningfulness values for 925 nouns. *Journal of Experimental Psychology*, 76, Suppl: 1-25.

Paivio A. 1971. Imagery and verbal processes, New York, Holt, Rinehart, and Winston.

Paivio A. 1986. Mental Representations: A Dual Coding Approach. New York: Oxford University Press.

Paivio A. 1991. Dual coding theory: Retrospect and current status. *Canadian Journal of Psychology*, 45, 255–287.

Paivio A. 2007. Mind and Its Evolution: A Dual Coding Theoretical Approach, Taylor & Francis.

Paivio A. 2010. Dual coding and the mental lexicon. *The Mental Lexicon*, 5(2): 205-230.

Paivio A., J. Yuille & P. Smythe 1966. Stimulus and response abstractness, imagery, and meaningfulness, and reported mediators in paired-associate learning. *Canadian Journal of Psychology*, 20, 362-77.

Papaxanthis C., T. Pozzo, X. Skoura & M. Schieppati 2002. Does order and timing in performance of imagined and actual movements affect the motor imagery process? The duration of walking and writing task. *Behavioural Brain Research*, 134, 209-215.

Patson N. D., E. S. Darowski, N. Moon & F. Ferreira. 2009. Lingering misinterpretations in garden-path sentences: evidence from a paraphrasing task. *Journal Experimental Psychology: Learning, Memory and Cognition*, 35, 280-285.

Pecher D., I. Boot, & S. Van Dantzig. 2011. Abstract Concepts: Sensory-Motor Grounding, Metaphors, and Beyond. In: B. Ross (ed) *The Psychology of Learning and Motivation*, Burlington: Academic Press, 217–248.

Pecher D., R. Zeelenberg & L. W. Barsalou. 2003. Verifying properties from different modalities for concepts produces switching costs. *Psychological Science*, 14, 119-124.

Pereira F. 2007. Creativity and artificial intelligence: a conceptual blending approach. Berlin: Mouton de Gruyter

Pexman P., I. Hargreaves, J. Edwards, L. C. Henry & B. Goodyear. 2007. Neural correlates of concreteness in semantic categorisation. *Journal of Cognitive Neuroscience*, 19, 1407-1419.

Pexman P. M., P. D. Siakaluk & M. J. Yap 2013. Introduction to the research topic meaning in mind: semantic richness effects in language processing. *Frontier of Human Neuroscience*, 7, 723.

Pietroski P. *forthcoming*. Lexicalising and combining. R. de Almeida & C. Manouilidou (eds.) *Verb Concepts: cognitive science perspectives on verb representation and processing*, New York: Oxford University Press.

Pietroski P. M. 2008. Minimalist Meaning, Internalist Interpretation. *Biolinguistics* 2(4), 317-341.

Pietroski P. M. 2010. Concepts, Meanings, and Truth: First Nature, Second Nature, and Hard Work. *Mind & Language*, 25(2), 247-278.

Plag I., G. Kunter, & S. Lappe.2007. Testing hypotheses about compound stress assignment in English: a corpus-based investigation. *Corpus Linguistics and Linguistic Theory* 3.2, 199-233.

Plaut D. & T. Shallice, 1993. Deep dyslexia: A case study of connectionist neuropsychology. *Cognitive Neuropsychology*, 10, 377-500.

Pollard C. & I. A. Sag. 1994. Head-Driven Phrase Structure Grammar. The University of Chicago Press, Chicago.

Price T. F., & E. Harmon-Jones. 2010. The effect of embodied emotive states on cognitive categorisation. *Emotion*, 10, 934–938.

Prinz J. J. 2002. Furnishing the Mind: Concepts and Their Perceptual Basis, MIT Press.

Prinz J. J. 2004. Which emotions are basic? D. Evans & P. Cruse (eds.) *Emotion, evolution, and rationality*. Oxford: Oxford University Press.

Pritchard T. 2007. The Character of Word Meaning. *Conference on Concept Types and Frames*, Duesseldorf: Heine University.

Pulvermüller F. 1999. Words in the brain's language. *Behavioral and Brain Sciences*, 22, 253–336.

Pulvermuller F., B. Mohr & H. Schleichert. 1999. Semantic or lexico-syntactic factors: what determines word-class specific activity in the human brain? *Neuroscience Letters*, 275, 81-4.

Pylkkanen L. 2008. Mismatching Meanings in Brain and Behavior. *Language and Linguistics Compass*, 2/4, 712–738.

Pylyshyn Z. 1984. Computation and Cognition: Toward a Foundation for Cognitive Science, MA: The MIT Press.

Pylyshyn Z. W. 1984. Computation and Cognition: Towards a Foundation for Cognitive Science. MIT Press.

Quaeghebeur L. 2012. The 'All-at-Onceness' of Embodied, Face to-Face Interaction. *Journal of Cognitive Semiotics*, IV(1), 167-188.

Raaijmakers J.G.W. & R.M. Shiffrin. 1992. Models for recall and recognition. *Annual Review of Psychology*, 43, 205-234.

RamnanI N. & R. Miall. 2004. A system in the human brain for predicting the actions of others. *National Neuroscience*, 7, 85-90.

Ramos C. & F. Sagols. 2011. The minimum cost flow problem with interval and fuzzy arc costs. *Morfismos*, 15, 57-68.

Ran B. & P. Duimering. 2009. Conceptual Combination: Models, Theories, and Controversies. S. P. Weingarten & H. O. Penat (eds.) *Cognitive Psychology Research Developments*. Nova Science Publishers, Inc.

Ratneshwar S., L. W. Barsalou, C. Pechmann, & M. Moore. 2001. Goal-Derived Categories: The Role of Personal and Situational Goals in Category Representations. *Journal of Consumer Psychology*, 10 (3), 147-158.

Recanati F. 1995. The alleged priority of literal interpretation. *Cognitive Science*, 19, 207-232.

Recanati F. 2004. Literal Meaning, Cambridge, Cambridge University Press.

Recanati F. 2001. Literal/non-literal. *Midwest Studies in Philosophy*, 25, 264-274.

Recchia G. & M. N. Jones. 2012. The semantic richness of abstract concepts. *Frontiers of Human Neuroscience*, 6, 315.

Rey G. 2005. Philosophical analysis as cognitive psychology: The case of empty concepts. In: H. Cohen & C. Lefebvre (eds.) *Handbook of categorisation in cognitive science*. Amsterdam Elsevier.

Reynolds A. & A. Paivio 1968. Cognitive and emotional determinants of speech. *Canadian Journal of Psychology*, 22, 164-75.

Richardson D., M. Spivey, L. W. Barsalou & K. McRae. 2003. Spatial representations activated during real-time comprehension of verbs. *Cognitive Science* 27, 767-780.

Rizzolatti G., L.Fadiga, V. Gallese & L. Fogassi. 1996. Premotor cortex and the recognition of motor actions. *Cognition Brain Research*. 3, 131-141.

Rizzolatti G., L. Fogassi & V. Gallese. 2001. Neurophysiological mechanisms underlying the understanding and imitation of action. *National Review of Neuroscience*, 2, 661–670.

Robin J. & M. Moscovitch. 2013. The Effects of Spatial Contextual Familiarity on Remembered Scenes, Episodic Memories, and Imagined Future Events. *Journal of Experimental Psychology: Learning, Memory and Cognition*. 40(2):459-71

Robinson G., J. Blair & L. Cipolotti. 1998. Dynamic aphasia: an inability to select between competing verbal responses? *Brain*, 121, Part 1, 77-89.

Rochat M. J., F. Caruana, A. Jezzini, L. Escola, I. Intskirveli, F. Grammont, V. Gallese, G. Rizzolatti & M. A. Umilta. 2010. Responses of mirror neurons in area F5 to hand and tool grasping observation. *Experimental Brain Research*, 204, 605-616.

Rodd J., I. Johnsrude & M. Davis. 2010. The role of domain-general frontal systems in language comprehension: evidence from dual-task interference and semantic ambiguity. *Brain and Language*, 115, 182-188.

