

**Changes the Translator Experiences within the Cognitive Process in a Translation  
Task of Metaphorical and Non Metaphorical Contexts Using Event-Related  
Potentials**

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**Universidad Autónoma de Manizales  
Master's Degree in Translation  
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### Abbreviations

[C]	Central
[CTMM]	Cognitive Theory of Metaphor and Metonymy
[EEG]	Electroencephalogram
[ERPs]	Event Related Potentials
[F]	Frontal
[fMRI]	Functional Magnetic Resonance Imaging
[I.Q.]	Intelligent Quotient
[L2]	Language 2
[L1]	Language 1
[Msec]	Millisecond
[O]	Occipital
[P]	Parietal
[PET]	Positron Emission Tomography
[ST]	Source Text
[SL]	Source Language
[SPECT]	Single-Photon Emission Computerized Tomography
[T]	Temporal
[TL]	Target Language
[TM]	Texto Meta
[TT]	Target Text
[TS]	Translation Studies
[TAP]	Think Aloud Protocols
[TCMM]	Teoría Cognitiva de la Metáfora y la Metonimia
[UDEA]	Universidad de Antioquia

## Abstract

This case study uses the Event Related Potentials, (ERPs) a neurophysiological measure to study the cognitive process in translation. The objective of this thesis project was to identify the differences between a group of translators and a group of non translators in a translation task of metaphorical and non metaphorical contexts through the N400. The instrument used for the tests was extracted from a parallel corpus, originally in English and their translation in Spanish within a public and political domain. From this corpus, we extracted 25 metaphorical and 25 non metaphorical contexts with their corresponding translations, and designed a post test interview containing specific theoretical and methodological questions related to the test.

The experimentation took place in the city of Medellín, and recorded using a *Medicid V* Electroencephalogram with a 36 channel (SYNAMPS system) and the *Mind Tracer 2.0* software. The results obtained, from both the empirical tests and the post-test interview; demonstrate a variety of theoretical implications most notable regarding, the importance of the concept of translation, the cognitive functions and the Cognitive Theory of Metaphor and Metonymy (CTMM), regarding the cultural and contextual aspects of the adequate translation of a discourse and the need for habituation to the source text (*ST*).

**Key words:** Cognitive process in translation. Event Related Potential (ERP). N400. Metaphorical context. Non metaphorical context.

## Resumen

En este estudio de caso utilizamos los Potenciales Evocados Cognitivos (PECs) como medida neurofisiológica para estudiar el proceso cognitivo en traducción. Este proyecto de tesis tuvo como objetivo identificar las diferencias entre un grupo de traductores y no traductores, al enfrentarse a una tarea de traducción de contextos metafóricos y no

metafóricos mediante la onda N400. Utilizamos un instrumento construido a partir de un corpus paralelo del dominio de la política en lengua de partida inglés y su traducción al español. Este corpus permitió la extracción de 25 contextos metafóricos y 25 contextos no metafóricos con sus respectivas traducciones. Además, diseñamos una entrevista que se realizó después de la prueba, la cual contenía preguntas teóricas y metodológicas relacionadas con la misma.

Para la experimentación se llevó a cabo en la ciudad de Medellín, utilizamos un electroencefalograma *Medicid V*, de 36 canales (Sistema SYNAMPS) y el *software Mind Tracer 2.0*. Los resultados obtenidos, con ambos instrumentos muestran una variedad de implicaciones teóricas evidenciadas en la importancia del concepto de traducción, las funciones cognitivas, y la Teoría Cognitiva de de la Metáfora y la Metonimia (TCMM) con respecto a los aspectos culturales y contextuales de la traducción adecuada de un discurso, así como la necesidad de habituación al texto meta (*TM*).

**Palabras clave:** Proceso cognitivo en traducción. Potenciales Evocados Cognitivos (PECs). Onda N400, Contexto metafórico. Contexto no metafórico.

## 1. Research problem

Translation is an ancient practice that has developed significantly from its beginnings in antiquity to its real world application and academic study today. The different approaches to translation studies, linguistic, textual, cognitive, communicative and socio-cultural (Suárez, 2005) permit the observation and description of this phenomenon from different perspectives of language and culture. These approaches have focused on the translation product from different linguistic perspectives making significant theoretical contributions to the discipline. In contrast, here, the process of translation, from a cognitive perspective, is the principal object under investigation in this thesis project, not the finished product.

The process of translation, simply defined, is all the different mental operations a translator performs while translating a text or discourse. The most common technique to study the process of translation has been Think Aloud Protocols (*TAP*). This method of investigation records the verbalization of strategies, permitting researchers a window into the underlying process. However, this technique has not allowed theorists of translation to describe the cognitive functions that contribute to the translation process. That is why this thesis project has been proposed. This project aims at describing, more completely and objectively, the process of translation from a cognitive perspective.

Event-related potentials (*ERPs*) are generated in the brain as a result of the activation of neural networks by external stimuli. They can be recorded non-invasively on the skin of the scalp and consist of precisely timed waves, or components, which reflects the synaptic activity on the dendrites of the cortical pyramidal cells. These recordings can provide a wealth of information regarding the spatial-temporal patterns of a wide range of cognitive processes. Unlike positron emission tomography (*PET*) and functional magnetic resonance imaging (*fMRI*) which measure blood flow and provide detailed anatomical mapping of activated brain regions, ERP recordings have a high

resolution of temporal precision which permits the investigation of many of the underlying aspects of cognition.

