A Contribution to the Understanding of Metaphor Comprehension by Latent Semantic Analysis

Romy van Kuijk
ANR: 107585

Bachelor's Thesis
Communication and Information Sciences
Specialization: Business Communication and Digital Media

Faculty of Humanities
Tilburg University, Tilburg

Supervisor: Dr. J. Schilperoord
Second Reader: Dr. M. M. P. Vanden Abeele

August 2014

Contents

Abstract

In the field of metaphor there is a discussion going on about what processes are involved in metaphor comprehension, mainly dominated by the Comparison view and the Categorization view. Furthermore, it is questioned how deeply categorical meanings are entrenched into the metaphor source. This exploratory study shows that Latent Semantic Analysis (LSA) can contribute to the understanding of metaphor comprehension. LSA is a mathematical method that uses co-occurrence data to say something about the semantic relatedness of different words or texts. The results of this study suggest that LSA can be used as an effective measurement tool to provide information about what processes are involved in metaphor comprehension, how deeply categorical meanings are entrenched into the metaphor source and how much people differ in their metaphor interpretations.

Introduction

In which way would you perceive the concept of love when hearing the metaphor LOVE IS A JOURNEY? You would probably perceive the concept of love in a different way than when hearing the metaphor LOVE IS WAR. In the case of LOVE IS A JOURNEY you would likely compare lovers to travelers, while you would perhaps compare lovers to rivals in the case of LOVE IS WAR. Lakoff and Johnson (1980) claim that our conceptual system is largely metaphorical and therefore our thoughts and our everyday experiences are very much a matter of metaphor. ''The essence of metaphor is understanding and experiencing one kind of thing in terms of another'' (Lakoff & Johnson, 1980, p. 455). A metaphor is typically defined as the mapping between two disparate conceptual domains, the target domain and the source domain (Lakoff, 1993). The metaphor target refers to the concept that borrows its properties and attributes from the source domain, in order to understand its meaning. In LOVE IS A JOURNEY the metaphor takes the form of X IS Y, in which X represents the target domain 'love' and Y the source domain 'journey'.

A considerable amount of research has been conducted on metaphor comprehension (e.g., Bowdle & Gentner, 2005; Glucksberg, 2003; Glucksberg & Keysar, 1990). On the one hand there is the comparison school of thought (e.g., Tversky, 1977; Miller, 1979) which assumes that metaphor comprehension is characterized by a property-matching process. According to this Comparison view people activate properties that are true for the metaphor target and source in isolation and start looking for shared properties between them. On the other hand there is the Categorization view which claims that metaphorical expressions are being understood as categorical assertions. This means that the metaphor source refers to both a basic-level concept and a super-ordinate conceptual category which subsumes the target (Glucksberg, 2003; Glucksberg & Keysar, 1990). According to this view, people activate a category consisting of a subset of properties of the metaphor source which can assign values to a set of dimensions of the target (Moreno, 2004). It is discussed by Bowdle and Gentner (2005) that conventional and novel metaphors are being processed in different ways.

Bowdle and Gentner (2005) argue that a source term may become polysemous when it is repeatedly used in a metaphorical context. The source term then refers to both a literal concept and associated metaphoric category. It is questioned whether categorical meanings

are only activated when the source is used in relation to the target domain or whether categorical meanings are perhaps so deeply entrenched into the metaphor source that the metaphoric category is automatically activated when using a specific source concept. For example, are categorical meanings such as ‘’a source of something valuable’’ automatically activated when thinking or talking about the concept ‘gold-mine’ *or* is the metaphoric category only activated when the source concept is being used in relation to the target?

This study attempts to provide new insights with regard to some of the uncertainties in the field of metaphor comprehension. In this exploratory study, it is suggested that Latent Semantic Analysis (LSA) can contribute to the debate that is currently going on in the field of metaphor. LSA is contextual theory of meaning which represents the meaning of a word by its relationship to other words (Landauer & Dumais, 1997). By looking at the co-occurrence of words or phrases in a large corpus of naturally produced language, LSA attempts to say something about their semantic relatedness. Kintsch (2000) earlier showed that LSA is capable of generating metaphor interpretations that are close to interpretations produced by humans. LSA can for example measure how closely related a metaphor target (e.g., ‘marriage’) and aspects of a metaphor source (e.g., roller-coaster: ‘up and down’ and ‘exciting’) are. Suppose that ‘marriage’ is found to be highly related to ‘up and down’ and ‘exciting’. This would mean that ‘marriage’ often co-occurs with ‘up and down’ and ‘exciting’ in language. Therefore suggesting that ‘marriage’ automatically activates the source-related properties ‘up and down’ and ‘exciting’ *or* that the source-related properties automatically activate the target concept ‘marriage’.

In this study it is examined to which extent interpretations of metaphorical expressions such as ‘’Susie and John are in a dead-end relationship’’, definitions and features of corresponding metaphor source terms (‘dead-end street’) are related to target and source terms. In other words, how closely related are metaphor interpretations (‘’there are problems in their relationship in which there is no way out anymore’’), definitions of the source (‘’a road which doesn’t continue’’) and features of the source (‘ending’, ‘u-turn’) to the metaphor target (‘relationship’) and source (‘dead-end street’)? The reason why this question is asked, is that it provides insights into the processes involved in metaphor comprehension. A high relatedness between a target term and literal aspects (i.e., definitions or features) of the metaphor source would for example indicate that when using a specific

target term, literal aspects which are true for the source domain in isolation are activated. This would raise support for the Comparison view. This view namely argues that in the interpretation process of metaphors, properties which are true for the metaphor target and source in isolation are activated, in order to search for common properties between them. On the other side, a high relatedness between a target term and metaphor interpretations would indicate that when using a specific target term, aspects which subsume both the target and source are activated. This would raise support for the Categorization view, since this view argues that in the comprehension process a super-ordinate category consisting of a subset of properties of the metaphor source which subsume the target is activated.

I am not only interested in how LSA can contribute to the understanding of the processes involved in metaphor comprehension, but I am also interested in how much difference there is between metaphor interpretations of different people. Again, I believe that LSA can contribute to the understanding of how similar people's metaphor interpretations are. LSA is a tool used to measure the semantic relatedness or similarity in meaning between different texts. Consequently, LSA should be able to compare different metaphor interpretations in terms of their similarity.

I will now briefly describe the outline of this paper. Firstly, a theoretical background will be sketched. Metaphor theory will be explained and previous research about metaphor comprehension will be discussed in detail. Subsequently, I will extensively explain how LSA serves as a model of meaning and why LSA can be used as an effective tool for this study. This is followed by the research questions and corresponding hypotheses. In the method section I will discuss in detail how the research has been conducted, which is followed by a discussion of the results. Lastly, some implications of this study are discussed and some recommendations for future research are given.

Theoretical Framework

Conceptual metaphor theory

A conceptual metaphor is defined as understanding one conceptual domain in terms of another conceptual domain (Lakoff, 1993). A conceptual domain is any coherent organization of experience (Kovecses, 2002). The conceptual domains involved in the conceptual metaphor are the target domain and the source domain. The target domain is the domain

that we try to understand through the use of the source domain. Conceptual metaphors typically have a more abstract concept as target domain and a more concrete concept as source domain. For example, in the conceptual metaphor LOVE IS A JOURNEY the abstract concept of love is understood in terms of the more concrete concept of journeys. Our experiences with the physical world serve as a foundation for the comprehension of more abstract concepts (Kovecses, 2002). According to the principle of unidirectionality, the metaphor process goes from the more concrete to the more abstract concept, but not the other way around (Kovocses, 2002).

Kovecses (2002) describes the relationship between conceptual metaphors and metaphorical linguistic expressions as follows: metaphorical linguistic expressions (e.g. ways of talking) are manifestations of the underlying conceptual metaphor (e.g. ways of thinking). For example, ''we are at crossroads,'' ''this relationship is a dead-end street,'' and ''we've gotten off track'' are metaphorical expressions which correspond to the conceptual metaphor LOVE IS A JOURNEY. Whereas metaphorical expressions such as ''this relationship is a dead-end street'' are used in our daily language, the wording LOVE IS A JOURNEY does not often occur in language as such.

Conceptual metaphors typically have the form TARGET DOMAIN IS SOURCE DOMAIN, in which there's a mapping from the source domain to the target domain. This mapping consists of a set of conceptual correspondences. Kovecses (2002) has indicated that the mapping from 'journey' to 'love' is characterized by the following set of conceptual correspondences:

Target: *love*		Source: *journey*
The lovers	correspond to	The travelers
The love relationship itself	corresponds to	The vehicle
Events in the relationship	correspond to	The journey
The progress made	corresponds to	The distance covered
The difficulties experienced	correspond to	The obstacles encountered
Choices about what to do	correspond to	Decisions about which way to go
The goal(s) of the relationship	corresponds to	The destination of the journey

These correspondences permit us to draw interferences between the two conceptual domains 'love' and 'journey', in which one can use knowledge about journeys to reason about love (Lakoff, 1993). In this way we are able to understand abstract concepts in terms of more concrete and comprehensible concepts.

The importance of metaphor

Metaphors are pervasive in our everyday life, not only in language, but also in the way we think and act (Lakoff & Johnson, 1980). It is a major and indispensable part of our ordinary, conventional way of conceptualizing the world (Lakoff, 1993). Communication is based on the same conceptual system that we use to think and act and therefore serves as an important source of evidence for what this system is like (Lakoff, 1993). In our everyday language we use a wide variety of metaphorical expressions which reflect our experiences. Many of our most mundane concepts, such as time, causation and states, are represented metaphorically, that is, in terms of other concepts (Lakoff, 1993). In order to fully understand an abstract concept we are better off using another concept that is more concrete, physical or tangible than the abstract concept (Kovecses, 2002). It seems almost impossible to imagine the difficulty, choice, goal or progress aspect of love without using our knowledge about journeys. This reflects how deeply rooted conceptual metaphors are in our ordinary way of conceptualizing the world.

Metaphor comprehension

Debate is still going on about how people understand metaphors. Traditionally, it is argued by Searle (1979) that people firstly derive the literal meaning from an utterance. Once the literal meaning is derived, it is assessed whether the literal meaning makes sense in the pragmatic context. Only if the literal meaning doesn't make sense alternative non-literal meanings are considered. According to this model literal false meanings must first be rejected before an alternative non-literal interpretation can be found. This suggests that literal meanings have unconditional priority and non-literal interpretations are optional (Glucksberg, 2003). However, this standard pragmatic view of metaphor comprehension is questioned since metaphorical utterances are being understood as quickly and easily as comparable literal expressions (e.g. Glucksberg, 1998; Gibbs, 1980). Furthermore, Glucksberg (1998) showed

that people automatically apprehend metaphorical meanings. Even when literal meanings are acceptable, such as the expression ''some surgeons are butchers'', people cannot suppress metaphorical meanings. Therefore metaphor comprehension is non-optional and automatic like any other kind of language comprehension, instead of being triggered by the failure of literal interpretations as is claimed by the standard pragmatic view (Glucksberg 2003).

According to the comparison school of thought (Tversky, 1977; Miller, 1979) people interpret metaphors by mentally converting them into similes. Consistent to this view the metaphorical expression ''my surgeon is a butcher'' would be converted into the literally true expression ''my surgeon is like a butcher''. After which people would start searching for shared properties between the target 'surgeon' and source 'butcher'. There are however a few concerns regarding the assumption that metaphors are treated as implicit comparisons. Literal comparisons are generally reversible, while metaphorical comparisons are not (Glucksberg & Keysar, 1990). Some metaphorical comparisons are reversible, but the meaning of the expression changes when it is reversed. Furthermore, the conversion-to-simile view of metaphor interpretation predicts a longer interpretation time for metaphorical expressions than for literal comparisons, since metaphors require an extra conversion step in order to understand them. However, a reaction time study (Johnson, 1996) showed that metaphorical expressions are comprehended significantly faster than literal comparisons. Apparently metaphors can be interpreted directly without mentally converting them into similes.