Rohrer T. 2005. Image Schemata in the Brain. B. Hampe & J. Grady (eds.) *From Perception to Meaning: Image Schemas in Cognitive Linguistics*. Berlin: Mouton de Gruyter.

Romani C., S. Mcalpine & R. C. Martin. 2008. Concreteness effects in different tasks: implications for models of short-term memory. *Quarterly Journal of Experimental Psychology (Hove)*, 61, 292-323.

Rosch E. 1975. Cognitive representations of semantic categories. *Journal of Experimental Psychology: General*, 104, 192-233.

Rosch E. 1978. Principles of categorisation. In: E. Rosch & B. Lloyd (eds.) *Cognition and categorisation*. Hillsdale, NJ: Erlbaum.

Rosch E. & C. Mervis. 1975. Family resemblances: Studies in the internal structure of categories. *Cognitive Psychology*, 7, 573-605.

Rose M. L. 2013. Releasing the constraints on aphasia therapy: the positive impact of gesture and multimodality treatments. *American Journal of Speech Language Pathology*, 22, 227-239.

Rosen G. "Abstract Objects", The Stanford Encyclopedia of Philosophy (Spring 2012 Ed.), Edward N. Zalta (ed.) http://plato.stanford.edu/archives/spr2012/entries/abstract-objects/>.

Rubin, D.C. & M.D Schulkind. 1997. The distribution of autobiographical memories across the life-span. *Memory & Cognition*, 25, 6, 859-866.

Rueckl J.G. & Aicher K.A. 2008. Are CORNER and BROTHER morphologically complex? Not in the long term. *Language & Cognitive Processes*, 23:972–1001.

Rugg M. D. & T. Curran. 2007. Event-related potentials and recognition memory. *Trends in Cognitive Science*, 11, 251-257.

Ruigrok N. and W. van Atteveldt. 2007. Global Angling with a Local Angle: How U.S., British, and Dutch Newspapers Frame Global and Local Terrorist Attacks. *The Harvard International Journal of Press/Politics* 12, 68-90.

Rumelhart D. 1980. Schemata: the building blocks of cognition. In: R. J., Spiro et al. (eds.) *Theoretical Issues in Reading Comprehension*. Hillsdale, NJ: Lawrence Erlbaum.

Rumelhart D. 1989. Toward a microstructural account of human reasoning. In: S. Vosniadou, & A. Ortony (eds.) *Similarity and analogical reasoning*. New York: Cambridge University Press.

Rumelhart D. E., P. Smolensky, J. L. McClelland & G. E. Hinton. 1986. Parallel distributed models of schemata and sequential thought processes. J. L. McClelland & D. E. Rumelhart (eds.) *Parallel Distributed Processing: Explorations in the Microstructure of Cognition*. Cambridge: MIT Press.

Sadoski M., E.T. Goetz, & J.B Fritz. 1993. Impact of concreteness on comprehensibility, interest, and memory for text: Implications for dual coding theory and text design. *Journal of Educational Psychology*, 85, 291-304.

Sadoski M. & A. Paivio. 1994. A Dual Coding view of imagery and verbal processes in reading comprehension. In: R. B. Ruddell, M. R. Ruddell & H. Singer (eds.) *Theoretical Models and Processes of Reading* (4th ed.) Newark, DE: International Reading Association.

Sambor J. 2005. Lexical networks. In: R. Köhler, G. Altmann & G. Piotrowski (eds.). *Quantitative Linguistik – Quantitative Linguistics*. Ein internationales Handbuch. Amsterdam: Benjamins. 447-457.

Sambre P. 2012. Fleshing out Language and Intersubjectivity: An Exploration of Merleau-Ponty's Legacy to Cognitive Linguistics. *Journal of Cognitive Semiotics*, IV(1), 189-224.

Sandra D. 1998. What linguists can and can't tell about the human mind: A reply to Croft. *Cognitive Linguistics*, 9, 4, 361-378.

Sandra D. & S. Rice. 1995. Network analyses of prepositional meaning: Mirroring whose mind– the linguist's or the language user's? *Cognitive Linguistics*, 6(1), 89-130.

Santa Ana O. 1999. Like an animal I was treated: Anti-immigrant metaphor in US public discourse. *Discourse & Society*, 10, 191-224.

Saracho O. 2012. Contemporary Perspectives on Research in Creativity in Early Childhood Education, Information Age Publication.

Schank R. & R. Abelson. 1977. Scripts, Plans, Goals, and Understanding: An Inquiry into Human Knowledge Structures, Lawrence Erlbaum Associates.

Scheufele B. 2004. Framing-effects approach: A theoretical and methodological critique. Communications, 29, 4, 401–428.

Scheufele B. 2006. Frames, schemata, and news reporting. Communications, 31, 65-83.

Scheufele B. & D. Scheufele. 2010. Of spreading activation, applicability, and schemas: Conceptual distinctions and their operational implications for measuring frames and framing effects. P. D'Angelo, & J. A. Kuypers, (eds.) *Doing news framing analysis: Empirical and theoretical perspectives*. New York: Routledge.

Schnall S., J. Haidt, G. Clore & A. Jordan. 2008. Disgust as embodied moral judgment. *Personality and Social Psychology Bulletin*, 34, 1096-1109.

Schwanenflugel P. 1991. Why are abstract concepts hard to understand? P. J. Schwanenflugel (ed.) *The psychology of word meanings*. Hillsdale, NJ: Lawrence Erlbaum Associates.

Schwanenflugel P., K. Harnishfeger & R. Stowe. 1988. Context availability and lexical decisions for abstract and concrete words. *Journal of Memory and Language & Communication*, 27 499–520.

Schwanenflugel P. & E. Shoben. 1983. Differential context effects in the comprehension of abstract and concrete verbal materials. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 9 82-102.

Sebanz N., H. Bekkering & G. Knoblich. 2006. Joint action: Bodies and minds moving together. *Trends in Cognitive Sciences*, 10, 70–76

Setti A., A. M. Borghi & A. Tessari. 2009. Moving hands, moving entities. *Brain and Cognition*, 70, 253-258.

Shah D., M. Boyle, M. Schmierbach, H. Keum & C. Armstrong. 2010. Specificity, complexity, and validity: Rescuing experimental research on framing effects. In: P, D'Angelo & J. A. Kuypers (eds.) *Doing news framing analysis: Empirical and theoretical perspectives*. New York Routledge.

Shah D. V., N. Kwak, M. Schmierbach & J. Zubric. 2004. The Interplay of News Frames on Cognitive Complexity. *Human Communication Research*, 30, 102-120.

Siakaluk P. D., Pexman P. M., Sears C. R., Wilson K., Locheed K. & Owen W. J. 2008. The benefits of sensorimotor knowledge: body-object interaction facilitates semantic processing. *Cognitive Science*. 32, 591–506

Sigman, M. & G. Cecchi. 2002. Global organization of the Wordnet lexicon. *Proceedings of National Academy of Science U.S.A*, 99, 1742-7.

Simon M., R. Herold, S. Fekete & T. Tenyi. 2007. Mirror neurons--novel data on the neurobiology of intersubjectivity. *Psychiatr Hung*, 22, 418-29.

Simonsen H. G., M. Lind, P. Hansen, E. Holm & B. H. Mevik. 2013. Imageability of Norwegian nouns, verbs and adjectives in a cross-linguistic perspective. *Clinical Linguistics and Phonetics*, 27, 435-46.

Sinha C. 1988. Language and Representation: a Socio-naturalistic Approach to Human Development. Hemel Hempstead, Harvester-Wheatsheaf.

Sinha C. 2009. Language as a bio-cultural niche and social institution. In Vyvyan Evans and Stéphanie Pourcel (Eds.) *New Directions in Cognitive Linguistics*. Amsterdam: John Benjamins, 289-310.

Sinha C. 2005. Blending out of the background: Play, props and staging in the material world. *Journal of Pragmatics* 37, 1537–1554

Sinha C. & Jensen de Lo´pez, Kristine, 2000. Language, culture and the embodiment of spatial cognition. *Cognitive Linguistics* 11, 17–41.