The translation of metaphor has been treated as a part of the more general problem of “*untranslatability*”. This association has two principal causes, the metaphor is considered “*indirect*” and therefore more difficult to understand and interpret. Also, the relationship between the two concepts, or domains, from which the metaphor gets its meaning is rooted in the shared cultural values of a particular society. This quality proves of particular difficulty for the translator because the meaning of the lexical constituents cannot be predicted from its referential meaning. In other words, the difficulty of metaphors in translation is not necessarily the lack of an equivalent lexical unit in the target language, but rather the diversity of the conceptualization of the world of identical objects. This falls in line with Dagut's (1976: 32) argument that there is no simplistic general rule for the translation of metaphor, but the translatability of any given source language (*SL*) metaphor depends on (1) the particular cultural experiences and semantic associations exploited by it, and (2) the extent to which these can, or cannot, be reproduced non-anomalously into the target language (*TL*), depending on the degree of conceptual overlap in each particular case.

## **2. Research question**

What are the changes that the translator experiences within the cognitive process in a translation task of metaphorical and non metaphorical contexts using event-related potentials (ERPs) as measure?

### **2.1 Previous studies**

#### **2.1.1 Event Related Potentials (ERPs) and bilingualism**

Alvarez, Holcomb, Grainger, (2003), conducted tests of semantic categorization using Spanish–English word streams. This study aimed at using ERPs to measure the organization and processing in both the first and second languages of bilinguals fairly early in their second language acquisition. The experimental group was comprised of twenty-eight undergraduate native English speaking volunteers from Tufts University who are enrolled in basic or intermediate Spanish courses.

Their results found that repetition effects started in the pre-N400 time period (150 – 300 msec) in which both English and Spanish words produced larger negativities with their first presentation to the subject than did the repetition of the same word in either language. The repetition effect continued in the following three windows of observation, 300 – 500 msec, 500 – 700 msec, 700 – 1000 msec. Through all three windows Spanish words continued to show a strong within-language repetition effect, while English words produced no clear between language repetition effect.

Thierry and Jing Wu (2006), tested 15 Chinese – English bilinguals who acquired English after the age of twelve, regarded as late fluent bilinguals, and fifteen monolingual controls. The trials consisted of a semantic relatedness task restricted to English word pairs, either related in meaning or not. Unknown to the test subjects half of the words pairs were chosen in such a way, that although the word pair was not

related in meaning they shared a character when translated into Chinese. For example *Train* and *Ham*, two wholly unrelated words, but when translated to the Chinese share the first character, *Huo Che* (train) and *Huo Tui* (ham).

Their results showed that across the three groups all responded faster to semantically related pairs than to unrelated pairs and no effect which correlated to Chinese character repetition in either of the monolingual groups. In contrast, the Chinese monolingual participants reading the translation of the English pairs demonstrated an interaction between semantic relatedness and the repetition of Chinese characters for both reaction times ( $F_{1,14} = 20.6, P > 0.0001$ ) and error rates ( $F_{1,14} = 11.6, P < 0.01$ ). Post hoc analysis showed that semantically unrelated words that shared a Chinese character correlated with significantly longer reaction times and higher error rates than all other conditions (all  $P < 0.01$ ).

Related to the implicit effects of the ERP responses, they found in the English monolinguals that the semantic relatedness reduced the mean amplitude significantly between 350 – 500 msec. While the hidden Chinese character repetition had no effect in this window and no other amplitude modulation could be observed on other ERP components. In the bilingual group they observed a main effect of semantic relatedness significantly smaller than in the previous group. Also, like the previous group there was no observable interaction between Chinese character repetition and the semantic effect. Semantically related targets and also targets that shared a Chinese character elicited an N400 with a more reduced amplitude than semantically unrelated targets and word pairs without the hidden Chinese character. Interestingly, the same N400 effect was reproduced in the Chinese monolingual group, with a difference of the P200 component that correlated with character repetition and responded to repetition priming but not semantic priming. This semantic repetition and character repetition priming that resulted in the reduction of the N400 component and its modulation; the authors interpret as evidence of the activation of Chinese translations in bilinguals. This hypothesis is further supported by the fact that English monolinguals only showed an N400

modulation in correlation to the semantic relatedness and not to the hidden Chinese character repetition.

Vigil-Colet, Pérez-Ollé and Garcia-Albea (2000), studied the role of the P300 component in relation to a translation and recognition task. They used twenty-four university students who are proficient bilingual speakers of Spanish and Catalan, twelve whose native language was Catalan, and twelve whose native language was Spanish. Their instrument composed of two-hundred word pairs in which one word was in Spanish and the second was its corresponding translation in Catalan and vice versa. The subjects then had to decide if the second word was a translation of the first. They found that L2 (Language 2) to L1 (language 1) response times for translations by the group of Spanish speakers significantly faster than for L1 to L2. In contrast, the Catalan dominant group only demonstrated a similar effect for low frequency words. Furthermore, they observed that L1 to L2 and L2 to L1 translation for Spanish natives seemed to be more sensitive to conceptual or semantic factors than to lexical factor, while this same phenomenon was only observed in the Catalan natives when translating L2 – L1.