Moreover, Glucksberg (2003) showed that metaphorical expressions of the form X IS Y are interpreted somewhat differently than their simile counterparts. People mentioned the properties 'rare' and 'valuable' for the simile ''some ideas are like diamonds'', whereas people mentioned the properties 'insightful' and 'creative' for the metaphorical counterpart ''some ideas are diamonds''. This indicates that different kinds of properties are prominent for metaphors, namely properties that are not usually true for the metaphor source in isolation (Glucksberg, 2003). Furthermore, metaphorical expressions and their simile counterparts differ in meaning, since they do not share the same referent (Glucksberg & Haught, 2006). In the simile form ''my lawyer is like a shark'', the term 'shark' refers to the literal fish. 'Shark' in its metaphorical counterpart ''my lawyer is a shark'' refers to an abstract

category of predatory features. Glucksberg and Haught (2006) therefore conclude that comparison theories of metaphor comprehension are fundamentally flawed, because metaphors and their corresponding similes differ in interpretability and meaning.

An alternative view is proposed by Glucksberg and Keysar's Class-Inclusion model (1990). They claim that metaphorical expressions are being understood as categorical assertions. Metaphors involve dual reference, that is, the metaphor source refers to both a basic-level concept and a super-ordinate conceptual category which subsumes the target. This super-ordinate category consists of a subset of properties of the metaphor source which can assigns values to a set of dimensions of the target (Moreno, 2004). When people use the metaphorical expression ''my job is a jail'', their intended meaning is that their job belongs to a category that is referred to by 'jail' (Glucksberg & Keysar, 1990). 'Jail' simultaneously refers to a basic-level concept (a building that is used to detain criminals) and a super-ordinate category of situations that are unpleasant, confining and difficult to escape from (Glucksberg, 2003). Consequently, metaphorical expressions differ from literal comparisons, in that metaphorical expressions involve dual reference while literal comparisons or similes involve only a single mapping between the target and source.

It is however argued that conventional and novel metaphors are being processed in different ways. Bowdle and Getner's Career of Metaphor hypothesis (2005) proposes that there is a shift in mode of comprehension when a novel metaphor becomes widely used and familiar. In the beginning, a metaphor is understood by a process of comparison and property matching, but when a metaphor becomes conventionalized it can be understood directly as a categorical assertion. Conventionalized metaphors involve a source term that refers to both a literal concept and to a super-ordinate conceptual category. The processes that are involved in metaphor comprehension for novel and conventional metaphors are visualized in figure 1 (Bowdle & Gentner, 2005).

Sometimes the metaphor source is repeatedly used in relation to a specific target domain to such a degree that the target domain may become conventionally associated with the source. Most likely there used to be a time that a 'road-block' only referred to ''a barricade that is set up on the road''. However, over time, the term road-block has been repeatedly used and activated in relation to the target domain. As a result, obstacles to motion (a road- block acts as an obstacle to the movement of a car) have become to refer to

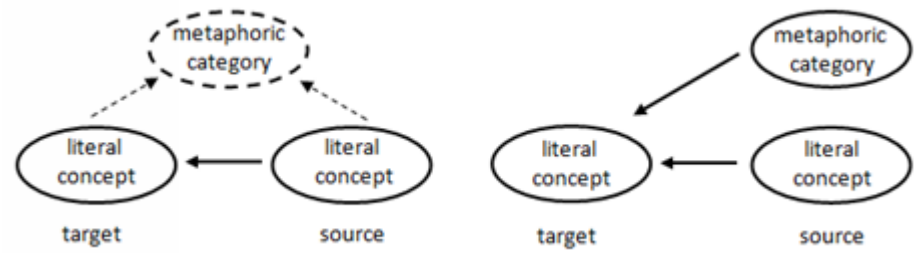

Figure 1. Processes involved in metaphor comprehension for respectively novel and conventional metaphors. Adapted from ''The Career of Metaphor,'' by B. F. Bowdle, and D. Gentner, 2005, Psychological Review, p. 209. Copyright 2005 by the American Psychological Association.

obstacles to action (an obstacle to meeting a goal). The conventionalized nature of the source is also reflected in the fact that dictionaries have decided to not only include the literal notion of road-block, but also the metaphorical notion ''something that stops the progress of a plan'' (''road-block,'' n.d.). The shift from novel to conventional metaphor may eventually lead to the dead of metaphors, which signifies the loss of any connection between the metaphoric category and the original source concept in people's mind (Bowdle & Gentner, 2005; Steen, 2008).

Furthermore, it is argued by Steen (2008) that metaphor processing depends on whether a metaphor is produced or received as deliberately metaphorical or not. Language use is metaphorically deliberate when it is consciously being selected to achieve a particular communicative or rhetorical effect by evoking a change in the addressee's perspective (Steen, 2008). In this sense ''a metaphor is used deliberatively when it is expressly meant to change the addressee's perspective on the referent or topic that is the target of the metaphor, by making the addressee look at it from a different conceptual domain or space, which functions as a conceptual source'' (Steen, 2008, p. 222). In addition, a metaphor would be experienced as deliberative when it is recognized as being a rhetorical device. Although, in general metaphors are not frequently produced as deliberatively metaphorical, deliberate metaphors are often found in poetry and music lyrics. Moreover, deliberative metaphors often occur in an X IS Y construction. Typical non-deliberate metaphors do not occur in X IS Y constructions and are not meant to overtly evoke a cross-domain mapping in the mind of the addressee to change the addressee's perspective on the referent (Steen, 2008). In the sentence ''the example wasn't clear'' *clear* isn't used in a deliberatively

metaphorical sense. In other words, *clear* isn't meant to evoke any aspects of the concrete domain of sight in the addressee's mind, but is meant to be interpreted as *illuminating*. In this way only deliberate metaphors may be processed by comparison and non-deliberate metaphors may be adequately understood by a process of categorization (Steen, 2008). Since most metaphors aren't used deliberatively, it is argued that ''a lot of metaphor may not be processed metaphorically, that is, with language users activating two comparable or parallel domains and retrieving or (re)constructing a mapping between them'' (Steen, 2008, p. 220).

Interpretative diversity of metaphor

The processes involved in metaphor comprehension are also indicated to be related to the interpretative diversity of figurative interpretations of target-source pairs (i.e., X IS Y or X IS LIKE Y). Interpretative diversity refers to the semantic richness of the figurative interpretation of a target-source pair. It depends on both the number of features involved in the interpretation and the uniformity of salience distribution of those features (Utsumi, 2005, 2007). Pairs that convey a large number of features shared by target and source are interpretatively more diverse than pairs that convey a small number of features shared by target and source. Moreover, a target-source pair that has a more uniform salience distribution is interpretatively more diverse than a target-source pair with a less uniform salience distribution of features. Consider the following two figurative statements: ''her cheeks are apples'' and ''your eyes are a lake''. Suppose that for the first expression the features 'round', 'red' and 'fresh' and for the second expression the features 'blue', 'trouble' and 'huge' are mentioned. According to the Interpretative Diversity view these target-source pairs would be equally diverse in terms of their semantic richness. However, suppose that for ''your eyes are a lake'' the feature 'trouble' is much more salient than the other two features, whereas for ''her cheeks are apples'' all features are equally salient. In this case ''her cheeks are apples'' is believed to be interpretatively more diverse, because its salience of features is more uniformly distributed. Utsumi (2007) showed that as the interpretative diversity of a target-source pair increases, the preference for and the relative comprehensibility of the metaphor form also increases. In other words, interpretative more diverse pairs are indicated to be comprehended as metaphors, that is, by a categorization

process. On the contrary, less interpretatively diverse pairs are indicated to be comprehended as similes, that is, by a comparison process. Earlier, the preference for metaphor or simile form of figurative statements has also been claimed to be dependent on the level of conventionality. People are found to prefer similes over metaphors for novel figurative statements, whereas they have a less strong preference for conventionalized figurative statements (Bowdle and Genter, 2005).

LSA as a model of meaning

From the previous sections it seems clear that the exact meaning of a word cannot be attributed to a word without taking into account the pragmatic context in which that word is used. Consider the semantic meaning of 'dark' in the following two sentences: ''Susie can't see well in the dark'' and ''Wouter was in the dark about their plans for the evening.'' In the first sentence 'dark' signifies the absence of light. 'Dark' has a more metaphorical meaning in the second sentence, namely that Wouter has no idea about tonight's plans. This example makes clear that one can't assign semantic meaning to the word 'dark' in isolation. This is in line with Wittgenstein's claim (1953) that word meanings can only be characterized by their family resemblance, that is, the way words are used in a discourse context.

Latent Semantic Analysis (LSA) is a mathematical method that basically uses the same underlying idea as Wittgenstein. It is a contextual theory of meaning that represents the meaning of a word by its relationships to other words in a high-dimensional semantic space. (Landauer & Dumais, 1997). A semantic space is a mathematical representation of a large body of text (Landauer, Foltz, & Laham, 1998). This large body of text, also called corpus, consists of about 37 000 documents, containing more than 92 000 word types. In this corpus, LSA considers the usage of words in the environment, assuming that words that occur close to each other are also close in meaning. By looking at word co-occurrence LSA attempts to tell something about their semantic relatedness.

Firstly, LSA constructs a co-occurrence matrix from the corpus, in which each row stands for a unique word and each column stands for a text passage or document. To demonstrate how such a matrix looks like, let us first consider the following text passages:

i Personality: What makes you the way you are

ii Personality plus: How to understand others by understanding yourself

iii Personality: Classic theories and modern research (5th Edition)

iv Personality types: Using the enneagram for self-discovery

v Personality (Psy 235 theories of personality)

vi Ten interesting things about human behavior

vii Personality

viii Gifts differing: Understanding personality type

ix Personality: Theory and research

x Personality psychology: Domains of knowledge about human nature, 4th Edition

xi The 16 personality types: Profiles, theory and type development

xii Discovering your personality type: The essential introduction to the enneagram, revised and expanded

These text passages are actually book titles. I searched for books at Amazone.com using 'personality' as a search term and took the top 12 book titles that appeared. At a single glance you can see that some words, such as 'personality' and 'theory', occur in multiple text passages. To see the frequency with which words occur in these text passages you can represent the text as a matrix. This co-occurrence matrix is shown in table 1.

Table 1

Co-occurrence matrix.

Word	i	ii	iii	iv	v	vi	vii	viii	ix	x	xi	xii
personality	1	1	1	1	2	0	1	1	1	1	1	1
research	0	0	1	0	0	0	0	0	1	0	0	0
type	0	0	0	0	0	0	0	1	0	0	1	1
types	0	0	0	1	0	0	0	0	0	0	1	0
understanding	0	1	0	0	0	0	0	1	0	0	0	0
enneagram	0	0	0	1	0	0	0	0	0	0	0	1
human	0	0	0	0	0	1	0	0	0	1	0	0
theory	0	0	0	0	0	0	0	0	1	0	1	0
theories	0	0	1	0	1	0	0	0	0	0	0	0

In this matrix, each row stands for a unique word and each column stands for a text passage (i-xii). The cells contain the frequency with which each word occurs in each text passage. For example, the word ‘personality’ occurs at least once in each text passage, except for text passage vi. Words that appear at least once in two or more text passages are marked. Words that do not contribute much meaning such as ‘and’, ‘the’ and ‘an’ are excluded. Note that the given matrix in table 1 is only used as an example to demonstrate how LSA represents a text as a matrix. In reality LSA uses a much larger corpus of written text as input for the co-occurrence matrix.