Sinha C. & Rodríguez, C. 2008. Language and the signifying object: from convention to imagination. In J. Zlatev, T. Racine, C. Sinha and E. Itkonen (eds.) *The Shared Mind: Perspectives on intersubjectivity*. Amsterdam: John Benjamins, 358-378.

Smith, L. 2005. Action alters shape categories. Cognitive Science. 29, 665–79

Smith, E. & D., Medin. 1981. Categories and concepts, Cambridge, MA, Harvard University Press.

Smith, E. & D. Osherson. 1984. Conceptual Combination with prototype concepts. *Cognitive Science*, 8, 337–361.

Smith, E. E., D. N. Osherson, L. J. Rips & M. Keane. 1988. Combining prototypes: A selective modification model. *Cognitive Science*, 12, 485-527.

Smith, E. E., E. Shafir & D. Osherson. 1993. Similarity, plausibility, and judgments of probability. *Cognition*, 49, 67-96.

Smith, E. E., E. J. Shoben & L. J. Rips. 1974. Structure and process in semantic decisions. *Psychological Review*, 81, 214-241.

Smith, L. 2005. Arithmetic Concepts, Skills, and Reasoning. *The American Journal of Psychology*, 118, 489-496.

Spalding T. & C. Gagné. 2007. Semantic property activation during the interpretation of combined concepts. *The Mental Lexicon*, 2, 25-47.

Sperber D. 1996. Explaining Culture: A Naturalistic Approach, Wiley.

Sperber D. 1997. Intuitive and Reflective Beliefs. *Mind & Language*, 12,67-83.

Sperber D. & D. Wilson. 1986. Relevance: Communication and Cognition, Oxford, Blackwell.

Stanfield R. & R. Zwaan. 2001. The effect of implied orientation derived from verbal context on picture recognition. *Psychological Science*, 12, 153-6.

Sanford A. J., & Graesser, A. C. (2006). Shallow processing and underspecification. *Discourse Processes*, 42(2), 99-108.

Staub A., K. Rayner, A. Pollatsek, J. Hyona & H. Majewski. 2007. The time course of plausibility effects on eye movements in reading: evidence from noun-noun compounds. *Journal of Experimental Psychology: Learning Memory Cognition*, 33, 1162-9.

Steen G. 2007. Finding Metaphor in Grammar and Usage: A methodological Analysis of Theory and Research, Amsterdam: John Benjamins.

Steen G. 2008. When is metaphor deliberate. In N. Johannesson, C. Alm-Arvius, & D. Minugh (eds.) *Selected papers from the 2008 Stockholm Metaphor Festival.* Stockholm: Stockholm University.

Steen G. 2011. What does "really deliberate" really mean?: More thoughts on metaphor and consciousness. *Metaphor and the Social World*, 1, 53-56.

Steen G. 2008. Finding metaphor in grammar and usage: A methodological analysis of theory and research. Amsterdam: John Benjamins.

Suied C., N. Bonneel & I. Viaud-Delmon. 2009. Integration of auditory and visual information in the recognition of realistic objects. *Experimental Brain Research*, 194, 91-102.

Sweetser E. 1999. Compositionality and blending: semantic composition in a cognitively realistic framework. In: G. Redeker & T. jen (eds.) *Cognitive Linguistics: Foundations, Scope and Methodology*. Berlin: Mouton de Gruyter.

Sweller J., P. Ayres & S. Kalyuga. 2011. Cognitive Load Theory, Springer.

Swinney D., T. Love, M. Walenski & E. Smith. 2007. Conceptual combination during sentence comprehension: evidence for compositional processes. *Psychological Sciences*, 18, 397-400.

Talmy L. 1983. How language structures space. H. Pick & J. L. Acredolo (eds.) *Spatial orientation: Theory, research, and application.* New York: Plenum Press.

Talmy L. 1988. Force dynamics in language and cognition. *Cognitive Science* 12, 49-100.

Talmy L. 2000a. Toward a cognitive semantics, volume I: Concept structuring systems. Cambridge, MA: MIT Press.

Talmy L. 2000b. Toward a cognitive semantics, volume II: Typology and process in concept structuring. Cambridge, MA, MIT Press.

Tanenhaus M. K. & S. Brown-schmidt. 2008. Language processing in the natural world. *Philosophical Transactions of Royal Society London Biological Science*, 363, 1105-22.

Taylor K. I., B. J. Devereux & L. K. Tyler. 2011. Conceptual structure: Towards an integrated neuro-cognitive account. *Language and Cognitive Processes*, 26, 1368-1401.

Teddlie C. & A. Tashakkori. 2003. Major issues and controversies in the use of mixed methods in the social and behavioral sciences. A. Tashakkori & C. Teddlie (eds.) *Handbook of mixed-methods in social and behavioral research.* Thousand Oaks, CA: Sage.

Tewksbury D. & D. A. Scheufele. 2009. News framing theory and research. In J. Bryant and M. B. Oliver (ed). *Media effects: Advances in theory and research,*. Hillsdale, NJ: Erlbaum.

Thagard P. 1984. Conceptual combination and scientific discovery. P. Asquith & P. Kitcher (eds.), Vol. 1, PSA East Lansing: Philosophy of Science Association, 3-2.

Thagard P. & K. Verbeurgt. 1998. Coherence as constraint satisfaction. *Cognitive Science*, 22, 1–24.

Tomasino B., L. Lotto, M. Sarlo, C. Civai, R. Rumiati, & R.I. Rumiati. 2013. Framing the Ultimatum Game: The contribution of simulation. *Frontiers in Humam Neuroscience* 7:33

Trueswell J. C., M. K. Tanenhaus & S. M. Garnsey. 1994. Semantic Influences on Parsing: Use of Thematic Role Information in Syntactic Ambiguity Resolution. *Journal of Memory and Language*, 33, 285-318.

Turner M. 1996. The Literary Mind: The Origins of Thought and Language, Oxford University Press, USA.

Tversky A. 1977. Features of similarity. *Psychological Review*, 84, 327-352.

Ungerer F. & H. Schmid. 2006. An Introduction to Cognitive Linguistics, London and New York, Longman.

Van dantzig S., D. Pecher, R. Zeelenberg & L. W. Barsalou. 2008. Perceptual processing affects conceptual processing. *Cognitive Science*, 32, 579-590.

Van Der Schaaf M., L. Baartman, F. Prins, A. Oosterbaan & H. Schaap. 2011. Feedback Dialogues That Stimulate Students' Reflective Thinking. *Scandinavian Journal of Educational Research*, 57, 227-245.

Vatakis A. & C. Spence. 2007. Cross-modal binding: evaluating the "unity assumption" using audio-visual speech stimuli. *Perception & Psychophysics*, 69, 744-56.

Vicente A. 2010. Clusters: On the structure of lexical concepts. *Dialectica*, 64, 79-106.

Vigliocco G., L. Meteyard, M. Andrews & S. Kousta. 2009. Toward a theory of semantic representation. *Language and Cognition*, Vol. 1(2).

Vigliocco G. & D. P. Vinson. 2007. Semantic representation. M. Gaskell & G. Altmann (eds.) *The Oxford handbook of psycholinguistics*. Oxford: Oxford University Press.

Vigliocco G., D. P. Vinson, W. Lewis & M. F. Garrett. 2004. Representing the meanings of object and action words: The featural and unitary semantic space (FUSS) hypothesis. *Cognitive Psychology*, 48, 422-488.

Ward T. & Y. Kolomyts. 2010. Cognition and creativity. J. Kaufman & R. Sternberg (eds.) *The Cambridge handbook of creativity*. New York, NY: Cambridge University Press.

Watson D. & D. Wiese. 1999. The two general activation systems of affect: Structural findings, evolutionary considerations, and psychobiological evidence. *Journal of Personality and Social Psychology*, 76, 820-838.

Wauters L.N., A.E.J.M, Tellings, W.H.J. Van Bon & A.W Van Haaften. 2003. Mode of acquisition of word meanings: The viability of a theoretical construct. *Applied Psycholinguistics*, 24, 385-406.