Regarding the P300 component, they found that the first word of each pair elicited a positive component with a peak latency of around 250 msec. The component commonly referred to as the storage component because of its association with the storage of a stimulus in short term memory. As for the second word, they found that High Frequency words elicited a greater P300 latency when compared to low-frequency words. They suggest that this data is compatible with the idea that the P300 component is related to the relevance of the stimulus in respect to the task, and also the degree to which the stimulus aligns with the representation stored in memory. In contrast for non-translation word pairs the P300 had a very low latency, followed by a positive peak around 600 msec, considered a marker of syntactic anomaly.

### **2.1.2 Event Related Potentials (ERPs) and metaphor**

Kazmerski, Blasko and Dessalegn (2003), used ERPs to study the individual differences of metaphor comprehension and its relationship to intelligence. Forty-eight subjects were chosen and separated into three groups based on their performance on the Kaufman Brief Intelligence Scale. In two distinct experiments they used an instrument of forty metaphors: twenty presented in their complete form and twenty presented as scrambled and also, forty literal sentences: twenty presented as complete and twenty presented as scrambled. In the first test, the subjects had to first read and understand the sentence, and then decide if it was literally true. While in the second test the subjects had to read the sentence and decide how difficult the metaphor was to understand on a scale from one to seven.

The results of the first test demonstrated little to no difference regarding correct responses between the three groups, all answered the question of truthfulness with an accuracy of 96%. However, the reaction times between groups and sentence type revealed a great range of differences between the three groups. They found that although for all three groups the response for true was quicker than the response for untrue; there was a direct correlation between speed of processing and intelligence quotient (I.Q.). This result appeared as a linear decrease between the three groups, the high I.Q. grouping being the fastest, while the low I.Q. groups reliably slower. Inspection of the means between groups also showed a linear relation between the three groups when comparing the response times between scrambled and metaphorical sentences. The reported degree of interference was only 11 msec for the low I.Q. group, 27 msec. for the medium I.Q. group, and 35 msec for the high I.Q. group. The authors propose that these results in particular mean the automaticity of metaphorical meaning activation is not a case of all or nothing. But instead, the higher the I.Q. of the reader, the more likely metaphorical meaning is activated which consequently creates interference in judging the metaphor to be literally true.

The different ERP responses between the three sentence types also fell into a continuum, scrambled appearing the most negative while literal appearing the most positive. Observed from the earliest responses, starting at 250 msec. to the later responses, lasting until about 600 msec. The results of the ERPs to scrambled sentence conditions was clearly more negative than literal sentences, metaphors falling somewhere in between the two previous conditions. Interestingly, the three conditions to a large extent converge in the 600 msec. window. Another interesting observation was the ERP differences between the three groups in respect to metaphorical sentences and scrambled sentences. The differences between these two sentence conditions appeared at the earliest recording window, 200-400 msec.; for the medium and high I.Q. groups they observed an overall more positive ERP response for metaphors than scrambled sentences. In contrast, the low I.Q. group showed little to no difference in the response between scrambled and metaphorical conditions in the regions associated with N400 component.

Coulson and Van Petten (2002) studied quantitative differences between the comprehension, literal sentences, conceptual mapping and metaphors using ERPs. They used 165 triplet sentences where the same word was used in the three conditions. They found that metaphors elicited a larger N400 component than did literal sentences, with literal mappings falling in between. They interpreted this data as agreeing with the hypothesis that the N400 is a measure of the difficulty of semantic processing. Although, the gradient of the N400 amplitude provides further evidence that metaphorical and literal language share some processing mechanisms.

Also, they found that metaphors correlated with the presence of a larger late positivity at posterior scalp sites than the other two conditions. In contrast, literal mapping elicited the largest late positivity at frontal sites (Fz, B1, Br). Furthermore, they observed in the follow up analysis that the interaction between condition and site correlated with differences between the front and the back of the head, instead of lateral differences. They interpret this in two general ways: first, that such differences reflect the modulation of an ERP component that was always present in all experimental

conditions and always larger at some scalp sites than other. On the other hand, true changes in the scalp distribution could be the result in the difference of sentence conditions. After normalization of the ERP data, they found that the late positivity elicited by metaphors was merely and amplitude enhancement present in all other conditions.

### 3. Justification

This investigation emerged from the necessity to evaluate the cognitive process in translation, simply defined as all underlying cognitive functions that make translation possible. This research centers on the analysis and characterization of the relationship between the cognitive functions that accompany an adequate translation process and the different responses to specific linguistic phenomenon that can be quantified and measured using event-related potentials (*ERPs*). To complete this goal and add to the scientific knowledge of translation, the researchers will analyze and measure the event-related potentials from a group of translators and non-translators who have a high level of English proficiency in the city of Medellin, Colombia.

Translation from a theoretical perspective is understood as a communicative act that shares many characteristics with monolingual communication, but diverges from normal communication in that it is a mediation process between two cultures and two languages. From a psycholinguistic perspective translation involves a variety of cognitive processes (memory, attention span, critical attitude, etc.) and abilities, logical reasoning, analysis and synthesis (Hurtado & Alves, 2009). This special act of communication involves a cognitive process characterized by a phase of analysis, comprehension and interpretation of a specific communicative situation in a source language (*SL*) and the translation of all relevant linguistic and extra linguistic information to a target language (*TL*). This process requires the adequate identification and reconstruction of all socio-cultural and communicative contexts inherent within all speech acts.