LSA transforms the statistics from the co-occurrence matrix into a high-dimensional space. Much information in the original word usage pattern is irrelevant. For example, authors can choose from multiple words when they write, but they choose to use a particular word and hereby automatically do not use an alternative. One author may use a specific word to describe a concept, while another author may use a different word to describe the same concept. This causes some noise in the word-concept relationship. LSA discards all the information in the original pattern of word usage that is accidental and inessential. LSA uses a mathematical technique called singular value decomposition for this purpose. It selects only the most important dimensions underlying the original co-occurrence matrix.

The large body of text I was talking about in the beginning of this section is now transformed into a high-dimensional semantic space. In this semantic space, word meanings and documents (such as sentences, paragraphs, essays or even book chapters) are represented as vectors. The cosine between two vectors can be measured in order to calculate the semantic relatedness of two vectors. A high cosine value represents a high semantic relatedness between two vectors and a low cosine value represents a low semantic relatedness between two vectors. The cosine value varies from -1 to 1, in which 0 signifies unrelatedness and 1 signifies identity. Readers unfamiliar with cosines can also think of cosine values as correlations. From now on, I will refer to these cosine values as correlations or similarity scores.

Suppose I want to know the semantic relatedness between the word ‘student’ and the intuitively related words ‘classroom’, ‘exam’, ‘university’ and the intuitively unrelated words ‘stone’ and ‘tractor’. LSA can compare the word ‘student’ to the intuitively related

and unrelated words in terms of how similar they are semantically. LSA has different applications to compute semantic relatedness. In this specific case we can use a one-to-many comparison of LSA. A one-to-many comparison allows you to compare the similarity of multiple terms or texts within a semantic space. One designated text ('student') is compared to all other texts ('classroom', 'exam', 'university', 'stone' and 'tractor') in terms of their similarity. LSA now generates similarity scores varying from -1 to 1 (0 signifies unrelatedness and 1 signifies identity) between 'student' and the other words. These similarity scores are shown in table 2[1].

Table 2

Similarity scores between 'student' and other terms.

terms	student
student	1.00
classroom	0.63
exam	0.40
university	0.27
stone	0.00
tractor	-0.02

Note. A correlation of zero signifies unrelatedness and a correlation of one signifies identity.
Note. A document-to-document space was used.

As you can see in table 2, the similarity score between 'student' and 'student' is one because these words are identical. The similarity scores between 'student' and the intuitively related words 'classroom', 'exam' and 'university' are respectively 0.63, 0.40 and 0.27. The similarity scores between 'student' and the intuitively unrelated words ''stone'' and ''tractor'' are respectively 0.00 and -0.02. Thus our intuitions regarding the semantic relatedness between the different words are confirmed by LSA. When comparing intuitively related words to 'student' LSA generates higher similarity scores than when comparing intuitively unrelated words to 'student' LSA. The more closely two words are related semantically, the higher their similarity score.

[1] Readers can check all correlations reported in this paper by using the applications of Latent Semantic Analysis on the website http://lsa.colorado.edu.

Now we have only correlated the word ‘student’ with respectively ‘classroom’, ‘exam’, ‘university’, ‘stone’ and ‘tractor’, but we can also compare all words to each other. LSA has a specific application which allows you to compare the similarity of multiple texts or terms to each other in a semantic space. This application is called matrix comparison and compares each text to all other texts. LSA again generates similarity scores varying from -1 to 1 for all terms. These similarity scores are shown in table 3.

Table 3

Similarity scores for all terms.

	student	classroom	exam	university	stone	tractor
student	1	0.63	0.40	0.27	0.00	-0.02
classroom	0.63	1	0.16	-0.09	-0.02	0.02
exam	0.40	0.16	1	0.19	0.08	0.04
university	0.27	-0.09	0.19	1	-0.06	0.03
stone	0.00	-0.02	0.08	-0.06	1	0.08
tractor	-0.02	0.02	0.04	0.03	0.08	1

Note. A correlation of zero signifies unrelatedness and a correlation of one signifies identity.
Note. A document space was used.

So, LSA is capable of comparing arbitrary words to other words, sentences or documents in terms of how close they are in semantic space. By looking at their co-occurrence LSA attempts to say something about their similarity in meaning. Words or texts that highly co-occur are assumed to be closely semantically related. LSA does however not take into account word order and therefore cannot distinguish the semantic difference between for example ‘’the cat was chased by the dog’’ and ‘’the dog was chased by the cat’’.

LSA applied to metaphor comprehension

Kintsch (2000) hypothesized that LSA should be able to understand metaphorical expressions in the same way as literal expressions, since metaphors can be directly understood like literal expressions. In his study, Kintsch (2000) compared ‘’my lawyer is a shark’’ and ‘lawyer’ with six relevant terms. Three of these terms were related to lawyer (*lawyer, justice, crime*) and three of these terms were related to shark (*shark, fish, vicious*). *Shark* and *fish* were chosen as inappropriate terms for the metaphorical shark and *vicious*

was chosen as an appropriate term for the metaphorical shark. Indeed, Kintsch (2000) showed that LSA produces metaphor interpretations that are close to interpretations produced by humans. 'Lawyer' by itself was found to be strongly related to *justice* and *crime*, not at all related to *shark* and *fish* and moderately related to *vicious*. Comparing ''my lawyer is a shark'' to the six terms, the relation for *justice* and *crime* remained strong, while *viciousness* was emphasized and *shark* and *fish* were found to have some relation with ''my lawyer is a shark''. These results indicate that ''my lawyer is a shark'' means something like ''my lawyer is vicious''. However, this is not the exact meaning that is intended, otherwise one might have said ''my lawyer is vicious'' in the first place. ''Thus, the meaning of a metaphor is not fully captured by a literal paraphrase, but is richer, more expressive, and fuzzier than corresponding literal expressions'' (Kintsch, 2001, p. 187).

Research questions

The aim of this exploratory study is to show that Latent Semantic Analysis can contribute to the debate that is going on in the field of metaphor comprehension. In order to understand how LSA can contribute to metaphor comprehension, we first have to fully understand the assumptions of the two main views dominating contemporary research. On the one hand, the Comparison view claims that metaphorical expressions are understood via a process of property matching. It assumes that properties which are true for the metaphor target and source in isolation are activated, in order to identify a match between these properties. Therefore, the metaphor target should be related to aspects that are true for the metaphor source in isolation – i.e., descriptions that are defining the source and literal features of the source. On the other hand, the Categorization view argues that metaphors are directly understood as categorical assertions. It assumes that a super-ordinate category, consisting of a set of properties of the source which subsume the target, is activated in the comprehension process. Therefore, the metaphor target should be related to metaphorical descriptions which subsume both the metaphor target and source (*met. descriptions*). Consequently, metaphorical expressions are suggested to be comprehended by a categorization process if the metaphor target is more closely related to *met. descriptions* than to *definitions* and *features* of the metaphor source. However, metaphorical expressions are suggested to be comprehended by a comparison process if the metaphor target is more

closely related to *definitions* and *features* of the source than to *met. descriptions*. In order to provide answers to this quandary, the following research question is addressed to in this study:

RQ1 How closely related are target and source terms to *met. descriptions*, *definitions* and *literal features* of the source?

And this is the point where LSA comes into play. Recall that LSA is a mathematical method that uses co-occurrence data to say something about the semantic relatedness of different words or texts. It assumes that words or texts that occur close to each other in language are also close in meaning. So, LSA is capable of comparing arbitrary words to other words or texts in terms of how closely related they are. Accordingly, LSA is also capable of comparing target and source terms to *met. descriptions*, *definitions* and *literal features* of the source in terms of their semantic relatedness. Note that LSA generates correlation scores varying from zero to one. Correlation scores close to zero indicate semantic unrelatedness – i.e., the correlated words or texts do not co-occur in language. Correlations close to one signify high semantic relatedness – i.e., the correlated words or texts do highly co-occur in language. Since language is based on the same conceptual system that we use to think and act, word co-occurrences indicate to which extent words are activated in each other's environment. You could for example correlate 'marriage' with ''it has ups and downs'' by LSA. A correlation score close to one would then indicate that the concept 'marriage' activates thoughts like ''it has ups and downs'' *or* that ''it has ups and downs'' activates the concept 'marriage' (correlation scores do not provide information about cause-effect relationships – i.e., ''*what* activates *what*?'').

Let's go back to the beginning of this section where I discussed the division in thoughts about the processes involved in metaphor comprehension. I explained that the Comparison and the Categorization view have different assumptions about which properties are activated in the process of metaphor comprehension. I also explained how these different assumptions lead to different expectations about the degree of relatedness between target and *met. descriptions, definitions* and *features* of the source. Now we have

also found a tool to test these expectations, namely Latent Semantic Analysis. Based on the theories discussed in this paper, it is hypothesized that:

H1 The metaphorical expressions in this study are comprehended by a comparison process if correlations for *target - definition/features* are higher than correlations for *target - met. descriptions*.

H2 The metaphorical expressions in this study are comprehended by a categorization process if correlations for *target - met. descriptions* are higher than correlations for *target – definition/features*.

In the theoretical framework I mentioned that metaphors are pervasive in the way we conceptualize the world. Because of the metaphorical nature of our conceptual system you could question whether certain concepts are that often being used in a metaphorical context that the metaphor source comes to refer to its metaphoric category. Bowdle and Gentner (2005) earlier discussed that the concept 'road-block' has been used in a metaphorical context that often, that it has come to refer to ''an obstacle to progress'' in general. This raises the question whether the metaphoric category is only activated when the source is used in relation to the target domain or whether it is also activated when the source is not used in relation to the target. The latter would indicate that categorical meanings are deeply entrenched into the metaphor source. Again, LSA might contribute to answering this question. LSA could correlate the metaphor source with literal aspects of the source (*definitions* and *literal features*) and *met. descriptions* in order to measure their semantic relatedness. A high semantic relatedness between the metaphor source and literal aspects of the source would indicate that the source concept highly activates literal meanings. On the contrary, a high semantic relatedness between the metaphor source and *met. descriptions* would indicate that the source concept highly activates metaphoric categorical meanings. It is therefore hypothesized that:

H3 If metaphoric categorical meanings are deeply entrenched into the metaphor source, correlations for *source – met. descriptions* are higher than correlations for *source – definition/features*.

All this time I have been talking about the processes involved in metaphor comprehension, ignoring the main characters in this story, namely the people who are actually doing the interpretation work. Let us just forget how people arrive at their metaphor interpretations for a moment and focus on how much people differ in their interpretations. Utsumi (2005, 2007) earlier studied how interpretatively diverse people's metaphor interpretations are by looking at what properties people mention and how uniformly the salience of these properties is distributed. To my knowledge, previous research has not examined the degree of similarity (or lack of similarity) of metaphor interpretations with the use of a mathematical method like LSA before. It is therefore aimed to answer the following question by LSA:

RQ2 How much do people differ in their metaphor interpretations?

LSA is capable of comparing multiple words or texts to each other in terms of their similarity. Accordingly, LSA should also be capable of comparing metaphor interpretations generated by different people in terms of their similarity. For each metaphorical expression, LSA could compare interpretations of different people to each other. A correlation score of zero would signify dissimilarity and a correlation score of one would signify identity. It is therefore hypothesized that:

H4 LSA will generate higher correlations for interpretations of metaphorical expressions that are interpreted in very similar ways than for metaphorical expressions that are interpreted in very different ways.