Wehr H. & J. M. Cowan. 1976. A dictionary of modern written Arabic, Spoken Language Services.

Wessel I., M. Meeren, F. Peeters, A.R. Arntz & H. Merckelbach. 2000. Correlates of autobiographical memory specificity: The role of depression, anxiety and childhood trauma. *Behaviour research and therapy*, 39(4), 409-421

Wheeler M. 2005. Reconstructing the cognitive world: The next Step, Cambridge, Mass, MIT Press.

Whaley C.P. (1978). Word-nonword classification time. Journal of Verbal Learning and Verbal Behavior. 17. 143-154

Wicker B., C. Keysers, J. Plailly, J. P. Royet, V. Gallese & G. Rizzolatti. 2003. Both of us disgusted in my insula: the common neural basis of seeing and feeling disgust. *Neuron*, 40, 655-64.

Wiemer-Hastings K., J. Krug & X. Xu. 2001. Imagery, context availability, contextual constraint and abstractness. In: J. Moore & K. Stenning (eds). *Proceedings of the twenty-third annual conference of the cognitive science society*, Mahwah, NJ. Lawrence Erlbaum Associates, Inc, 1106–1111.

Wiemer-Hastings K. & X. XU. 2005. Content Differences for Abstract and Concrete Concepts. *Cognitive Science*, 29, 719-736.

Williams L. & J. Bargh. 2008. Keeping one's distance: the influence of spatial distance cues on affect and evaluation. *Psychological Sciences*, 19, 302-8.

Wilson Deirdre & R. Carston. 2007. A unitary approach to lexical pragmatics: Relevance, inference and ad hoc concepts. In: N. Burton-Roberts (ed.) *Pragmatics*. London: Palgrave.

Wilson M. 2002. Six views of embodied cognition. *Psychonomic Bulletin and Review*, 9, 625-36.

Wilson-Mendenhall, C., L. Barrett, W. Simmons & L. W. Barsalou. 2011. Grounding emotion in situated conceptualization. *Neuropsychologia*, 49, 1105-27.

Wisniewski E. J. 1996. Construal and Similarity in conceptual combination. *Journal of Memory and Language*, 35, 434-453.

Wisniewski E. J. 1997a. Conceptual combination: Possibilities and esthetics. B. S., Ward, M. Smith, & J. Vaid (eds.) *Creative thought: An investigation of conceptual structures and processes*. Washington DC: American Psychological Association.

Wisniewski E. J. 1997b. When concepts combine. *Psychonomic Bulletin & Review*, 4 (2), 167-183.

Wisniewski E. J. 2000. Similarity, alignment, and conceptual combination: Comment on Estes and Glucksberg. *Memory & Cognition*, 28, 35-38.

Wisniewski E. J. & D. Gentner 1991. On the combinatorial semantics of noun pairs: Minor and major adjustments to meaning. G. B. Simpson (ed.) *Understanding word and sentence*. Amsterdam: North Holland.

Wixted J. T. (2007). Dual-process theory and signal-detection theory of recognition memory. Psychological Review, 114, 152–176.

Yamagishi K. & J. Miyamoto. 1996. Asymmetries in strength of preference: A focus shift model of valence effects in difference judgment. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 22, 493- 509.

Yang J., P. Zhao, Z. Zhu, A. Mecklinger, Z. Fang & H. Li. 2013. Memory asymmetry of forward and backward associations in recognition tasks. *Journal of Experimental Psychology: Learning Memory Cognitio*n, 39, 253-269.

Yin R. K. (2003). Case study research: Design and methods (3rd ed.). Thousand Oaks, CA: Sage.

Yonelinas A. 1994. Receiver-operating characteristics in recognition memory: Evidence for a dual-process model. *Journal of Experimental Psychology: Learning, Memory, & Cognition*, 20, 1341-1354.

Yonelinas A. (2001) Consciousness, control and confidence: the three Cs of recognition memory. *Journal Experimental Psychology General* 130:361–379.

Yonelinas A., L. Otten, K. Shaw & M. Rugg. 2005. Separating the brain regions involved in recollection and familiarity in recognition memory. *Journal of Neuroscience*, 25, 3002-3008.

Zadeh, L. 1965. Fuzzy sets. *Information and Control*, 8, 338–353.

Zadeh L. 1976. A fuzzy-algorithmic approach to the definition of complex or imprecise concepts. *International Journal of Man-Machine Studies*, 8, 249-291.

Zadeh L. 1982. A note on prototype theory and fuzzy sets. *Cognition*, 12(3), 291-298.

Zajonc R. B., P. Pietromonaco & J. A. Bargh. 1982. Independence and interaction of affect and cognition. In M. S. Clark & S. T. Fiske (Eds.), *Affect and cognition: The seventeenth annual Carnegie symposium on cognition*, 211-227. Hillsdale, NJ: Lawrence Erlbaum.

Zeelenberg R., Pecher, D., & Raaijmakers, J. G. W. (2003). Associative repetition priming: A selective review and theoretical implications. In J. Bowers & C. Marsolek (Eds.), *Rethinking implicit memory* (261–283). Oxford, England: Oxford University Press.

Zhang L., T. Zhou, J. Zhang, Z. Liu, J. Fan & Y. Zhu. 2006. In search of the Chinese self: an fMRI study. *Science China Life Sciences*, 49, 89-96.

Zhang X., Z. Han & Y. Bi. 2013. Are abstract and concrete concepts organized differently? Evidence from the blocked translation paradigm. *Applied Psycholinguistics*, 34, 1059-1092.

Zelinsky-Wibbelt C. (1993). The semantics of spatial prepositions. Berlin: Mouton De Gruyter.

Ziemke T. 2003. What's that thing called embodiment? In: R. Alterman & D. Kirsch (eds.) *Proceedings of the 25th Annual Meeting of the Cognitive Science Society*. Boston, Mass: Cognitive Science Society.

Zwaan R. 2004. The immersed experiencer: Toward an embodied theory of language comprehension. In B.H. Ross (ed.) *Psychology of Learning and*

Motivation: Advances in Research and Theory, Vol 44, 44. New York: Academic Press.

Zwaan R., C. Madden, R. Yaxley & M. Aveyard. 2004. Moving words: dynamic representations in language comprehension. *Cognitive Science*, 28, 611-619.

Zwaan R., R. Stanfield & R. Yaxley. 2002. Language comprehenders mentally represent the shapes of objects. *Psychological Sciences*, 13, 168-171.

Zwaan R. & L. Taylor. 2006. Seeing, acting, understanding: motor resonance in language comprehension. *Journal of Experimental Psychology: General*, 135, 1-11.

Appendices

1. Appendix 1: Recruitment Flyer

This is an English version of the information letter which was presented to the participants either online or on paper.

Information Letter

Bangor University,

Bangor, Gwynedd LL57 2DG

Tel: (01248) 351151 (main switchboard)

School: School of Linguistics and English Language +44 (0) 1248-382264

Programme: PhD in Linguistics

PhD project Title:

An experimental approach to the meaning construction and interpretation of abstract concepts

Supervisor: Professor Vyvyan Frederick Evans +44 (0)1248 383295

By: Mohamed Al Husain

This work investigates how human beings represent and interpret abstract concepts individually and in utterances. We, hereby, invite you to take part in a number of tasks for which you get training sessions first. The same task may be repeated twice to get more data.

You will be instructed, in these tasks, either to rate words such as “freedom”, “truth”, etc., according to some variables, describe their meaning by listing their features, make lexical choices and so on. Your involvement in these tasks is voluntary, and will take approximately one to two sessions on two successive days. Each session lasts for one hour of your time.

Before taking part in one task or more, you will attend training session to familiarize you with the topic, tasks and the software environment. At the end of the task, you will receive a detailed feedback about the task and 20000 ID bonus.

You may decline to participate in any task presented in these experiments if you so wish without any penalty or loss.

All of the provided personal details are retained completely confidential.