Recent trends in empirical research have mainly focused on the nature of bilingualism, L2 lexical access, L2 comprehension, and the nature of “*natural translation*”, a type of translation that arises naturally from bilingualism. But few have focused on the process of the translator. There has been, however, within translation research an attempt to describe and define the concept of translator competence from a

cognitive perspective based on the development of cognitive networks and connectionist approaches. Amparo Hurtado and Fabio Alves (2009) point out that although there are studies which compare the performance between professional translators and translation students, there has been no empirical study of the acquisition process as a whole.

Recently, translation researchers have adopted Think Aloud Protocols (*TAP*), a technique borrowed from psychology, in hopes of deepening the understanding of the underlying cognitive process during the realization of a translation task (Shreve, 1997). This technique enables the approximation of the underlying cognitive process, from the analysis of the conscious verbalization of strategies and stages within the process. The primary goal is to improve the abilities of the translator through better understanding of the process and thereby developing new and better teaching techniques. Key cognitive difference emerging from these descriptions, define the difference between units of translation; natural translation following word to word as the primary unit, while professional translation the unit is much larger from meaning to meaning.

Although this method has shed light on the translation process and contributed to the production of updated teaching techniques and theoretical models, it remains an incomplete window into the mental inner workings of translation, as Hurtado and Alves (2009) note the process is not amendable to direct observation. The method records periods of silence, strategies used, and the making of decisions, but many solutions come to the translator as a flash without a conscious process. Furthermore, one can presume that during the long periods of silence, present in the recordings, the brain is still processing information.

TAP tests offer insight and observation into some of the cognitive and strategic mechanisms during the translation process, but because of the conscious nature of the verbalization, and the unconscious nature of the cognitive process, many of the processes of translation remain outside the possible investigation by this method and do not allow for the analysis of the cognitive process from a more objective perspective, such as the neurophysiological studies of ERPs.

ERPs are understood as the electrical response of the brain on which the cognitive functions required by the specific task depends. The contents of the stimulus information vary the function of cognitive processes, such as attention, memory, perception, language, and thus enable the study of brain activity relating to mental processes. This type of empirical test has been particularly effective in the investigation of language processing because of its high temporal resolution and ability to register differences in scalp distribution.

Metaphors have long been misunderstood as belonging solely to elevated speech and art, but recent research in linguistics has drastically changed this misconception. Lakoff and Johnson (2003) consider that metaphor is much more than a simple embellishment but a cognitive phenomenon with conceptual and cultural roots that infuses everyday speech acts. Metaphors have the power to create realities within a discourse and effect the categorization of human experience with an image that is cultural and contextually specific. Their presence in a discourse is one of the most subtle and difficult to understand and transfer. With this in mind a translator should not only identify the metaphor in context and its meaning, but furthermore realize a contextualized interpretation of the intentionality and the conceptual cohesion behind the phenomenon to recreate the discourse in the target language and culture that has the same linguistic and extra-linguistic characteristics as in the source language and culture.

This is why the surge in importance of the description and analysis of the cognitive translation process regarding metaphors. In order for a translator to identify and analyze a metaphor in a source language and culture and later transfer it to a target language and culture requires a more complicated process of comprehension and translation. This is most certainly due to the cultural roots, and the unique conceptualization of experience within all cultures. The description of the translation process enables both professional and aspiring translators to have a more complete understanding of the translation process from a cognitive perspective and a major contribution that will improve the abilities of translators and leads to better translation products and teaching methods (Bell, 1991).

The research proposed here permits the investigators to observe a more complete picture of the brain activity of the translator, not only the conscious activity that can be verbalized like in TAPs. This study relays on the human resource with formation in translation and also on the utilization of the necessary technology to apply the instrument design. With this in mind, this empirical low risk empirical-analytical study, does not only hope to contribute to the understanding of the cognitive process in translation, from theory to description. But furthermore we hope that it will open a path to the cognitive study of socio-cultural contexts and models which is of the utmost importance in the labor of translation.

### **3.1 Objectives**

- To identify the changes that the translator undergoes in their cognitive process in a translation task of metaphorical and non metaphorical contexts using ERPs as a measure.
- To determine the characteristics of the process of translation that evidence when comparing an experimental and control group when they face a specific translation task.
- To compare the similarities and differences of the cognitive process in a translation task of metaphorical and non metaphorical contexts, between the experimental and control group.

### **3.2 Theoretical framework**

#### **3.2.1 Process of translation**

Here, translation is viewed as a series of mental steps, or processes, that a translator carries out when he or she confronts a source text (*ST*) with the intention to reproduce a target text (*TT*). These mental processes include his, or her, previous knowledge, memory, perception, and attention, as well as the all relevant abilities and skills which lead to the resolution of problems and the final making of decisions. This approach focusing on the process instead of the product is relatively new within translation theory.

The two theoretical perspectives, linguistic and textual, which have dominated the history of the discipline, will be briefly explained to elaborate a contextual theoretical perspective within the study of translation.

The linguistic approach is driven by authors such as Vinay & Darbelnet (1958), Mounin (1963), Nida & Taber (1969), Newmark (1988), to mention a few, and centers around the study of translation through a method of comparative linguistics. The semantic and syntactic relationship between the languages translated, and the descriptions and comparisons of the translated texts are the primary focus of these paradigms. Hoping to improve the product of translation through the study, and development of methodology, which focuses on important linguistic features such as morphology, syntactic, and semantics and semiotics.