Method

Participants

Participants were personally approached and participated in the experiment on a voluntary

basis. A total of 27 students, of which 19 undergraduate and 8 graduate, participated. 19 (70,4%) of all participants were female and 8 (29,6%) were male. Age ranged from 19 to 28 years, with a mean age of 22. The youngest female participant was 20 years old, whereas the youngest male participant was 19 years old. Among the female participants the oldest participant was 28 years old and among the male participants the oldest participant was 24 years old. 27,0% of all participants was Dutch, 14,8% of all participants was American and the remaining participants had a Turkish (11,1%), Canadian (7,4%), Singaporean (3,7%), Portuguese (3,7%), Mexican (3,7%), Italian (3,7%), Pakistan (3,7%), German (3,7%), Finnish (3,7%) or British (3,7%) nationality. 37,0% of all participants had a Dutch mother tongue, 25,9% was a native English speaker, 11,1% was a native Turkish speaker and the remaining participants had either a German, Finnish, Chinese, Italian, Arabic, Spanish or Portuguese mother tongue. All students were either native or proficient speakers of English. More specific, 1 participant had a B2 (upper intermediate) level according to the Common European Framework of Reference for Languages (CEFR). 10 participants had a C1 level according to CEFR, which signifies effective operational proficiency in English. 3 participants had a C2 level according to CEFR, which signifies mastery or proficiency in English. The English proficiency level according CEFR from the remaining participants was unknown. Participants were asked to rate how frequently they read, write and speak English on a five-point scale (ranging from 1, not at all to 5, all the time). On average, participants scored respectively 4.37 (*SD= 0.742*), 4.15 (*SD= 0.864*) and 3.85 (*SD= 1.199*) on reading, writing and speaking frequency. Reading, writing and speaking scores were transformed into one variable in order to asses English usage frequency. On average, participants scored 4.12 (*SD= 0.868*) on English usage frequency on a five-point scale (ranging from 1, not at all to 5, all the time). A sufficient level of English proficiency was required since the experiment was abducted in English and demanded high cognitive involvement in English. All participants were currently studying at a university level. 44,4% of all participants was exchange student.

Material

A questionnaire was constructed on Thesistools.com to examine participants' associations towards metaphorical expressions and literal interpretations of the corresponding source terms. Sixteen metaphorical expressions were constructed for the experiment. They were

inspired by the second draft version of the Master Metaphor List (Lakoff, Espenson & Schwartz, 1991) and previous research conducted on metaphor. All metaphorical expressions were manifestations of four conceptual metaphors: LIFE IS A JOURNEY, LOVE IS A JOURNEY, IDEAS ARE FOOD and EMOTION IS TEMPERATURE. For example, the metaphorical expression ''the past few years have been a marathon for John'' was used for the conceptual metaphor LIFE IS A JOURNEY. ''Wouter and Susie's marriage was a roller-coaster ride'' was one of the metaphorical expressions underlying the conceptual metaphor LOVE IS A JOURNEY. ''Tom's novel is the caviar of the book world'' was one of the metaphorical expressions used for the conceptual metaphor IDEAS ARE FOOD and ''During the discussion Wouter erupted'' was one of the metaphorical expressions underlying the conceptual metaphor EMOTION IS TEMPERATURE. In addition, all source terms corresponding to the metaphorical expressions were used in this study. A list of all metaphorical expressions and their corresponding source terms can be found in appendix I.

The questionnaire included a total of eight metaphorical expressions, so each participant only saw half of the metaphorical expressions that were constructed. Furthermore, the questionnaire included a total of eight single terms. The terms used in the experiment consisted of source terms corresponding to the metaphorical expressions that were constructed. Participants never saw a source term that they had seen before in one of the metaphorical expressions, in order to avoid interference effects. So if a participant saw the metaphorical expression ''Wouter and Susie's marriage was a roller-coaster ride'' he or she never saw the source term 'roller-coaster ride'.

Instruments

The questionnaire consisted of a descriptive and an experimental part. In the descriptive part participants were asked for their personal data: age, gender, current educational level, nationality, mother tongue and English proficiency. Participants had to indicate how frequently they used English. Participants were asked to rate how often they read, write and speak English on a five-point scale (ranging from 1, not at all to 5, all the time). Participants were also asked for their English level according to CEFR. Furthermore, participants were asked whether they were currently on exchange.

The experimental part was divided in two parts. In the first part participants were exposed to eight metaphorical expressions. Participants had to generate interpretations of the metaphorical expressions. Each time participants were asked to interpret the target in terms of the source: ''Why can you compare *target* to *source*?'' Participants had to generate as many associations as possible. Interpretations of metaphorical expressions corresponding to the conceptual metaphors LIFE IS A JOURNEY, LIFE IS A JOURNEY, IDEAS ARE FOOD and EMOTION IS TEMPERATURE were each measured by four items.

In the second part participants were exposed to eight terms in isolation. The terms consisted of the source term corresponding to one the metaphorical expressions used. Participants had to generate literal associations for the terms. Each time participants were asked to define the term: ''How would you define *source term*?'' For each conceptual metaphor, literal interpretations of the source term were measured by four items. Furthermore, participants were asked to list three features for each term: ''Please list three features of *source term*.'' Features of the source term were also measured by four items for each conceptual metaphor. All items can be found in appendix I.

LSA was used as a tool to measure how closely semantically related target and source terms were to metaphor interpretations, definitions and features of the source generated by participants. LSA was also used to compare participants' individual metaphor interpretations in terms of their similarity. Furthermore, IBM SPSS Statistics 20 was used to analyze the data generated by LSA.

Procedure

Participants were personally approached and participated in the experiment on a voluntary basis. They were sent an e-mail with a link to the online questionnaire. Firstly, they were informed about the aim of the study, as well as the duration of the experiment and what they could expect during the experiment. By participating in the study, participants gave permission for the use of their answers for research purposes. They were guaranteed that the collected data would be processed anonymously.

Firstly, participants were asked for some personal details (such as age, gender, current educational level, nationality, mother tongue and English proficiency). Subsequently, they had to read a detailed task description for the first part of the experimental

questionnaire. An example was given to clarify what was expected from the participants. Eight metaphorical expressions were presented to the participants and they had to generate interpretations for each metaphorical expression. Each time they had to answer the following question: ''Why can you compare *target* to *source*?'' Participants were asked to write down as many interpretations as possible. Participants were then presented with another detailed task description and corresponding example for the second part of the experimental questionnaire. They were exposed to eight terms in isolation and had to generate literal interpretations for each term. Furthermore, they had to list three features for each the term. It was emphasized that they had to generate literal interpretations and they should avoid figurative associations. Participants could proceed at their own pace trough the questionnaire.

After the last question it was announced that participants had completed the tasks. By clicking on the submit button their answers were submitted. Finally, participants were thanked for their participation.

Research design

Participants were exposed to as well metaphorical expressions as to the corresponding source terms. Therefore a within-subject design was used. In total there were two versions of the questionnaire. In one version participants were exposed to the equal numbered metaphorical expressions and the unequal numbered source terms. In the other version participants were exposed to the unequal numbered metaphorical expressions and the equal numbered source terms. Consequently, participants never saw a source term that they had seen before in one of the metaphorical expressions. They were randomly assigned to one of the two versions.

Data analysis

Firstly, metaphorical expressions together with their interpretations and source terms together with their literal interpretations were listed in a well-ordered way. The data were slightly modified since LSA cannot recognize certain words and grammatical constructions such as abbreviations. Therefore, constructions such as *isn't*, *doesn't* and *won't* had to be modified into respectively *is not*, *does not* and *will not*. Furthermore, names were deleted

and replaced by appropriate pronouns. For example, ''Elisabeth and Tom have many ups and downs in their relationship'' was altered in ''they have many ups and downs in their relationship''. Moreover, some interpretations generated by participants had to be deleted since they flawed the LSA results. In some cases participants had listed features for the term in isolation when they were asked to define the given term. For example, one participant had quoted 'full' when he was asked to define a three-course meal. In other cases the given definitions were inappropriate for the term. For instance, one participant defined caviar as 'baby shrimps'. These data were removed in order to prevent data from being flawed.

There were three conditions: one condition in which participants were asked to generate metaphor interpretations, one condition in which participants were asked to define the source term and one condition in which participants were asked to list features of the source term. I will refer to these conditions as respectively *metaphor biased*, *definition source* and *feature source*. For *metaphor biased* the target and source term were correlated with metaphor interpretations generated by participants. For each metaphorical expression a one-to-many comparison test of LSA was used to compare respectively target and source term to metaphor interpretations for each participant. For *definition source* the target and source term were correlated with definitions of the source term generated by participants. For each metaphorical expression a one-to-many comparison test of LSA was used to compare respectively target and source term to definitions of the source term for each participant. For *feature source* the target and source term were correlated with features of the source term generated by participants. For each metaphorical expression a one-to-many comparison test of LSA was used to compare respectively target and source term to features of the source term for each participant. For each condition, an average was taken from the correlations between target/source terms and data from individuals. By correlating target and source terms with the three conditions, it was aimed to examine the extent to which target and source terms co-occur with the three conditions.

Correlations for *metaphor biased* were systematically heightened due to absolute repetitions of target and source terms. Participants mentioned target and source terms when interpreting metaphorical expressions. As a consequence, LSA generated higher correlations. To demonstrate how absolute repetitions of target and source terms systematically heightened correlations, let us first have a look at table 4. In table 4 several

metaphor interpretations of the metaphorical expression ''their marriage was a roller-coaster ride'' are correlated with the source term 'marriage'.

Table 4

Metaphor interpretations correlated with target term.

Metaphor interpretations	marriage
Their marriage was full of unexpected events.	0.74
It was full of unexpected events.	-0.04
A lot of things happened in their marriage that they did not expect.	0.58
A lot of things happened they did not expect.	-0.01
Unforeseen things happened in their marriage.	0.66
Unforeseen things happened.	-0.03

Note. A correlation of zero signifies unrelatedness and a correlation of one signifies identity.
Note. A document-to-document space was used.

Note that the metaphor interpretations ''their marriage was full of unexpected events'' and ''it was full of unexpected events'' semantically have the same meaning: 'it' refers to 'marriage'. However, there is a huge difference in correlation size when correlating these semantically identical metaphor interpretations with 'marriage'. Correlations are respectively 0.74 and -0.04, indicating that the first metaphor interpretation is closely semantically related to the source and the second metaphor interpretation is not at all related to the source. So, absolute repetition of the source term 'marriage' has a corrupting effect on the correlation size.

In order to purely measure to which extent target and source terms co-occur with metaphor interpretations, absolute repetitions of the target term were deleted in case of correlating target terms with metaphor interpretations. Absolute repetitions of the source term were deleted when correlating source terms with metaphor interpretations. After removal of absolute repetitions data were presented to LSA for a second time. Removal of absolute repetitions lead to more accurate correlations.

Planned Analyses

To test H1 (corr. *target – definition/features* > corr. *target – met. descriptions*) and H2 (corr. *target - met. descriptions* > corr. *target – definition/features*) it was examined whether there

were any differences in mean correlations between target and the three conditions (*metaphor biased, definition source* and *feature source*). A paired sample t-test was used to compare the mean correlations of *target – metaphor biased* to the mean correlation scores of *target – definition source* and *target – feature source*. To test H3 (corr. *source – met. descriptions* > corr. *source – definition/features*) it was examined whether there were any differences in mean correlations between source and the three conditions. A paired sample t-test was used to compare the mean correlations of *source – metaphor biased* to the mean correlations of *source – definition source* and *source – feature source*.