Guided by the interest of this study in the statistical significance of the entire responses, you will not be identified individually in any way in this research. Rather, every participant will be coded anonymously as (participant 1, 2, 3, …, n). So, there are no expected risks associated with your involvement in these tasks.

If you have any query, remark or concern about your involvement in this study, please contact the head of the department of Arab Language.

2. Appendix 2: Consent Form

This is an English version of the consent form which was presented to the participants either online or on paper.

Consent Form

I hereby give my consent to take part in one or more of the experiments being designed and presented by Mr M. Al Husain, as part of his PhD dissertation. I have decided to enrol in these tasks, based on the information leaflet I have read and completely understood. According to this information leaflet, my identity and personal details will be kept anonymous and facial features will be digitally masked by (blurring effect to cover the face). In the Information-Consent Letter, I understood that I have had the opportunity to ask for any additional details and have the right to withdraw this consent at any time with no consequences. My involvement or withdrawal will have no impact on my status in the department or the University. If I decline to participate in any of these tasks, I could alternatively participate in others to earn the same bonus.

I acknowledge that by signing this consent form or emailing it back to sender, I have read, understand and agree to participate.

I, hereby, ☐ agree/ ☐disagree and sign up to participate in the tasks.

Programme Type: ☐ Undergraduate ☐ Postgraduate

Name:

Signature:

3. Appendix 3: Row data

The following is the row list of stimuli used in this work. The actual stimuli for the (Imageability, Reference-Type and Verbal Coding tasks) includes only those with mean familiarity ratings of 1. 63 and above. Words with mean familiarity rating less than 1.63 were excluded. The following table is an overview of the mean rating for 201 words.

Stimuli	Translation	Mean Familiarit	Mean Imageabilit	Mean Reference-	Mean Verbal
احتلال	conquest	6.89	4.36	4.56	4.41
احتمال	possibility	5.82	6.15	5.79	5.45
ادعاء	allegation	6.85	5.57	4.36	4.69
اذلال	humiliation	6.89	4.58	4.68	4.58
اذى	harm	6.85	5.71	5.13	4.59
ارضية	floor	7.00	1.91	2.05	1.43
ازدراء	disdain	5.82	5.80	5.44	5.47
استيفاء	redemption	6.81	6.65	6.26	6.17
استئناف	resumption	6.83	6.04	5.33	4.84
اسد	lion	7.00	2.17	1.76	2.72
اسفل	down	7.00	4.38	4.19	3.27
اصلاح	reform	6.83	5.95	5.02	5.04
اعجاب	adoration	5.82	4.93	5.66	5.27
اعلى	up	6.87	4.30	4.26	3.31
اغاثة	assistance	6.89	4.07	4.77	4.44
اقناع	persuasion	6.91	5.68	4.99	5.20
البراق	Bouraq	6.83	3.53	4.25	2.84
القواعد	regulation	6.87	5.81	4.62	4.58
امام	Imam	6.92	5.00	3.95	3.09
امانة	sincerity	6.87	4.72	5.50	5.81

امرة	command	6.87	4.73	4.27	4.68
امل	hope	5.82	5.99	6.52	5.69
اهمال	negligence	6.85	5.90	5.09	5.28
اية	verse	7.00	4.46	4.60	3.36
ايمان	faith	6.81	5.96	6.24	6.04
بهجة	cheerfulness	6.87	3.74	4.74	3.58
بؤس	misery	6.85	4.01	5.22	4.70
تباين	variance	6.85	4.56	4.64	6.55
تزامن	coincidence	6.80	6.05	5.23	5.04
تسلسل	sequence	6.87	4.68	2.87	3.35
تسليم	acknowledgement	6.89	4.75	5.06	4.80
تسوية	reconciliation	6.85	4.30	5.07	5.62
تصريح	statement	6.85	4.79	4.49	3.97
تغيير	change	6.83	4.95	5.00	3.58
تفائل	optimism	6.85	4.94	5.68	5.73
تقوى	piety	6.80	6.83	6.91	6.89
تلفاز	TV	7.00	1.84	2.07	2.08
توازن	balance	5.82	4.73	5.18	5.04
تواصل	communication	6.87	3.75	2.94	1.64
تواضع	humbleness	6.87	6.05	5.95	4.72
توقع	expectation	6.89	5.89	5.06	5.23
ثروة	wealth	7.00	3.76	2.13	2.63
ثقافة	culture	6.85	5.78	5.62	5.51
ثقب	hole	7.00	1.40	2.15	1.18
ثقة	trust	6.87	4.95	5.77	5.60
ثناء	praise	6.90	4.38	4.72	4.74
جدال	dispute	6.87	4.00	4.38	3.30

جدول	stream	7.00	1.66	2.48	1.41
جريدة	newspaper	7.00	2.09	1.92	1.97
جزر	carrot	7.00	1.31	1.72	1.39
جمال	beauty	6.81	4.11	4.92	4.81
جهنم	Hell	6.91	6.04	6.38	4.99
حافز	motivation	6.84	4.93	5.17	4.93
حالة	state	6.85	6.09	5.30	5.44
حب	love	6.89	4.56	4.25	4.47
حجة	reasoning	6.83	5.60	4.93	5.40
حذر	alertness	6.89	4.04	4.17	4.28
حرب	war	6.95	4.19	1.73	3.10
حرمان	depravity	6.85	5.86	5.53	5.39
حس	sense	6.87	4.45	5.75	4.65
حطب	log	7.00	1.48	1.61	1.43
حق	rights	6.87	6.18	5.39	5.32
حقيقة	truth	6.85	5.89	6.27	5.68
حكم	judgement	6.87	4.99	4.62	5.03
حكمة	wisdom	5.82	5.93	6.08	5.46
حكومة	government	6.87	4.62	2.74	2.84
حياة	life	7.00	6.14	6.42	5.85
حيطة	caution	6.87	4.55	4.45	4.63
خزانة	closet	7.00	1.66	1.75	1.43
خطر	danger	7.00	5.82	5.29	3.81
خوف	fear	6.89	6.23	4.09	4.81
داجن	tame	6.89	5.90	5.50	5.60
دخان	smoke	7.00	2.27	2.66	2.69
ربى	nurture	6.83	5.62	5.18	5.31

رذيلة	vice	5.82	6.23	6.08	5.81
رصيد	credit	6.84	4.83	5.90	5.76
رقم سري	pin number	6.98	4.42	2.99	3.19
رمز	symbol	6.83	2.87	5.45	4.96
رواية	fiction	7.00	4.88	2.76	3.10
روح	spirit	5.82	5.62	4.30	4.70
زمن	time	5.82	6.03	6.47	6.12
زواج	marriage	7.00	5.00	4.28	2.84
سترة	jacket	7.00	1.64	1.76	1.43
سر	secret	6.87	5.01	5.49	3.26
سرير	bed	7.00	1.42	1.90	1.20
سفينة	ship	7.00	2.73	1.97	3.11
سقالة	scaffold	5.82	1.53	1.94	1.54
سلام	peace	6.89	4.58	5.50	4.55
سلة	basket	7.00	1.35	1.77	1.29
سلطة	authority	6.84	5.05	5.62	5.61
سيادة	supremacy	6.80	5.88	5.48	5.03
سيارة	car	7.00	1.21	1.75	1.05
شاشة	monitor	7.00	2.15	2.08	3.03
شاي	tea	7.00	1.80	1.70	1.84
شجرة	tree	7.00	1.10	1.43	1.01
شر	evil	5.82	4.53	5.17	4.06
شفقة	sympathy	6.83	4.99	5.63	5.12
شك	doubt	6.89	6.02	5.52	5.49
شمس	sun	7.00	4.07	2.34	2.54
شوق	longing	6.83	4.45	5.78	5.21
صبر	patience	6.89	4.80	5.33	4.88