These theories gave rise to the textual approach which leaves aside the comparison of language unlike the previous approach, and focuses on the comparison of texts. More accurately, the primary concern of this perspective is how the linguistic qualities of the text and the interaction with the structure of the discourse and how this contributes significantly to the recreation of the target text (*TT*). This theory postulates that the recreation of the *TT* is possible only after the comprehension of the source text (*ST*) from a morphological, syntactic, semantic, pragmatic and stylistic perspective. The comprehension of both texts, *TT* and *ST*, thus becomes an important aspect and in many ways opens the door to the interest in the process of translation and not only the product. Some of the authors who have contributed to this approach include Wilss (1988), Reiss & Vermeer (1984), Nord (1991), Baker (1992), Neubert & Shreve (1992), among others.

The first approximation to a cognitive approach was made by Seleskovitch & Lederer (1986), with their proposal of an interpretive model. Starting from the obvious observation that the interpreter should re-express the discourse emitted by the speaker, only once the meaning of the discourse is understood in the source language (*SL*). In this process of comprehension and re-expression two important features converge in the

recreation of the discourse; the translator must take into account important aspects such as: pre-existing cognitive baggage and semantic information. From this, authors like Bell (1991), Kussmaul (1995), Wilss (1996), and Kiraly (1995), began to emphasize the process of translation in place of the product. They reasoned, in order to arrive at a culturally and linguistically adequate translation product, the translator should realize a process that integrates not only linguistic and cultural aspects but furthermore process all relevant information in and surrounding the source text to produce the target text.

Translation as a profession has evolved significantly through history and nowadays, theorists consider it as a complex act of communication and mediation. Bell (1991) defined this act of communication as sharing many of the same contextual and discursive features of normal monolingual communication such as; a specific situation, a speaker emitting a discourse, a listener, and a cultural context in which this complex interaction takes place. But translation diverges from a normal act of communication because the translator understands the speech act, as if he or she were the normal listener, and then transfers this act and all its qualities to a new context and culture. This is why the act of translation becomes an act of mediation; because he or she exists in the middle of the communication process as both the receptor and the speaker.

Bell (1991) considers the process of translation as a key aspect for study. He proposes a more complete understanding of the process will lead to improved teaching methodology, abilities of translators and hence better translation products. The objective of translation is to re-express all aspects of a discourse, or text, from one language and culture to another language and culture. Bell (1991) emphasizes the need to more comprehensively define and comprehend the overall concept of translation. By doing so, translators will understand that translation is not a simple act of transferring information, but a complex transfer of all relevant features both linguistic and extra-linguistic, of any given discourse. In place of solely focusing on the process, the action of the translator, or the product, the text produced a greater focus on the concept of translation, which encompasses both the action, and the product will lead to a greater theoretical cohesion.

From this essential aspect of the concept translation, emerges the necessity for the description and explanation of the bilateral relationship that exists between the process and the product. The product is the result of the reciprocal relationship between the translator, the *ST* and the target receptors (Wilss, 1996). These two essential elements do not exist in isolation from one another; it is the process that creates the product. Bell (1991) views this process as characteristically mental, and for this reason is subject to study and explain through the cognitive sciences. His model consists of three forms of memory systems: syntactic, semantic, and pragmatic which account for aspects such as perception, information processing and memory processing. These mental processes infuse in the comprehension of the *ST* and the analysis and creation of the *TT*, and are essential aspects of the new and wider concept of translation. Bell states “the replacement of a representation of a text in one language by a representation of an equivalent text in a second language” (1991, .p. 20), from this statement it can be inferred that a global representation of both texts has a place in the mind of the translator. This global representation provided by the source text corresponds to the initial input to begin the information processing. This process is by no means linear; there is a blend of both top-down and bottom-up processes all which lead to the analysis and creation of the target text.

Bell (1991) elaborated a model of the translation process from the perspective of psycholinguistics and artificial intelligence. This model, he stated, was developed with an end to give a more complete representation of the phenomenon of translation. Within his model the process has two principal phases, analysis and synthesis, which permit the translator not only understand the original text but also produce a target text that satisfies all communicative aspects. Within the process proposed there are six components, the processing of information, psychological dominance, short term and long term memory which play a central role in the understanding and production of both texts (*ST* and *TT*). Top-bottom and bottom-up processing and the visual recognition of the text itself identify and transfer the syntactic, semantic, and pragmatic aspects which govern the organization of the *TT*. This model illustrates a cascading and interactive process in which all phases and components interact simultaneously. Integrating all

areas of communication and language in light of the fact that meaning does not solely rely on semantics and syntactic but also pragmatics and culture.

Kiraly (1995), like Bell, believes understanding the process will lead to better teaching practices as well as better translation products. He postulates that the actual translation process is a combination of mental processes that are both conscious and unconscious. Employing the TAP method of analysis Kiraly (1995) compared the process of experienced professional translators, with those of novice translator students. He identified an intrinsic relationship between foreign language learning and translation, and also noted the two key differences between professional translators and their novice counterparts. First, professionals appear more methodic than their novice counterparts. While secondly, he observed that trainees tend to take more time and often are prone to omit important information. These studies aimed at describing the translation process providing relevant information and observations to both improve the existing translation methodologies and to diagnose the cognitive differences between novice and professional translators.

Shreve (1997) establishes translation as a process of communication in which the translator should consider three important aspects. (1) Translation as an act of communication, (2) translation as a median of communication between the source text (*ST*) and the target text (*TT*), and (3) translation as a cognitive process which aims at communicating a message adequately in a different socio-cultural context. They stress the co-mingling of both linguistic and cultural knowledge to achieve this objective (Shreve 1997). “Translation and interpreting are not only, or even primarily linguistic processes. To be properly understood, they must be seen in their social, cultural, and, of course, psychological contexts.” (Neubert, 1997, p. 5).