Results

Target and source terms correlated with the three conditions

Asking people to generate metaphor interpretations and interpret terms in isolation has lead to an impressive and rich dataset. Target and source terms were correlated with the three conditions (*metaphor biased, definition source* and *feature source*). The mean correlation scores for each metaphorical expression are shown in table 5. The total mean correlation scores of target correlated with *metaphor biased*, *definition source* and *feature source* were all close to zero, respectively 0.044, 0.009 and 0.008. A paired sample t-test demonstrated that the mean correlation scores of *target - metaphor biased* were significantly higher than the mean correlation scores of *target - definition source* ($t(15) = 6.17$, $p < .001$) and *target - feature source* ($t(15) = 5.22$, $p < .001$). There was found no difference in mean correlation scores between *target - definition source* and *target - feature source*, $t(15) = .08$, $p = .94$. More concrete, the target was more closely related to *metaphor biased* than to *definition source* and *feature source*. There was no difference in semantic relatedness between *target - definition source* and *target - feature source*. This pattern was found for all metaphorical expressions, except for ''he had reached a boiling point''. For this metaphorical expression, mean correlation scores of *target - metaphor biased* were lower than mean correlation scores of *target - definition source* and *target - feature source*.

A paired sample t-test demonstrated that the mean correlation scores of *source - definition source* were significantly higher than the mean correlation scores of *source - metaphor biased*, $t(15) = 9.11$, $p < .001$. The mean correlation scores of *source - feature source* were also significantly higher than the mean correlation scores of *source - metaphor*

Table 5

Target and source terms correlated with the three conditions (metaphor biased, definition source and feature source).

Metaphorical expression	Metaphor biased		Definition source		Feature source	
	target	source	target	source	target	source
Her life has been a meandering river.	0,033	0,163	-0,002	0,424	0,026	0,196
After university he was at cross-roads.	0,059	0,019	0,012	0,303	0,005	0,199
He sails trough life.	0,052	0,018	0,020	0,382	0,036	0,220
The past few years have been a marathon.	0,029	0,053	-0,018	0,295	-0,023	0,245
Their relationship has been a bumpy road.	0,008	-0,006	-0,011	0,718	-0,024	0,211
Their marriage was a roller-coaster ride.	0,043	0,077	0,016	0,512	0,007	0,304
They are in a dead-end relationship.	0,050	0,058	0,011	0,560	-0,008	0,164
His affair was a road-block in his marriage.	0,074	0,002	-0,009	0,495	0,010	0,251
The lecture was a three-course meal.	0,030	0,145	0,012	0,585	0,006	0,346
She put a lot of spice in her idea.	0,028	0,039	0,003	0,104	0,002	0,045
His novel is the caviar of the book world.	0,053	0,070	0,005	0,442	0,011	0,316
Chapter two of the book was a meaty one.	0,023	0,026	0,003	0,276	-0,007	0,171
He had reached a boiling point.	0,024	0,007	0,038	0,468	0,060	0,190
During the discussion he erupted.	0,021	0,130	0,006	0,733	-0,008	0,442
The crowd was all fired up.	0,113	0,051	0,051	0,384	0,030	0,176
He was having a heated debate with his boss.	0,059	0,013	0,002	0,197	0,011	0,156
Total mean	0,044	0,054	0,009	0,430	0,008	0,227

Note. A correlation of zero signifies unrelatedness and a correlation of one signifies identity.
Note. A document-to-document space was used.
Note. Names are replaced by appropriate pronouns.

biased, t(15) = 8.77, p< .001. The mean correlation scores of *source - definition source* were significantly higher than the mean correlation scores of *source - feature source*, t(15) = 6.36, p< .001. More concrete, the source was more closely related to *definition source* and *feature source* than to *metaphor biased*. The source was more closely related to *definition source* than to *feature source*.

Differences within the three conditions

The total mean correlation of *target - metaphor biased* was 0,044 and the total mean correlation of *source - metaphor biased* was 0,054. A paired sample t-test demonstrated that there was no difference in correlations between *target - metaphor biased* and *source - metaphor biased*, t(15) = .67, p = .51. The total mean correlation of *target - definition source* was 0.009 and the total mean correlation of *source - definition source* was 0,430. Mean correlation scores for *source - definition source* were significantly higher than mean correlation scores for *target - definition source*, t(15) = 9.66, p< .001 (effect consistency = 100 percent). The total mean correlation of *target - feature source* was 0.008 and the total mean correlation of *source - feature source* was 0,227. Mean correlation scores of *source - feature source* were significantly higher than mean correlation scores of *target - feature source*, t(15) = 8.97, p< .001 (effect consistency = 100 percent).

Similarity of metaphor interpretations

On first sight metaphor interpretations generated by participants look a lot like each other. Participants mentioned similar properties when they were asked to compare target to source. For the metaphorical expression ''Susie's life has been a meandering river'' participants interpreted Susie's life as ''full of unexpected events, difficulties and different choices''. Susie's life was also characterized as ''lacking clear direction'' and ''uncertain''. Moreover, several participants mentioned that Susie's life is ''full of bad and good events'' and that she tried many things in her life. Participants' individual metaphor interpretations for ''Susie's life has been a meandering river'' are shown in table 6. An overview of participants' interpretations for all metaphorical expressions can be found in appendix II.

Table 6

Participants' interpretations for the metaphorical expression ''Susie's life has been a meandering river.''

Susie's life has been a meandering river. *Why can you compare Susie's life to a meandering river?*	
i	Because Susie is always wandering and flowing and does not have a clear direction.
ii	Maybe because she has had many difficulties and big choices, just like a meandering river that is hard to go through.
iii	Like a meandering river, life knows its turns, due to all kind of events and experiences a person goes through, throughout his life.

iv	Always something happened which she didn't expect/planned. She had many different choices in her life. She wasn't happy all the time, tried many things, and maybe she now found the thing which makes her happy.
v	Because unexpected things happen in her life, just like the curves of the river. Because she takes life, as good or bad as it gets. The river is sometimes fine and stable and sometimes it takes a curve.
vi	Susie's life has taken a lot of twists and turns for better or for worse.
vii	Susie's life has lacked direction and goals.
viii	Just like a meandering river with unexpected curves, Susie's life is also full of unexpected events and things. The river goes its own way, just like Susie does. Susie's life is filled with bad and good things, and the meandering river characterizes the good and bad parts of life.
ix	Because Susie switches path quickly. Suzy goes with the flow, without a clear purpose.
x	Susie's life is never straightforward. Susie can never clearly see what is ahead of her.
xi	She has many ups and downs in her life.
xii	Susie's life has been with ups and downs. Susie's life hasn't always been certain. Susie has done many different things in her life.

For each metaphorical expression, metaphor interpretations for each participant were compared to each other by a matrix comparison of LSA. The similarity scores for metaphor interpretations (i-xii) of ''Susie's life has been a meandering river'' are shown in table 7. As you can see in table 7, similarity scores for interpretations of this metaphorical expression ranged from 0.13 to 0.89. Metaphor interpretations i and iii were the most different. Metaphor interpretations v and viii were the most similar. A correlational average was taken from all participants' interpretations for ''Susie's life has been a meandering river'' and was 0.491.

Table 7

Similarity scores for interpretations of the metaphorical expression ''Susie's life has been a meandering river.''

	i	ii	iii	iv	v	vi	vii	viii	ix	x	xi	xii
i	1	0.30	0.13	0.49	0.36	0.39	0.55	0.34	0.61	0.57	0.49	0.44
ii	0.30	1	0.46	0.40	0.60	0.34	0.27	0.64	0.32	0.34	0.39	0.37
iii	0.13	0.46	1	0.14	0.57	0.37	0.32	0.62	0.16	0.19	0.24	0.29
iv	0.49	0.40	0.14	1	0.49	0.55	0.52	0.53	0.47	0.74	0.76	0.81
v	0.36	0.60	0.57	0.49	1	0.49	0.37	0.89	0.37	0.48	0.49	0.52
vi	0.39	0.34	0.37	0.55	0.49	1	0.64	0.52	0.34	0.60	0.72	0.71
vii	0.55	0.27	0.32	0.52	0.37	0.64	1	0.40	0.33	0.63	0.69	0.65
viii	0.34	0.64	0.62	0.53	0.89	0.52	0.40	1	0.36	0.50	0.54	0.58

ix	0.61	0.32	0.16	0.47	0.37	0.34	0.33	0.36	1	0.59	0.53	0.40
x	0.57	0.34	0.19	0.74	0.48	0.60	0.63	0.50	0.59	1	0.87	0.76
xi	0.49	0.39	0.24	0.76	0.49	0.72	0.69	0.54	0.53	0.87	1	0.88
xii	0.44	0.37	0.29	0.81	0.52	0.71	0.65	0.58	0.40	0.76	0.88	1

Note. A correlation of zero signifies unrelatedness and a correlation of one signifies identity.
Note. A document space was used.

The mean similarity scores for all metaphorical expressions are shown in table 8. Similarity scores ranged from 0,227 to 0,509 (see column 2). Note that the mean similarity scores indicate the variance in interpretation between metaphorical expressions - i.e., the interpretations of some metaphorical expressions are distributed in more similar ways than others. The metaphorical expression ''he was having a heated debate with his boss'' had the lowest similarity score of all metaphorical expressions. ''Their marriage was a roller-coaster ride'' had the highest similarity score of all expressions.

Table 8

Similarity scores for metaphorical interpretations generated by participants.

Metaphorical expression	Mean	SD	Minimum	Maximum
Her life has been a meandering river.	0,491	0,178	0,13	0,89
After university he was at cross-roads.	0,359	0,132	0,08	0,78
He sails trough life.	0,381	0,170	0,12	0,90
The past few years have been a marathon.	0,316	0,161	0,06	0,68
Their relationship has been a bumpy road.	0,397	0,194	0,04	0,89
Their marriage was a roller-coaster ride.	0,509	0,212	0,10	0,90
They are in a dead-end relationship.	0,396	0,202	0,08	0,88
His affair was a road-block in his marriage.	0,399	0,205	0,00	0,88
The lecture was a three-course meal.	0,287	0,134	0,06	0,74
She put a lot of spice in her idea.	0,418	0,182	0,16	0,90
His novel is the caviar of the book world.	0,299	0,182	0,03	0,84
Chapter two of the book was a meaty one.	0,274	0,207	-0,06	0,83
He had reached a boiling point.	0,385	0,246	0,00	0,90
During the discussion he erupted.	0,435	0,212	0,03	0,82
The crowd was all fired up.	0,243	0,245	-0,05	0,86
He was having a heated debate with his boss.	0,227	0,172	-0,02	0,78

Note. A correlation of zero signifies unrelatedness and a correlation of one signifies identity.
Note. Names are replaced by appropriate pronouns.

The standard deviation for each metaphorical expression is given in the third column. The standard deviation provides more information about the degree of agreement among participants – i.e., it indicates the variance in interpretation within each metaphorical

expression. The metaphorical expression ‘’after university he was at cross-roads’’ had the lowest standard deviation and ‘’he had reached a boiling point’’ had the highest standard deviation. More concrete, participants agreed the most about how ‘’after university he was at cross-roads’’ should be interpreted and agreed the least about how ‘’he had reached a boiling point’’ should be interpreted. Similarity scores for interpretations of the former expression varied from 0.08 to 0.78. Similarity scores for interpretations of ‘’he had reached a boiling point’’ were characterized by more extremes. Interpretations of participants that were the most different had a similarity score of 0.00 and interpretations of participants that were the most similar had a similarity score of 0.90. For each metaphorical expression, some participants highly agreed and some participants highly differed in their interpretations, characterized by the minimum and maximum similarity scores (shown in respectively column 4 and 5).