صحن	saucer	7.00	1.36	1.50	1.25
صخرة	rock	7.00	1.49	1.84	1.48
صداقة	friendship	6.89	4.22	5.68	4.05
ضرورة	necessity	6.83	4.88	5.48	5.03
ضمير	conscience	6.81	5.91	6.57	5.91
ضوء	light	7.00	5.66	2.32	2.68
طاعة	obedience	6.84	6.08	5.15	5.52
طريق سريع	highway	7.00	1.84	2.07	1.93
طريقة	method	5.82	3.73	4.58	5.39
عار	dishonour	6.84	6.34	5.56	5.79
عاصفة	storm	7.00	2.64	4.21	2.79
عاطفة	emotion	6.90	5.07	6.44	4.42
عرض	offer	6.89	4.67	4.92	4.75
عسل	honey	7.00	1.76	1.85	1.84
عقل	reason	6.90	4.45	5.75	4.65
علاقة	relation	5.82	6.39	5.60	5.38
عملية	process	6.85	6.35	5.68	5.51
عهد	reign	6.87	6.43	4.94	5.50
عيادة	clinic	7.00	2.10	1.90	1.71
غضب	rage	6.91	4.29	5.07	3.39
غيرة	jealousy	6.87	4.70	5.50	5.15
فارق	distinction	6.83	5.96	5.22	5.40
فايرس	virus	6.87	4.94	2.76	3.22
فائدة	benefit	6.87	5.07	4.77	3.44
فترة	period	6.84	2.56	2.37	1.24
فتنة	temptation	5.82	4.45	5.39	5.18
فجر	dawn	6.91	2.18	2.12	1.66

فخر	pride	6.80	5.77	6.13	4.75
فرحة	delight	6.95	4.07	5.71	3.85
فضاء	space	7.00	2.18	4.34	3.72
فضيلة	virtue	6.80	6.23	6.08	5.46
فقر	poverty	6.90	4.08	5.05	4.37
فكرة	idea	6.85	6.66	6.52	6.06
قاطع	partition	6.87	1.70	1.92	1.79
قبول	approval	6.84	5.79	5.14	3.99
قدر	fate	6.81	6.59	6.79	6.84
قرار	decision	6.85	5.77	5.48	4.85
قطة	cat	7.00	1.41	1.63	1.39
قلم	pen	7.00	1.40	1.45	1.36
قمع	repression	6.85	5.64	5.10	5.26
قيمة	value	6.83	5.59	5.46	5.26
كرسي	chair	7.00	1.12	1.59	1.08
كره	hate	6.89	4.40	5.13	4.12
لابتوب	laptop	7.00	1.79	1.83	2.85
لعبة	game	7.00	4.97	2.28	2.07
لعنة	curse	5.82	6.25	6.23	5.17
لوحة اعلان	billboard	6.96	1.76	1.85	1.86
لوحة مفاتيح	keyboard	7.00	1.64	1.84	1.53
لياقة	fitness	6.87	4.08	4.53	3.63
مًساواة	equality	6.83	4.75	5.06	4.80
ماساة	tragedy	6.87	4.74	4.95	6.68
مدرسة	school	7.00	2.10	2.03	1.83
مدني	civilian	6.83	4.66	2.80	4.92
مدونة	blog	6.87	2.15	2.21	3.86

مرءاب	garage	7.00	1.60	1.73	1.43
مراعاة	deference	6.84	6.08	5.15	5.52
مرض	illness	5.82	3.87	4.29	4.04
مزاج	mood	5.82	5.62	5.68	5.38
نجاح	success	7.00	1.98	1.91	1.60
نزاع	conflict	7.00	2.19	2.24	2.01
نسيم	breeze	6.90	6.16	5.23	5.07
نظرية	theory	6.87	4.83	5.88	3.68
نقص	lack	6.89	4.89	5.32	4.14
هزيمة	defeat	7.00	1.76	2.06	1.39
وعد	promise	6.80	5.99	4.90	5.84
وفاء	loyalty	7.00	2.25	1.78	1.98
ولاء	allegiance	7.00	1.93	1.66	1.72
ياس	despair	6.90	4.33	4.70	4.71
Number of Items	N	201	201	201	201
Maximum rating	MAX.	7.00	6.83	6.91	6.89
Minimum rating	MIN	6.89	1.68	1.81	1.43
Mean values	Mean	6.95	3.02	3.19	2.92
Standard Deviation	SD	0.077781746	1.895046174	1.944543648	2.107178208

4. Appendix 4: Online Questionnaire samples

A sample of the experiment web pages for experiments one, two and three. This web page starts with two pages, namely: The information letter and concept form. Each of the rest of the web pages contains a task-based content which requires the subject to respond.

4.1. Information letter

Experiments information and consent

Bangor University, Bangor, Gwynedd LL57 2DG Tel: (01248) 351151 (main switchboard)
School: School of Linguistics and English Language +44 (0) 1248-382264
Programme: PhD in Linguistics
PhD project Title: Meaning Construction in Novel Conceptual Combinations
Supervisor: Professor Vyv. Fredrick Evans +44 (0)1248 383295
By: Mohamed Al Husain
This work investigates how humans represent and interpret abstract concepts individually and in utterances. We, hereby, invite you to take part in a number of tasks for which you get training sessions first. The same task may be repeated twice for getting more data.
You will be instructed, in the tasks, either to rate words such as "freedom" or "truth" according to some variables, describe their meaning by listing their features, make lexical choices and so on. Your involvement in these tasks is voluntary, and will take approximately one to two sessions on two successive days. Each session lasts for one hour of your time.
Before taking part in one task or more, you will attend training session to familiarize you with the topic, tasks and the software environment. At the end of the task, you will receive a detailed feedback about the task and 20000 ID bonus.
You may decline to participate in any task presented in the survey if you so wish without any penalty or loss.
All of the provided personal details are completely confidential.
Guided by the interest of this study in the statistical significance of the entire responses, you will not be identified individually in any way in this research. Rather, every participant will be coded anonymously as (participant 1, 2, 3, ..., n). So, there are no expected risks associated with your involvement in these tasks.
If you have any query, remark or concern about your involvement in this study, please contact the head of the department of Arab Language.

Next >>

Create your own survey for free with eSurv.org

4.2. Consent Form

Consent

Consent Form
I hereby give my consent to take part in one or more of the experiments being designed and presented by Mr M. Al Husain, as part of his PhD dissertation. I have decided to enrol in these tasks, based on the information leaflet I have read and completely understood. According to this information leaflet, my identity, personal details will be kept anonymous and facial features will be digitally masked by (blurring effect to cover the face). In the Information-Consent Letter, I understood that I have had the opportunity to ask for any additional details and have the right to withdraw this consent at any time with no consequences. My involvement or withdrawal will have no impact on my status in the department or the University. If I decline to participate in any of these tasks, I could alternatively participate in other to earn the same bonus.
I acknowledge that by signing this consent form or email it back to sender, I have read, understand and agree to participate.

By clicking NEXT,You confirm thatYou have read, understood and agreed to participate.

Programme Type (المرحلة الدراسية)

- **Undergraduate (جامعية)**
- **Postgraduate (دراسات عليا)**

Your Consent

	نعم (Yes)	لا (No)
هل تقبل المشاركة (Do you accept to participate)		

Reset

<< Back Next >>

4.3. Familiarity Task

Task 1: Familiarity : This task investigates how familiar are you with the concepts and their meaning. Whether you ahve come across them or experienced them physically or mentally

Add Logo

Please, rate the following words on a 7-point scale in terms of their familiarity; the task is to decide how easy or difficult it is to identify their meaning. How familiar you are with something has nothing to do with how much you like the referent that the word names it. Your familiarity with it has more to do with how much you know about the meaning of the word itself, or how often you encounter it, read about it, know every bit of its meaning and so on. Here's an example. Suppose the item is "Pulpit" and you have no idea what Pulpit is. In that case you should tick 1. If you know what it is, but feel that you are very unfamiliar with it, perhaps because you know almost nothing about it, or perhaps because you have hardly ever know about its meaning, you should tick 7.