Neubert (1997) argues translation is an abnormal act of communication because it involves two different linguistic codes which should reproduce equivalent situational intentionality of the *ST* in the *TT*. He describes marked differences between a monolingual act of communication and an act of communication mediated by a

translator and establishes six principal differences; Mediation, distancing and paraphrasing, displaced situationality, bilingual and multilingual inter-textuality, and creativity (Neubert, 1997). These differences are essential in any translation process, comingling both theory and practice leading to a well structure final product.

While translating, the translator becomes a mediator establishing a close multi-dimensional relationship between the source text author, and all relevant aspects of the source text and the source culture with the target text's receptors and their culture. The intended goal is to produce a "*duplicated*" version in a new unique context. Although, many critics of translation insist that duplication is impossible and these two texts could never be truly identical. What is hoped for is the mental representation of the target receiver of the message corresponds with that of the original, or that of the original receiver. Ideally, if this is achieved the new receivers will be under the impression that they are receiving the message directly from the author of the original and not the translator. Therefore, it is of the utmost importance the wide knowledge of the translator regarding the language, the culture and the topic.

Evidence relating to the process of understanding a discourse in preparation of translation, has demonstrated that the target language influences the comprehension of the original text and the original language influences the target text. In the light of this, translators as mediators should pay attention to two languages two cultures and carry out the process of translation with an end to produce a culturally and pragmatically adequate product. There is a special interest in the process of mediation, because of its uniqueness in translation. In this process, translators become the first source text (*ST*) receptors immersed in a cognitive medium, providing them with the necessary elements to produce the mental representations of the *ST*. Through this, emerges the capability of verbalizing within a new specific context of communication a linguistically and culturally adequate message to a new receptor.

The second difference is distancing and paraphrasing, this considers the dual role of translators. In this context dual means a kind of double linguistic and cultural position. It

is important to note that translators should be as neutral as possible in a translation task. This neutrality is particularly evident, because of the adoption of an outside and objective position of observer. Although translators take position of observers, it is important to note that there is also a complete participation in the act of communication. A translation which is systematically and methodically undergone ideally compiles lexically, syntactically, semantically and stylistically.

Distance in this context means that translators are not intended to be emotionally or theoretically involved with the discourse and has a close relationship with the concept of “*duality*”. It is the distance that allows translators to monitor the cognitive process, to be objective, as well as to find the linguistic resources in the target language (*TL*) to paraphrase the discourse.

The third difference is displaced situationality. This characteristic refers to the discourse as an act of communication within a situational context. This means translators have the responsibility accurately and precisely identify and define the context of the act of communication before translation. The analysis of pragmatic, semantic and extra-linguistic features any discourse convey within it, leads to the identification of the coherence and cohesion of the discourse. These latter aspects are key to identify both the explicit and implicit features the acts of communication convey guiding the cognitive process in translation.

The fourth feature is bilingual and multilingual intertextuality, this refers to the idea that discourses do not exist in isolation; they are entities that form part of a system of discourses which are interconnected due to various situational and contextual factors and functions. Intertextuality refers to the textual characteristics of different types of texts and therefore is of utmost importance to take it into account as a key aspect that governs much of the translation process. Translators move back and forth between two systems of communication or two distinct worlds, their attention must be divided between two or more strategies that permit the production of an adequate target

discourse from a social, cultural, and linguistic perspective while staying true to the source text.

Another of the enumerated differences is creativity. The term creativity here refers to the application of both linguistic and cultural knowledge which translators accumulate through practice and experience enabling the development of skills and abilities to interconnect those aspects in the translated discourse. Therefore, the process of translation involves a great deal of creativity. A target discourse does not come from nothing; it is the result of a combination of knowledge, expertise, and intuition all applied within a creative process. This creative process then weaves the old linguistic structure into a new one in which the linguistic forms, structures and morphologies are new. This new semantic fabric, translators constantly need to find alternative creative ways of expression which are culturally and socially acceptable in the target language. This process also related to the resolution of problems.

Lastly is adaption as pragmatic expansion. Translation is considered as an interaction between people instead of languages, which starts and finishes with an interaction defined by certain pragmatic conditions. Translators must first identify all shared cognitive knowledge with the source text author and secondly contextualize the said discourse so that they can start the process of translation. It is important to note that pragmatic qualities of a discourse include the consideration of extra-linguistic features of both language 1 (*L1*) and language 2 (*L2*).

These six differences described above are present in the process of any translation. They do not occur linearly, but on the contrary, are simultaneous and interconnected during the whole process. Neubert (1997) also states that translation is an abnormal act of communication from the point of view that it involves more than one linguistic code, which although different, should tend toward the preservation of the same situationality and intentionality of source text author. Likewise, translation involves two languages, two cultures and two acts of communication, the distinct cognitive process of

understanding and processing the information includes the two languages, the two cultures and the two acts of communication as well.

In the cognitive process of translation *translatio* goes through various internal stages from the comprehension of the original text to the passage of the original content and lastly the production of the target text. The first stage of comprehension of the source text is the most similar to normal communication, although the process of reading a text should not deviate from the primary purpose of translation. Studies have shown that when a translator comprehends a text for the purpose of translation, lexical items in the target language become unconsciously activated and the initial stages of conscious planning take place (Thierry & Jing Wu, 2007).