Conclusion

Several theories have addressed the question what kind of processes are involved in metaphor comprehension. Contemporary research is dominated by two theories: the Comparison and the Categorization theory. The Comparison view argues that metaphors are comprehended by a process of property matching. It assumes that properties which are true for the metaphor target in isolation and properties which are true for the metaphor source in isolation are activated, in order to identify a match between these properties. The Categorization view argues that a super-ordinate category of the metaphor source which subsumes the target is activated. In this exploratory study, the processes involved in metaphor comprehension are studied by LSA. It should be emphasized that it is not the aim of this study to provide strong evidence favoring one of the theories of metaphor comprehension. The primary aim is to show that Latent Semantic Analysis can contribute to the understanding of metaphor comprehension.

The two theories have different assumptions about what kind of properties are activated in the process of metaphor comprehension. This leads to different expectations about the degree of relatedness between the metaphor target and metaphorical descriptions, definitions and literal features of the metaphor source. Metaphorical descriptions are argued to contain more categorical meanings, whereas definitions and

features of the metaphor source contain only literal meanings. Metaphors are indicated to be comprehended by a comparison process if the metaphor target is more closely related to definitions and literal features of the source than to metaphorical descriptions. However, metaphors are indicated to be comprehended by a categorization process if the metaphor target is more closely related to metaphorical descriptions than to definitions and features of the source. LSA can be used as an effective measurement tool to confirm one of these expectations, since LSA is a mathematical method that measures the semantic relatedness of different terms or texts.

In this study LSA has generated higher correlation scores when the metaphor target is correlated with metaphorical descriptions than when the metaphor target is correlated with definitions and literal features of the source. This indicates that the metaphorical expressions used in this study are comprehended by a categorization process – i.e., by activating a metaphoric category. Therefore, hypothesis 2 should be confirmed and hypothesis 1 should automatically be rejected. The metaphor target is found to be more closely related to metaphorical descriptions than to descriptions that are defining the metaphor source. This is in line with previous research which applied LSA on metaphor comprehension. Kintsch (2000) showed that the metaphor target was found to be moderately related to categorical meanings of the metaphor source and not at all related to literal meanings of the metaphor source. Furthermore, the metaphor target is found to be more closely related to metaphorical descriptions than to literal features of the metaphor source. This is in line with the research findings of Glucksberg (2003). He showed that people mostly mention features that are not true for the metaphor source in isolation when interpreting metaphors.

Thirdly, it is hypothesized that metaphoric categorical meanings are deeply entrenched into the metaphor source, if LSA generates higher correlation scores when the metaphor source is correlated with metaphorical descriptions than when the metaphor source is correlated with definitions or literal features of the source (H3). In this study there is found no evidence that categorical meanings are deeply entrenched into the source. The metaphor source is found to be related to definitions and literal features of the source to a much greater extent than to metaphorical descriptions. It should however not be ignored that there is a mean correlation score of 0,054 on a scale from zero to one when correlating

the metaphor source with metaphorical descriptions. This indicates that there is some weak relatedness – i.e., a metaphor source may weakly activate categorical meanings. Nevertheless, there is no sign of deep entrenchment of categorical meanings in the metaphor source. There are three possible conclusions for these results. In the first place, these results could indicate that categorical meanings are not deeply entrenched into the metaphor source. In that case, metaphoric categorical meanings are (barely) not activated when a source concept is being used. Bowdle and Gentner's Career of Metaphor hypothesis (2005) predicts that the source concept may come to refer to its metaphoric category as the metaphor source is repeatedly derived or activated in relation to the target domain. Consequently, categorical meanings are perhaps not found to be deeply entrenched into the source concept, because the metaphorical expressions used in this study may be in the early stages of their 'metaphor career'. In this study the degree of conventionality of metaphors has not been taken into account. However, the source concept 'road-block', one of the source concepts mentioned in the literature that has come to refer to its metaphoric category, is also used in this study and is no exception to the rule. Therefore we might have to conclude that either the research design of this study is inadequate or that LSA is not an adequate measurement tool to provide answers to this issue.

Lastly, it is hypothesized that LSA will generate higher correlation scores for interpretations of metaphorical expressions that are interpreted in very similar ways than for metaphorical expressions that are interpreted in very different ways (H4). In general, it can be concluded that the metaphorical expressions used in this study are interpreted in quite similar ways. However, some metaphorical expressions are interpreted in a more uniform way than others. Participants agree the most about how the metaphorical expression ''after university he was at cross-roads'' should be interpreted and the least about how ''he had reached a boiling point'' should be interpreted. In other words, participants' interpretations of the former expression deviate less from each other. For each metaphorical expression there are some participants who highly agree about their interpretations and some participants who highly disagree about their interpretations.

In this study it is shown how Latent Semantic Analysis can contribute to the understanding of metaphor comprehension. LSA has been used to quantify qualitative information such as the processes involved in metaphor comprehension and the degree of

agreement about metaphor interpretation. For example, the extent to which people differ in their interpretations has been expressed in numbers (i.e., correlation scores). Consequently, it can easily be compared how differently metaphorical expressions are interpreted. In my opinion, LSA can be used as an effective tool in the field of metaphor. I would like to conclude on a positive note, with the prediction of a bright future for Latent Semantic Analysis in the field of metaphor.

Discussion

It is suggested in the literature that the processes involved in metaphor comprehension are determined by three factors: the linguistic form of a metaphorical expression, the degree of conventionality and the degree of intentionality. It is argued that similes of the form X IS Y are comprehended as comparisons. Metaphors of the form X IS Y are claimed to be comprehended as categorizations, in which X is a member of the category Y (Bowdle & Gentner, 2005; Utsumi, 2007). Bowdle and Gentner (2005) claim that novel metaphors are comprehended by a process of comparison and more conventionalized metaphors by a process of categorization. Steen (2008) argues that only deliberate metaphors are processed by comparison and that non-deliberate metaphors are understood by a categorization process. In general, metaphor is not frequently used in a deliberate way – i.e., consciously being used as a rhetorical device. It is therefore claimed that a lot of metaphor may not be processed in a metaphorical way, that is, by constructing a mapping between the metaphor target and source (Steen, 2008). It is however not within the scope of this study to conclude anything about metaphor comprehension in relation to the linguistic form, the degree of conventionality or the degree of intentionality of metaphor. These factors have not been taken into account in this study.

Future research

It is suggested for future research to examine why some metaphorical expressions are interpreted in more similar ways than others. Similarity of metaphor interpretation could for example be studied in relation to metaphor conventionality or the form in which a metaphorical expression is displayed. It can be argued that the degree of agreement in interpretation is an indication of the conventionality of a metaphor. It is then assumed that,

as people's metaphor interpretations deviate less from each other, a metaphor is considered as more conventional. In this study, the only metaphorical expression that was suggested to be comprehended by a comparison process (''he had reached a boiling point'') also showed the most deviation in interpretation. Assuming that novel metaphors are comprehended by a comparison process (Bowdle & Gentner, 2005) and interpretations of novel metaphors show more deviation, the results of this study support each other that ''he had reached a boiling point'' is likely a (relatively) novel metaphor. Future research should explore in more depth whether LSA could be used as an effective tool to measure the degree of metaphor conventionality. A novel metaphor is indicated to consist of a target and source concept that are normally not set in comparison to each other – i.e., two concepts that normally not co-occur in language. LSA might be an effective tool to measure metaphor conventionality, since it is a mathematical method which gathers co-occurrence data.

One of the implications of this study is that the three factors which are argued to determine the processes involved in metaphor comprehension - linguistic form of the metaphorical expression, degree of conventionality and degree of intentionality - have not been taken into account. Consequently, in this study cannot be made any claims about metaphor comprehension in relation to these factors. Future research using LSA to study metaphor comprehension should take the three factors which are argued to determine the processes involved in metaphor comprehension into account.

References

Bowdle, B. F., & Gentner, D. (2005). The career of metaphor. *Psychological Review*, *112*(1), 193-216.

Gibbs, R. W. (1980). Spilling the beans on understanding and memory for idioms in conversation. *Memory & Cognition*, *8*(2), 149-156.

Glucksberg, S. (2003). The psycholinguistics of metaphor. *Trends in cognitive sciences*, *7*(2), 92-96.

Glucksberg, S. (1998). Understanding metaphors. *Current Directions in Psychological Science*, *7*(2), 39-43.

Glucksberg, S., & Haught, C. (2006). On the relation between metaphor and simile: When comparison fails. *Mind & Language*, *21*(3), 360-378.

Glucksberg, S., & Keysar, B. (1990). Understanding metaphorical comparisons: Beyond similarity. *Psychological review*, *97*(1), 3.

Johnson, A. T. (1996). Comprehension of metaphors and similes: A reaction time study. *Metaphor and Symbol*, *11*(2), 145-159.

Kintsch, W. (2000). Metaphor comprehension: A computational theory. *Psychonomic Bulletin & Review*, *7*(2), 257-266.

Kintsch, W. (2001). Predication. *Cognitive Science*, *25*(2), 173-202.

Kovecses, Z. (2002). *Metaphor: A practical introduction*. Oxford University Press.

Lakoff, G. (1993). The contemporary theory of metaphor. In A. Ortony (Ed.), *Metaphor and thought* (pp. 203-251). Cambridge, England: Cambridge University Press.

Lakoff, G., Espenson, J., & Schwartz, A. (1991). The master metaphor list. Draft 2nd ed. Retrieved from http://araw.mede.uic.edu/~alansz/metaphor/METAPHORLIST.pdf

Lakoff, G., & Johnson, M. (1980). Conceptual metaphor in everyday language. *The journal of Philosophy*, *77*(8), 453-486.

Landauer, T. K., & Dumais, S. T. (1997). A solution to Plato's problem: The latent semantic analysis theory of acquisition, induction, and representation of knowledge. *Psychological review*, *104*(2), 211.

Landauer, T. K., Foltz, P. W., & Laham, D. (1998). Introduction to Latent Semantic Analysis. *Discourse Processes,* 25, 259-284.

Miller, G. (1979). Images and models, similes and metaphors. In A. Ortony (Ed.), Metaphor

and thought (pp. 202-253). Cambridge, England: Cambridge University Press.

Moreno, R. E. V. (2004). Metaphor interpretation and emergence. Retrieved from http://www.phon.ucl.ac.uk/publications/WPL/04papers/vega_moreno.pdf

Road-block. (n.d.). In *Longman Dictionary of Contemporary English*. Retrieved from http://www.ldoceonline.com/dictionary/roadblock

Searle, J. (1979). Metaphor. In A. Ortony (Ed.), *Metaphor and thought* (pp. 92-123). Cambridge, England: Cambridge University Press.

Steen, G. (2008). The paradox of metaphor: Why we need a three-dimensional model of metaphor. *Metaphor and Symbol, 23*(4), 213-241.

Tversky, A. (1977). Features of similarity. *Psychological review*, *84*(4), 327.

Utsumi, A. (2005). The role of feature emergence in metaphor appreciation. *Metaphor and Symbol, 20*(3), 151-172.

Utsumi, A. (2007). Interpretative diversity explains metaphor-simile distinction. *Metaphor and symbol, 22*(4), 291-312.

Wittgenstein, L. (1953). *Philosophical investigations*. New York: Macmillan.