Add Question

Edit | Copy | Move | Logic | Split Page | Delete

How familiar are you with the following concepts:

	1. never	2.	3.	4. adequatly	5.	6.	7. Very Familiar
منبر (pulpit)							
سلام (peace)							
شاشة (monitor)							
خوف (fear)							
حس (sense)							
حكومة (government)							
دخان (smoke)							
تسلسل (sequence)							
شجرة (tree)							
تغيير (change)							

Reset

4.4. Imageability Task

Mental Images

This task has to do with what mental images we have for the referents of words. The things for which we may have mental images are they simply exist in the world.

Do you have images in your mind for the following concepts? In other words, How imageable are these for you? Rate them on 1-7 scale.
You are to rate how concrete an apple is by ticking a number on this 7-point scale. A 1 means that you think the item is highly imageable as you have an image of it in your mind. A 4 means you feel the word could trigger an image in your mind but not clear enough to fit within imageable entities such as an apple. A 7 means you have no image of whatsoever in your mind for that word.

	1. Highly imageable	2.	3.	4. adequately imageable	5.	6.	7. No image at all
منبر (pulpit)							
سلام (peace)							
شاشة (monitor)							
خوف (fear)							
حس (sense)							
حكومة (government)							
دخان (smoke)							
تسلسل (sequence)							
شجرة (tree)							
تغيير (change)							

Reset

<< Back | Next >>

4.5. Reference-Type

Referent-Type

Reference-Type

This task has to do with whether the entities the words refer do/do not have any physical properties(such as colour, size, sound, smell, dimensions, etc). By entities that words serve to index we have in our minds the entities that inhibit the world such as people, artefacts, pain, ghost, angles, truth, faith, etc. However, a person has more physical properties than a pain and the latter has more physical properties that a ghost. We may draw/ hear/see a ghost but can't do the same with "faith". So, "faith" could be rated as ⊠ 7 while "Car" could be rated as ⊠ 1. A ghost and pain could get higher rating than "faith".

	1. physical	2.	3.	4.	5.	6.	7.non-physical
منبر (pulpit)							
سلام (peace)							
شاشة (monitor)							
خوف (fear)							
حس (sense)							
حكومة (government)							
دخان (smoke)							
تسلسل (sequence)							
شجرة (tree)							
تغيير (change)							

Reset

<< Back | Next >>

4.6. Verbal Coding

Verbal Coding

This task has to do with what definition we have in mind for words meaning. Verbal Encoding refers to how much explanations and rephrases you need to explain the meaning for such words as you think enough for the listener to understand them. Let's take the definition of words "repression" and "apple! , you are to rate how definable an apple is by ticking a number on this 7-point Likert scale. You may tick ☒ 7 for "repression" which means that you think the item is highly definable as you think it requires more explanations and rephrases to define its meaning. ☒ 1-point means you feel that the word requires less definition for the listener to understand its meaning.

This task has to do with how easy or difficult is it to define words' meaning. Verbal definition refers to how much explanations and rephrases you need to explain the meaning for such words as you think enough for the listener to understand them.

	1.Easy to define	2.	3.	4.	5.	6.	7.Hard to be define
منبر (pulpit)	☐	☐	☐	☐	☐	☐	☐
سلام (peace)	☐	☐	☐	☐	☐	☐	☐
شاشة (monitor)	☐	☐	☐	☐	☐	☐	☐
خوف (fear)	☐	☐	☐	☐	☐	☐	☐
حس (sense)	☐	☐	☐	☐	☐	☐	☐
حكومة (government)	☐	☐	☐	☐	☐	☐	☐
دخان (smoke)	☐	☐	☐	☐	☐	☐	☐
تسلسل (sequence)	☐	☐	☐	☐	☐	☐	☐
شجرة (tree)	☐	☐	☐	☐	☐	☐	☐
تغيير (change)	☐	☐	☐	☐	☐	☐	☐

Reset

<< Back | Next >>

4.7. Features Generation and Ranking

Concept Definition by Features Listing & Ranking

Our understanding of the meaning of a given concepts, "heart", can be expressed by offering brief definitions such as

It is a Body organ
It is red organ
Heart is part of the body
Heart is a cone shape
It is made of muscles
Heart beats
Heart pumps blood
It beats automaticallyIt is a Body organ

"If you are familiar with the concept given above, using single words and short utterances to describe it means" in the form of "X is Y" X has Y", or "X does Y", etc, as you have done in your training session.

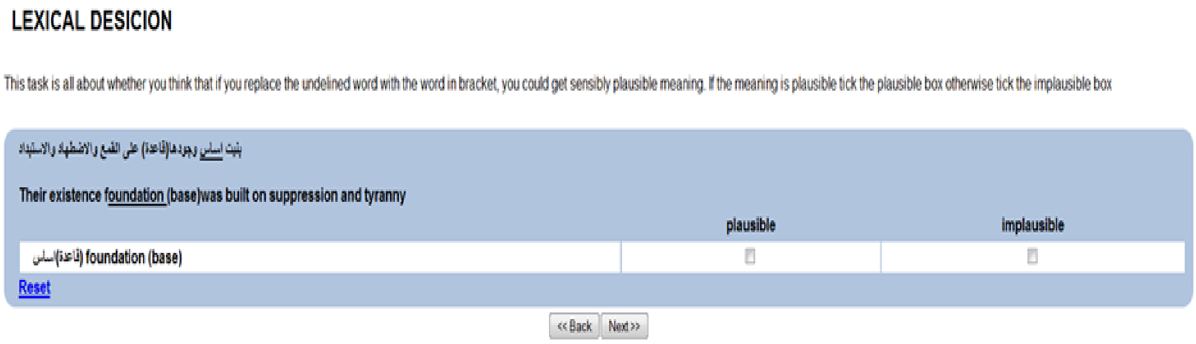
1. منبر (pulpit)

<< Back | Next >>

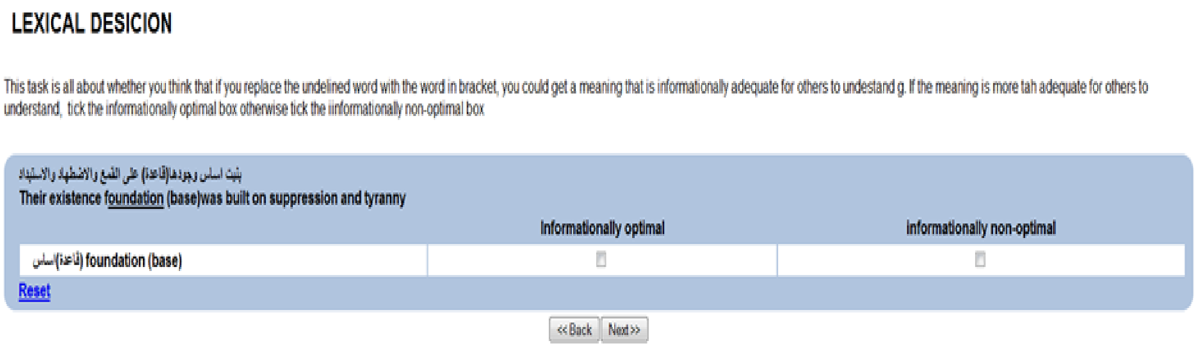
5. Lexical Decision

This web page has two embedded sub-pages, one addresses plausibility and the other addresses informational optimality.

5.1. Plausibility



5.2. Informativeness



5. Appendix 5: General statistical overview of Experiment 1

The following table illustrates the three word groups according to their lexico-semantic features: Mean rating, Standard deviation and Standard Error

Group Type	Word Group 1			Word Group 2			Word Group 3		
Lexico-semantic features	Imageability	Reference-Type	Verbal Coding	Imageability	Reference-Type	Verbal Coding	Imageability	Reference-Type	Verbal Coding
Mean	6.05	5.60	5.53	4.47	4.20	3.90	1.85	1.96	1.75
SD	0.567672	0.718984	1. 343503	0.383330	0.459804	1.499066	0.420515	0.279393	0.493570
SE	0.058599	0.096947	0.162923	0.059794	0.049015	0.170834	0.051377	0.037006	0.065956
N	68			77			56		

6. Appendix 6: Features Generation and Ranking

The raw stimuli for Experiment 2. The stimuli fall into three word groups.