Neubert (1997) postulates that the process of translation involves two principal stages: one external and one internal. The former establishes two parallel interactive relationships, the first between the translator and the *ST* and the second between the translator and receptors of the *TT*. The latter consists of the comprehension processes regarding the *ST*, and the translation and production of the *TT* (Neubert, 1997). This relation should center on the capacity of the translator to interpret and infer relevant information in the *ST* and the linguistic ability, both semantic and pragmatic, which enables the production of said discourse in a new socio-cultural context. The *ST* comprehension requires activation of memory, perception, attention and decision making in the translator's mind. This they refer to as "and translation is the result of the complex integration of a variety of common cognitive mechanisms acting over specific configuration of neural sites." (Shreve & Diamond, 1997, p. 246).

This interplay represents different mental functions and shared knowledge which regulates the enunciation and comprehension of a specific speech act. Also, they are principally responsible for the decisions made to produce the target discourse. In the end, the integration and comprehension of the cognitive processes during translation, characterized by cross-linguistic and cross-cultural features, will lead to a higher level of translation competence and teaching methods.

From another perspective, Wilss (1996) proposes the development of translation studies (*TS*) from a cognitive perspective. The proposal based on cognitive psychology, which Wilss states relates to translation: “cognitive psychology seeks to understand perceiving, thinking, remembering, problem solving, understanding, language use, learning and other mental phenomena.” (Wilss, 1996, p. 38). These mental functions which cognitive psychology seeks to understand are fundamental to translation. The discipline of translation requires someone who first possesses the abilities and skills in at least two languages and also knows the linguistic extra-linguistic and socio-cultural aspects of the languages. Lastly, the translator needs to dominate both declarative and procedural knowledge. This means, the translator’s knowing “*what*” and knowing “*how*”, within the specific communicative context, leads to the adequate execution of the reproduction of a discourse. All of which fall into the realm of cognitive functions that cognitive psychology seeks to understand. From these insights, he is in favor of developing different types of experimental studies, and borrowing physiological methods, which contribute to the understanding of mental information processing. Wilss (1996) states: “what is required is a cognitive, hermeneutic, associative way of thinking; one seeks to capture translator performance in a dynamic way and regards translation as a specific form of linguistic information processing” (Wilss, 1996, p. 31). In the light of this, translation requires dynamic analysis, not only from the language structure point of view, but from the perspective of information and interpretive processing. Therefore, studies conducted to analyze translation as a dynamic process would help to understand this complex phenomenon.

Although, Wilss (1996) does not propose a descriptive model of the process of translation, he does suggest some key features that should be included in such a model. First he draws a clear distinction between *ability* and *skill*. These two concepts need to be well defined in the light of the translation process. *Ability* refers to the innate faculty one has to perform a task, whereas *skill* refers to the developed talents or expertise through a learning process, employed in a complimentary bilateral relationship. Reproducing a text in another language requires, apart from knowledge and a complete process of comprehension, a balanced combination and application of the features just

mentioned. His cognitive approach to translation begins by giving importance to knowledge, and based on Bartlett's (1932) theory of *schemata*. This theory considers knowledge is divided into well structured cognitive units that create something like scaffolding, which transforms throughout the translator's experience and learning; and is the principal reason why knowledge and experience become relevant aspects in any translation task.

The theory of schemata, mentioned above, maintains a close relationship with the translators' mental processes, abilities and skills. Wilss (1996) gives special importance to the problem solving and the decision making processes, considering these two complex mental processes as key factors in translating a discourse. Several factors converge when translating a discourse: language, knowledge, culture, expertise, abilities and skills and the ability to carry out pertinent research when needed. All are interconnected and converge within the problem solving and decision making stages.

### **3.2.2 Cognitive processes**

The study of perception and cognition looks to understand how an organism transforms, organizes, stores and uses information arising from the world in sense data and memory. Martin Bly (1999) defines cognitive science as the study of mental representations, and computations of physical systems that make complex behavior possible. This field of study categorizes these basic mental mechanisms into simple and complex processes; the former consists of sensation, perception, attention, and memory, while the latter includes thinking, language and intelligence. These processes make possible the construction of mental representations, which refer to the construction of concepts and mental images. An organism receives information through the sensorimotor or visual system, which then passes through the limbic system arriving at the areas of the brain involved in the language identification and production. Once the stimulus has reached the proper area comes the problem solving activity that is the interaction and activation of the experiences of the world and the knowledge that leads to the decision making process that in terms of Wilss (1996) requires six steps: identification, clarification of

the problem to solve, research, procedure, time to make the choice, and finally evaluation of the choice made.

### 3.2.3 Attention

“Everyone knows what attention is. It is the taking possession by the mind, in clear and vivid form, of one out of what seem several simultaneously possible objects or trains of thought.” (James, 1890, pp. 403–404). Attention as a faculty employs different sub-components: orienting, detection, shifting and the maintenance of vigilance. Although, how these separate components interact with different types of stimulus are still open for debate. The general questions that have been of interest in empirical research are concepts such as *Divided Attention*, or how much can be taken on at once, *Selective Attention*, how relevant stimuli are processed while irrelevant stimuli ignored (John Duncan 1996). It can be said for certain, whatever their relationship or definitions may be, or the systems of subcomponents that comprise them, both are important in any translation and recognition task.