Appendix I

Metaphorical expressions and corresponding metaphor vehicles

Metaphorical expressions underlying the conceptual metaphor ''life is a journey''

LIFE_1	Susie's life has been a meandering river.
	Metaphor vehicle: meandering river
MLIFE_1	*Why can you compare Susie's life to meandering river?*
LLIFE_1A	*How would you define a meandering river?*
LLIFE_1B	*Please list three features of a meandering river.*
LIFE_2	After university Robin was at cross-roads.
	Metaphor vehicle: cross-roads
MLIFE_2	*Why can you compare Robin's position in life to a cross-roads?*
LLIFE_2A	*How would you define a cross-roads?*
LLIFE_2B	*Please list three features of a cross-roads.*
LIFE_3	Robin sails trough life.
	Metaphor vehicle: sailing trip
MLIFE_3	*Why can you compare Robin's life to a sailing trip?*
LLIFE_3A	*How would you define a sailing trip?*
LLIFE_3B	*Please list three features of a sailing trip.*
LIFE_4	The past few years have been a marathon for John.
	Metaphor vehicle: marathon
MLIFE_4	*Why can you compare John's life to a sailing trip?*
LLIFE_4A	*How would you define a marathon?*
LLIFE_4B	*Please list three features of a marathon.*

Metaphorical expressions underlying the conceptual metaphor ''love is a journey''

LOVE_1	Elisabeth and Tom's relationship has been a bumpy road.
	Metaphor vehicle: bumpy road
MLOVE_1	*Why can you compare Elisabeth and Tom's relationship to a bumpy road?*
LLOVE_1A	*How would you define a bumpy road?*
LLOVE_1B	*Please list three features of a bumpy road.*
LOVE_2	Wouter and Susan's marriage was a roller-coaster ride.
	Metaphor vehicle: roller-coaster ride
MLOVE_2	*Why can you compare Wouter and Susan's marriage to a roller-coaster ride?*
LLOVE_2A	*How would you define a roller-coaster ride?*
LLOVE_2B	*Please list three features of a roller-coaster ride.*
LOVE_3	Susie and John are in a dead-end relationship.
	Metaphor vehicle: dead-end street
MLOVE_3	*Why can you compare Susie and John's relationship to a dead-end street?*
LLOVE_3A	*How would you define a dead-end street?*
LLOVE_3B	*Please list three features of a dead-end street.*

LOVE_4 Tom's affair was a road-block in his marriage.
Metaphor vehicle: road-block
MLOVE_4 *Why can you compare Tom's affair to a road-block?*
LLOVE_4A *How would you define a road-block?*
LLOVE_4B *Please list three features of a road-block.*

Metaphorical expressions underlying the conceptual metaphor ''ideas are food''

IDEA_1 The lecture was a three-course meal.
MIDEA_1 *Why can you compare the lecture to a three-course meal?*
LIDEA_1A *How would you define a three-course meal?*
LIDEA_1B *Please list three features of a three-course meal.*

IDEA_2 Susie put a lot of spice in her idea.
MIDEA_2 *Why can you compare Susie's idea to spice?*
LIDEA_2A *How would you define spice?*
LIDEA_2B *Please list three features of spice.*

IDEA_3 Tom's novel is the caviar of the book world.
MIDEA_3 *Why can you compare Tom's novel to caviar?*
LIDEA_3A *How would you define caviar?*
LIDEA_3B *Please list three features of caviar.*

IDEA_4 Chapter two of the book was a meaty one.
MIDEA_4 *Why can you compare the book chapter to meat?*
LIDEA_4A *How would you define meat?*
LIDEA_4B *Please list three features of meat.*

Metaphorical expressions underlying the conceptual metaphor ''emotion is temperature''

EMO_1 David had reached a boiling point.
Metaphor vehicle: boiling point
MEMO_1 *Why can you compare David's state of mind to reaching a boiling point?*
LEMO_1A *How would you define a boiling point?*
LEMO_1B *please list three features of a boiling point.*

EMO_2 During the discussion Wouter erupted.
Metaphor vehicle: volcano eruption
MEMO_2 *Why can you compare Wouter's behavior during the discussion to a volcano eruption?*
LEMO_2A *How would you define a volcano eruption?*
LEMO_2B *Please list three features of a volcano eruption.*

EMO_3 The crowd was all fired up.
Metaphor vehicle: fire
MEMO_3 *Why can you compare the crowd to fire?*
LEMO_3A *How would you define fire?*
LEMO_3B *Please list three features of fire?*

EMO_4 Tom was having a heated debate with his boss.
Metaphor vehicle: heat

MEMO_4 *Why can you compare the debate to heat?*

LEMO_4A *How would you define heat?*

LEMO_4B *Please list three features of heat.*

Appendix II

Overview of participants' metaphor interpretations

Metaphorical expressions underlying the conceptual metaphor ''life is a journey''

LIFE_1	Susie's life has been a meandering river.
Because Susie is always wandering and flowing and does not have a clear direction.	
Maybe because she has had many difficulties and big choices, just like a meandering river that is hard to go through.	
Like a meandering river, life knows its turns, due to all kind of events and experiences a person goes through, throughout his life.	
Always something happened which she didn't expect/planned. She had many different choices in her life. She wasn't happy all the time, tried many things, and maybe she now found the thing which makes her happy.	
Because unexpected things happen in her life, just like the curves of the river. Because she takes life, as good or bad as it gets. The river is sometimes fine and stable and sometimes it takes a curve.	
Susie's life has taken a lot of twists and turns for better or for worse.	
Susie's life has lacked direction and goals.	
Just like a meandering river with unexpected curves, Susie's life is also full of unexpected events and things. The river goes its own way, just like Susie does. Susie's life is filled with bad and good things, and the meandering river characterizes the good and bad parts of life.	
Because Susie switches path quickly. Suzy goes with the flow, without a clear purpose.	
Susie's life is never straightforward. Susie can never clearly see what is ahead of her.	
She has many ups and downs in her life.	
Susie's life has been with ups and downs. Susie's life hasn't always been certain. Susie has done many different things in her life.	

LIFE_2	After university Robin was at cross-roads.
Because he doesn't know what choice to make or direction to go.	
Because after university Robin was asked to make a decision that would change his life.	
It can be compared to a crossroad, because Robin had many roads (destinations to make as in get a job or study more) to go to after his studies.	
She's at a moment which is hard in life, just like a crossroads.	
It means he has many paths to choose from and he has to decide now.	
Robin had to make decisions about what to do after university. Robin had different options like having four options in a crossroads after graduation.	
You have multiple options of ways to pursue. Many possibilities. He doesn't know what to do next because of the variety of options.	
Because on a crossroads you can take different routes, just like after university different routes in life.	
just like a crossroad, you have to make a decision in which direction you want to go.	
After university you have lots of opportunities and chances which can be like crossroads because you have to make choices.	
At a crossroads you have to decide which way to turn, after graduation you also have to choose which direction you are going to choose. Once you make your decision of which way to turn, you can't easily go back. You will never find out what the other direction would have been like. It can be a difficult decision to make which way to turn.	
Robin's position life is in transition. She is trying to find herself after university.	
Robin did not know what life path he wanted to take next. He was just completing a milestone and was starting onto the next one (next street). The world was open to Robin now and he had many	

options (each path was a different option). The world is made up of many choices just like choosing what path to take on a crossroad.
He doesn’t know where he is going to in the future. He can choose different ways to go.
There were many directions Robin could go. Two things in her life were crossing over.

LIFE_3 Robin sails trough life.

Robin glides through life easily without too many problems.
Robin has had an easy and entertaining life like a sailor sailing through the ocean.
When his life goes easy for him, it's like a sailing trip. The sense of freedom plays a role here too I imagine. You can feel free on a sailing trip, like you can feel about your life.
He is fine with his life. He lives the opportunities he is given. He experiences new adventurous things. He enjoys his life, which is more like a hillbilly life.
Just like a sailing trip, sometimes things are fine (wind is on the right side), but sometimes they are not (wind is on the wrong side). Or just like a sailing trip, life is very easy for him.
Like a sailor does not know how much it will wind tomorrow, Robin is not too concerned about the future, just see what it brings.
Robin doesn't worry too much about making plans for her life and allows events to unfold without worrying about them.
Robin's life is very easy to him, just like a sailing trip. Robin's life is full of good things (the wind of the right side) and bad things (the wind on the wrong side).
Because she is being carried by something else and doesn't have to exert any effort of her own. Robin's life is very easy.
He struggles in life. He has many challenges in life that hard to deal with.
Because sometimes you have the wind behind your back and everything is easy and fun, and sometimes you have the wind against you (as with sailing) and than life is more difficult and less fun.

LIFE_4 The past few years have been a marathon for John.

A marathon is a long run, kind of like the journey of life.
Because he has undergone a series of events which made his life look like running a marathon.
A marathon is very exhausting. A marathon demands a lot of energy and commitment from the runner. Johns past years have demanded the same things as a marathon demands the runner.
A marathon is hard, and the past few years of John's life probably too.
It means he had went through a long and tiring journey.
John had accomplished lots of things in last years. The past few years were not easy for John.
Because he was very busy, it has been a long journey for him that demanded a huge effort.
Because it took very long, sometimes painful and sometimes with nice moments.
A marathon is exhausting, challenging, and never ending walk to the finish.
The life of John has not been easy, just like a marathon.
It is a long journey to get where you want to be. It is difficult. You cannot see what is ahead.
John has a lot going on that takes time and effort like a marathon.
He had to overcome adversity. He had to keep looking toward his goals even when times got hard.
The past few years were long and tiring. John felt amazing when he accomplished his goals as he worked hard to achieve them.
Because he is busy on and on, and he doesn't take rest then his life looks like a marathon. But you can also interpret it like: his life is a competition.
There have been many challenges in his life in a short time. The challenges have made the years seem very long and slow.

Metaphorical expressions underlying the conceptual metaphor ''love is a journey''

LOVE_1	**Elisabeth and Tom's relationship has been a bumpy road.**

Because Elisabeth and Tom are often fighting so they have come across many "bumps" in the road of their relationship.
Because they have had obstacles or probably have been fighting which is like hitting bumps in a road.
A relationship can have its bumps. It's ups and downs. Discussions, fights and the like are the aspects that cause these bumps along the way. Just like a bumpy road.
It was never easy. Always with problems in between which could have led to some unfortunate situations (like betraying someone), even to breakups. Unfortunate situations means also health problems, or other problems what one person experienced.
The bumpy road stands for the ups and downs in their relationship. The bumpy road stands for a difficult way, with lots of trouble, just like their relationship.
Elisabeth and Tom have experienced a lot of ups and downs in their relationship, like a car bumping.
Elisabeth and Tom have had many relationship problems.
Just like a bumpy road, their relationship has ups and downs. Their relationship is difficult and full of problems, just like a bumpy road. A bumpy road is exciting, and so is their relationship.
Because in every relationships there are ups and downs.
Elisabeth and Tom have many ups and downs in their relationship. It is not a consistent relationship.
Elisabeth and Tom have to pull themselves out of many problems.
They have some struggles in their relationship.
Elisabeth and Tom's relationship has been difficult sometimes. Elisabeth and Tom's relationship has had its ups and downs. It was difficult for Elisabeth and Tom to get where they are right now in their relationship.

LOVE_2	**Wouter and Susan's marriage was a roller-coaster ride.**

A roller coaster ride is wild, unstable, out of control, like their relationship.
Because their marriage had some easy and happy moments and some sadder and harder ones, just like in a rollercoaster you have ups and downs.
Just as a rollercoaster has ups and downs , marriage has very cool times (ups) and not that good times (downs).
The marriage went with ups and downs, just like a rollercoaster.
It means their marriage has a lot of ups and downs.
They had ups and downs in their marriage such as having ups and downs in a roller coaster. They were ok some days and fighting other days. Their emotions to each other were not stable.
The marriage was not stable at all. They could be really good or have real troubles, it was changing every time.
Because it has ups and downs. Because it's thrilling. Because it can go terribly wrong, just like a rollercoaster ride.
Just like a rollercoaster, marriage is unpredictable and you have to be prepared for the bumpy ride.
The life of Wouter and Susan was probably a little hectic, with ups and downs, never knowing where it will bring you next.
It both goes fast. It involves unexpected twists and turns. It is exciting, but also scary.
There is up and downs in marriage, just like a ride on the roller-coaster.
There are a lot of ups and downs in marriage. In marriage you never know what is going to happen just like on a rollercoaster. Being married is a thrilling experience. Marriage has its highs and has its lows but is always exciting like a rollercoaster. Being married and committed to somebody is scary just like a rollercoaster.
It goes up and down. It is an exciting marriage (a rollercoaster is also exciting).