Group 1	كرسي,(chair); شاي, (tea); جزر,(carrot); سرير,(bed); عيادة ,(clinic); مفكرة,(diary); مكتب,(office); جريدة,(newspaper); قاطع,(partition); نافذة,(window); قلم,(pen); مدونة,(blog); حطب,(log); خزانة,(cabinet); سلة, (basket); بَلاَط (tiles) ; صخرة, (rock); لوحة مفاتيح (keyboard); مِنْبَر, (pulpit); فجر,(dawn);
Group 2	فوق, (up) مرض (illness) تواصل (communication) مواجهه (encounter) مكافاءة (reward) جدال (dispute) ثناء (praise) ماساة (tragedy) اذى (harm) بؤس (misery) خوف (fear) حذر (alertness) اسفل (down) امام (Imam) ادعاء (allegation)

	اذلال	(humiliation)
	بهجة	(cheerfulness)
	غضب	(rage)
	كره	(hate)
	شفقة	(sympathy)
Group 3	تقوى	(piety)
	قدر	(fate)
	فكرة	(idea)
	امل	(hope)
	حقيقة	(truth)
	ايمان	(faith)
	فضيلة	(virtue)
	معرفة	(knowledge)
	توقع	(anticipation)
	ثقة	(trust)
	عقل	(reason)
	حس	(sense)
	منهاج	(approach)
	قملية	(process)
	صداقة	(friendship)
	ثقافة	(culture)
	علاقة	(relation)
	نقص	(lack)
	احتمال	(possibility)
	اساس	(foundation)

7. Appendix 7: Compositionality correlation with Plausibility and Informativeness

Compositional Structure (2-word)	Compositional Structure (4-word) & (6-word)	Source Lexical concept
منبرالاعتراف (confession pulpit) منبر الموتى (dead [people] pulpit)	منبر الأخوات التواصلي للحرية (sisters' pulpit for freedom)	كرسي (chair)
	منبر السلام العادل يعلن عن تفاهمات بينه و الحزب the pulpit of just peace announces understanding with the party	
سلة مهملات (Waste basket) سلة التطبيقات (applications basket)	اقر البرلمان سلة قوانين (the parliament indorsed a basket of laws)	زنبيل (scuttle)
	اوزع بين احبتي سلة همومي و احزاني (distribute my pains and distress basket among my folk)	
خزانة الملابس (clothes cabinet) خزانة الادب (literature cabinet)	يبحث تشكيل الكابينة الوزارية (discusses the formation of ministerial cabinet)	دولاب (Wardrobe)
	آراء الفراء النحوية في خزانة الأدب (Al-Fra'a opinions on literature cabinet)	
سرير ملكي (King bed) سرير الحياة (Life bed)	صحبة مع سرير مرضه (companionship with his illness bed)	فراش (mattress)
	اليمن الدبلوماسي على سرير الموت (Yemen diplomacy on death bed)	
مائدة البحث (research table) مائدة الجراح (surgeon table)	يجلسون على مائدة مستديرة (They sit on round table)	بساط (carpet)
	عملية السلام وسوريا وإيران على مائدة وزراء خارجية أوروبا (Peace process in Syria is now on the table of Europe exterior minsters)	
غياب الوعي (absent awareness) عمق الوعي (awareness depth)	يتسم بعمق الوعي موقف (position characterized by awareness depth)	ضمير Conscience
	الوعي المصرفي امتلاك المعرفة والمهارات التي تمكنك من اتخاذ القرارات المالية Banking awareness is having skills for taking financial decisions	
عتبة طفولته (history doorstep) عتبة المسجد (mosque doorstep)	صلاة الجمعة أمام عتبة المسجد (Friday prayers at the mosque doorstep)	خطوة (Footstep)
	صبي لم يتخطى عتبة طفولته ليدرك شبابه (a child who never passed his childhood doorstep to live his youth)	
سلطة القضاء (Judicial authority) سلطة الحب love authority)	قيل الكثير عن سلطة مؤقتة (Much is said about temporary authority)	قوة Strength
	الفعل تحكمه سلطة العقل (action is governed by reason authority)	

Compositional Structure (2-word)	Compositional Structure (4-word) & (6-word)	Source Lexical concept
ثقافة الغابة (jungle culture) ثقافة الكتب (bookish culture)	مواجهة ثقافة الإرهاب التي ابتليت بها الدول العربية (Face the terror culture which Arab states bear) على الجميع تعلم تقافة قبول الاخر (for us all to learn the culture of accepting the other)	تعليم (Education)
نافذة الأرض (earth window) نافذة تواصل (communication window)	تفتح نافذة القبر grave window is opened	باب (door)
آلهة بيضاء (white god) الهة السماء (heaven gods)	الهة النفس هواها (the self's god is its desires)	اله (God)
نقاش حواري (interactive argument) نقاش بناء (constructive argument)	اتسم اللقاء بنقاش معتدل (The meeting assumed a moderate argument) اليمن الدبلوماسي على سرير الموت (Yemen diplomacy on death bed)	جدل (dispute)
روح العصر (age spirit) روح النص (text spirit)	تأخذ روح العصر الى ضفاف الحكمة (takes the age spirit to wisdom banks) افكار لا تتلائم مع روح النص (ideas do not suit the text spirit)	نَفْس (soul)
حكمة اليوم (wisdom of the day) ضفاف الحكمة (wisdom Banks)	طلب الامين العام الاطراف المتحاربة التحلي بالحكمة (Secretary-General advised the conflicted parties to uphold wisdom)	(Patience)
نوم دافئ (warm sleep) بنوم طويل (a long sleep)	أساسيات *نوم* الطفل (the basics of child's sleep) هل نحن في *نوم طويل* أو هناك يأس من الخطابات السياسية (Are diving in a long sleep or despaired by the political address)	حلم (dream)
قلم ميت (dead pen)	ان ذلك من شطح القلم (All of this was a dead pen slip)	النَقل J.

شطح القلم (pen slip)	قلم طليق خير من لسان لايجيد بلوغ القصد (fluent pen is better that a tongue does not express intention)	

Compositional Structure (2-word)	Compositional Structure (4-word) & (6-word)	Source Lexical concept
بطن الأرض (earth belly) نطاب ديلا (hand palm)	كل شئ على ظهر الارض (everything on the earth back)	السماء (Sky)
	الماء يأتي من نافذة الأرض (water comes from the earth window)	
سط الدخان (amid smokes)	البرلمان وحطب الدخان (parliament and smokes logs)	النار (fire)
	أعمدة الدخان تتصاعد في الضاحية الجنوبية (smokes pillars from the southern area)	
تهور الكلمات (words heedlessness) صخب الكلمات (words yells)	لعبة الكلمات (Words game)	الحروف (letters)
	الكلمات وادي الحب، وادي الاستنارة Words are the valley of love and valley of enlightening)	
وراء القضبان (behind bars) ما وراء الاحداث (behind the events)	وراءهم يوم عظيم (behind them the judgement day)	امام (before, in front, ahead)
	ان وراء صمتي حكاية تدور اسمها الكبرياء (behind my silence a story its name the pride)	
خطوة مباركة (blessed step) خطوة الطفل الاولى (child's first step)	القمر يخطو خطواته الأخيرة (the moon takes its final step)	مشي (walk)
	خطوة عملاقة في طريق الاصلاح الديمقراطي (A gigantic step in the way to democratic reform)	
جيب القميص (Jacket pocket) قميص النوم (night shirt)	فقد تمزق قميصُ الليل (night shirt was torn away)	المعطف (jacket)
	الشعب خالعاً قميص العزة لابساً قميص الذلة (people took off the glory shirt and put on Humiliation shirt)	
سوار العسل (honey bracelet) سوار الذهب (gold bracelet)	تلبس سوار الياسمين (wears jasmine bracelet)	قيْد (shackles)
	اكسر سواركم الحديدي من يدي (I break your metal bracelet from my hand)	