The marriage was full of ups and downs. The marriage was exciting and scary at times.

LOVE_3 Susie and John are in a dead-end relationship.

Perhaps because their relationship is not going anywhere,(you can't go anywhere on a dead end street).
Their relationship will not result in marriage or anything in the future, just like a dead end which goes nowhere.
It can be that at some point in the relationship, both sides don't see a way out. They can't go on like this. It makes them feel like if they're on a dead-end street, with no exit. They don't know how to solve their problems and the situation is hopeless.
you cannot continue the relationship, and there is going to be a time where they are going to break up. Nor they have to move back, and start from the beginning on. Maybe they made some mistakes and have to clarify the situation.
Just like a dead-end street, their relationship will not go any deeper, more superficial. Just like a dead-end street, their relationship is going to end.
There is no way to progress anymore for Susie and John.
Susie and John's relationship will inevitably fail.
Their relationship will be ended up soon, like a dead-end street you can't go any further. Their relationship doesn't work, they won't get to the point they want to reach, like a dead-end street .
Because there is nothing ahead, no future. They have hit a wall and can't move beyond it.
Susie and John can no longer continue their relationship. Neither party can benefit anymore from the relationship.
Relationship won't have a happy ending.
In a dead-end street there is no way out of the street, and in Susie and John's relationship there are problems in which there is no way out anymore.

LOVE_4 Tom's affair was a road-block in his marriage.

A road block is a stop sign, so Tom's affair would be similar to this.
A road block is something you can't get past, the same way, Tom's affair was something which made his marriage stop.
A road block stops traffic, just as a road block stops someone's journey, the affair stopped the journey Tom had, which is the marriage.
When the road is blocked, you can't continue your path, so Tom's affair prevents him from continuing his marriage.
It means that the affair poses as an obstacle to the progress of his marriage.
John's affair made his marriage come to an end just like a road block.
Because it was preventing his marriage to be a good marriage.
Because it blocked his feelings for his wife while she had feelings for him.
Even if you fix the road block you always can see the mark which it has left behind.
Tom's affair disturbed the marriage, just like a road block on the road disturbed the speed of a car on the road.
A road block stops you from going on the way you were going, an affair stops you from going on with your relationship. It is unexpected and sudden.
The affair got in the way of his marriage like a something blocking the road.
The affair stopped the marriage suddenly like a road block stops traffic. The affair caused trouble in the relationship like the trouble caused to a drunk driver at a road block. The affair was unwanted just like a road block is unwanted. Tom did not want his wife to find out about his affair just like a driver does not want to be caught for anything at a roadblock.
The affair is standing between Tom and his wife. The affair blocks the love to his wife.
It is a roadblock because it is preventing him from making any progress in his marriage.

Metaphorical expressions underlying the conceptual metaphor ''ideas are food''

IDEA_1	The lecture was a three-course meal.

Maybe because the lecture was really long and extensive, like a three course meal.
The lecture was very comprehensive and it included everything you need just like a three course meal has all the nutrients you would need in a day.
A lecture can be divided into an introduction, main section and final words. Like you would have a appetizer, main course and desert as a three-course meal.
It took a long time, the course. There were different things you could have learned. Easy at the beginning, in the middle more difficult, and to the end a little bit more easy, and more enjoying.
Because the lecture takes a long time, just like three-course meals. A three-course meal implies that you're full of eating, and the lecture can be so full of information.
The lecture was so long and detailed it was like starting your meal hungry and ending up stuffed.
The lecture was extensive and left you feeling overwhelmed, similar to the way in which a big meal makes you feel stuffed.
The lecture takes a long time, just like a three-course meal. The lecture consists of an introduction, a key part and a finishing part, just like a three-meal course.
It had a starter, entree, and ended on a sweet not. It was complete and covered the entire topic from beginning to end.
The lecture went very well. The lecture was easy to understand/easy to give.
Everything is in the lecture.
The lecture was very long. The lecture had a big content. Many things were told in the lecture.

IDEA_2	Susie put a lot of spice in her idea.

Spice improves the flavour, an idea with spice has special ingredients.
Because, like spice makes food more tasteful, a spicy idea is a more interesting one.
Spice is used to give food a different taste also exciting, creative. So the idea of Susie is also creative and exciting.
The idea is not as usual, because spice isn't as usual too.
Its means a lot of creativity to enrich the idea.
Susie is not completely sure about her idea there are some things that make her disturb just like spice.
Susie was very creative in her idea.
Her idea contains something she is unfamiliar with.
Just like spice, an idea has to be very hot!
Susie's idea is different than average.
Spice has to do with personal taste, some people like a lot of spice, some don't. Your own ideas are also personal that some might like and others not. Spice adds something extra to the taste, it also ads something extra to your idea.
Susie put a lot of spice means thought and creativity to her idea.
She made the idea exciting just like spice makes food exciting. Some people will like the idea and some won't like the idea just like some people like spice while others dislike spice (a lot of controversy in the idea). The spice made the idea different just like spice makes taste of food different.
Because there is power in the idea.
There is a lot of excitement in her ideas. She puts a lot of thought into her ideas.

IDEA_3	Tom’s novel is the caviar of the book world.
Because it is a rich novel, or doing very well in the book world. Tom's novel is probably of high standards, like caviar. Caviar is a high-end luxury good. The novel is probably ranked on the high-end of the scale as well. Like caviar, it’s really good. It is a really good/exclusive one, but not everyone likes it. Caviar is very luxurious food and so his novel is also very special and gives him status. Caviar is for special events, so his book is also meant only for special, fanatical readers. The book is very highly regarded, the best of the best. Tom's novel is of the best quality one can find. Just like caviar, his novel is very special and exclusive. Just like caviar, his novel is very expensive. Just like not everybody likes caviar, so not everybody likes the novel. Because it is something rare. Generally geared towards the upper class. Because you only enjoy it in small doses. Tom's novel is exquisite and rare. Tom's novel worth’s better than his competitors Caviar is the best food in the world, and Tom's novel is a very good book, so his book is the caviar of the book world.	

IDEA_4	Chapter two of the book was a meaty one.
Meat is thick and hard to chew, comparing the book to meat would mean it’s difficult to consume. Because, just like meat, it was tasteful. Meat is hard, when you chew it, it is difficult to make it soft and then eat it. When reading, you can compare comprehending to chew and swallow, if it’s an easy chapter and the words are easy , you don’t have difficulties chewing and swallowing. In contrast, when the words are hard or the topic is hard, it’s difficult to chew it and swallow it (comprehend it). Meat is often heavy to metabolize, so chapter two is a heavy chapter to read. It means it provokes a lot of thought and debate. Chapter two was full of joy. Chapter two was the one with full of information. It was very easy and nice. Meat was involved in the chapter. It took a while to get through. It was bloody. The meat is the best part of a dinner. It takes a lot of time to get through. Meat has lots of substance, the same with the chapter, it had lots of information and so much happened. Chapter two had a lot of substance just like meat. Chapter two had a lot of juicy information just like how meat has a lot of juice. Chapter two was amazing just like a great piece of tasty meat. Because it was a heavy chapter. The chapter was thick and full of a lot of information. The chapter was hard to digest at times.	

Metaphorical expressions underlying the conceptual metaphor ‘’emotion is temperature’’

EMO_1	David had reached a boiling point.
David had reached his point of being ready for a change, or very angry, ie - boiling point. Probably David was so angry that he couldn't take it anymore so he started shouting or fighting, just like how the water starts to boil. When David is angry and that anger is building up and building up, it can reach a point where it comes to a 'boiling point'. All the anger that has been piling up reaches its limit.	

David did something after he reached this point. The boiling point was only a part of a series of actions.
Because he is so angry, that he reached the boiling point.
Everyone and everything has their limits.
David felt so overwhelmed he needed to let out his emotions.
David is very angry, and so he is going to break apart, like a boiling point.
Heating up is associated with getting mad, becoming volatile or changing from his normal state.
David had had enough. David was very angry.
He got very angry.
It was all enough for David. He reached a point that he was furious and a boiling point reaches a certain point too.

EMO_2 During the discussion Wouter erupted.

Volcanoes erupt violently, the same way Wouter got mad.
Because, like lava in a volcano, Wouter's ideas began flowing relentlessly.
Because a volcano erupts drastically and violently, so Wouter's conversation, from one moment to another changed rapidly and became violent.
He suddenly said what he thinks, just like a volcano suddenly erupts.
It means he exploded with rage.
Wouter became very angry and said whatever he wants to say just like a volcano eruption. Wouter waited some time before telling what he wanted to tell just like a volcano waits before eruption.
He was so angry that he started saying everything, his words came out of his mouths just like the lava in a volcano eruption.
Because both become loud, red and hot.
A discussion is like a volcano, it sometimes explodes in ways you did not always predicted.
Because when someone gets angry, he or she gets a red head, feeling hot and wants to get all the irritation out, just like a volcano eruption.
It both comes unexpected. A volcano eruption is hot, and you can also be heated of anger. It both is an explosion, in Wouter's case of words, he can't keep it in. The volcano can't either.
During the discussion he got heated and frustrated.
When volcanoes have enough pressure built up they erupt just like how Wouter built up enough anger to erupt in the discussion. Wouter was gushing loud noises like a volcano gushes noises and lava. Volcanoes are seen as scary and destructive just like Wouter's attitude in the discussion.
The pressure becomes more and more and then you can explode (like a volcano eruption) you are mad.
He had a strong reaction to something that was said. He became very fired up about something that was said.

EMO_3 The crowd was all fired up.

Because the crowd had a lot of energy.
Because the crowd was getting excited.
Fire is intense, like a crowd can be intense. Fire is hot, like a crowd can become when the vibe is there.
Everyone was passionate, or aggressive. There were a lot of emotions, a simple/small action could erupt the group and could lead into serious actions of the group.
Just like a fire, the crowd spreads itself rapidly.
The temperature and atmosphere rises in the audience.
The crowd had strong emotions and was energized.
Just like fire, people were spread everywhere.
Like molecules when they are excited by heat and begin to move faster, creating more energy.
The crowd was very excited.The crowd was very angry.

The crowd became so excited. If there's fire, there is heat, and if the crowd is fired up they seem heated and aggressive and fire can be this too.

EMO_4 Tom was having a heated debate with his boss.
Heated would mean on fire which is dangerous, like the argument. Because the debate was so strong it made him hot. Heat means energy. Energy in a conversation means being passionate, energetic or even violent. So those adjectives were present in the conversation. Heat is warm, passionate and fierce, so Tom stands firmly to his opinion in the debate. It means that the debate has prompted a lot of furious and intense exchanges. The debate was very hot one. The boss and Tom may be having an argument about an important topic. Because they were both angry and the debate was being very intense. Because some people get heated during debates. Trying to be louder than the other person requires a loud voice and causes sweat/heat. Heat is like a tension that has to get out somehow. Because of the effort in the discussion..? When you're angry you get hot, which can happen during a debate. Heated debated figuratively means a big and argumentative debate. The debate was uncomfortable just like being in too much heat. The debate had a lot of powerful answers in it just like how heat is powerful. The debate made everybody hot because of stress just like how heat makes people hot. Heat is energy and the debate had a lot of energy in it. Because the tension rose on (in de debate). The debate was getting emotional .