The majority of the previous work dealing with attention centers on what is called “*selective information processing*”. This concept is based upon the fact that attention modulates signal detectability, which relates to the notion relevant stimuli are attended to more accurately and quickly than irrelevant stimuli. Furthermore, it has become clear through empirical tests that the relevance of a specific stimulus is processed quantitatively differently than extraneous stimuli (Baddeley, 1986). These aspects fall within the definition and explanation of developed psycholinguistic models of attention, making a distinction between automatic and controlled processes. Automatic processes are automatic, do not require cognitive resources; unlike the controlled processes which are slower, serial, and require resources.

Research involving PET tests and recordings from scalp electrodes has provided important information regarding the role of attention in high level cognitive skills. This has particular relevance to the current research. Skills such as reading, has a high

dependence on rapid processing. A skilled reader fixates on any given word for only about 275 msec. (Rayner and Sereno, 1994) with activation of the cingulate cortex appearing as early as 150 msec. after a stimulus. Because attention can occur quite early after the input of a stimulus, it has been suggested that subjects can carry out a number of different operations with the same activated neural network.

### 3.2.4 Memory

Van der Linden and Poncelet (1998) define memory as, “The term *memory* implies the capacity to store, recall, and encode information.” This cognitive capacity is the interest of many empirical investigations and theoretical models, and plays an important role in the translation process. The first proposal that memory might be the function of two distinct systems instead of a singular system was made by James (1890). He developed a model of memory that consisted of two distinct systems, *primary* and *secondary* memory. Other more recent proposals have made various distinctions regarding the different types of memory; short vs. long term, implicit vs. explicit and working memory, among others.

*Working memory* implies a limited capacity system which controls temporary storage and the processing of information while a cognitive task is being performed. Previously researchers thought hypothesized two principal functions, the storage and recall of information that will be needed in a few seconds and as a path way to long term memory. Braddley’s model (1986) has defined this type of memory as a principal limited capacity attention control system, the *central executive*, coupled with at least two sub-servant systems; the most principally investigated being the phonological loop, and the visual -spatial sketchpad. Various empirical investigations seem to confirm that this type of memory is significant contribution to various cognitive abilities including: reading, auditory comprehension, vocabulary acquisition, counting and mental arithmetic, reasoning, problem solving and planning (Van der Linden & Poncelet, 1998).

There are several proposals of how memory plays a role in sentence processing and comprehension. One theory considers the function of the phonological loop (Saffran & Marin, 1975) as responsible for the first pass syntactic analysis of a sentence. In contrast, other views consider that the phonological loop as responsible in second pass analysis of a sentence after the syntactic analysis, but before the full interpretation of the structure. Likewise, there are several competing theories as to the role of the central executive system and the processing of language. Adding to the difficulties, research has attributed many distinct abilities to the central executive, control of processing, and storage activities (Van der Linden & Poncelet, 1998). What is clear; memory is a complex phenomenon which relays on many different levels of representations, and central to the comprehension of language.

### **3.2.5 Cognitive process in translation**

The advent of cognitive science has opened up the possibility to study the process of translation from an objective empirical perspective, instead of solely from analysis and criticism of the product. Therefore, the study of the cognitive process in translation is a new and distinct theoretical perspective which analyzes translation as an information processing, a problem-solving and a decision making activity, which are complex mental processes.

Translation is considered as an act of communication, and a mental process (Hurtado, 2007). In this section translation is viewed as a cognitive process, which is simply defined as all the underlying cognitive functions that make translation possible. Translation does not only require that a translator decode and recode a message, but more precisely the translator has to simultaneously act as the original receiver of the message and the original sender of the message. Authors such as, Bell (1991), Kiraly (1995) y Firth, (1964) are just some of the authors that have taken an interest in the study of the cognitive process of translation and have contributed to the development of cognitive models. They consider the comprehension of the process is essential to the

production of adequate models from all perspectives of communication, syntactic, semantics, pragmatics and stylistics.

Shreve & Diamond (1997) approach the process of translation using a heuristic method. This method aims at educating translation researchers, who are not familiar with areas of psycholinguistics and cognition, to understand the cognitive process in reference to translation and interpretation. They establish translation as a process of communication. They consider three important elements; translation as an act of communication, translation as a median of communication between the *source text (ST)* and *target text (TT)* and lastly, translation as a cognitive process which aims at communicating a message adequately in a different socio-cultural context. This complex process of communication requires both linguistic and cultural knowledge in order to achieve this objective (Shreve, 1997). The process of translation as a whole is composed of a number of linguistic, cultural and specific types of knowledge, which is why translation should not be taken as an isolated and static task. “Translation and interpreting are not only, or even primarily linguistic processes. To be properly understood, they must be seen in their social, cultural, and, of course, psychological contexts.” (Neubert, 1997, p. 5). Their perspective of translation agrees with Hurtado’s (2007) and Wilss’ (1996) in the sense that they first considers translation as an act of communication, secondly as a mental process that requires specific abilities and skills. Communication and mental process become quite important concepts within translation because; communication refers to the interaction one establishes with another to convey a message within a specific context. Translation is an interaction between individuals, or groups of individuals. The concept of mental process refers to all the cognitive functions activated in specific tasks one performs to both produce and receive a said message. With this in mind, one can place translation as an in-between task which needs to include both communication and mental processes.

In the light of this, theorists of translation who study this task from the cognitive perspective try to first understand the processing of information. Because, comprehension and information processing is the beginning in a series of steps which

lead to the re-production of the discourse. From this perspective, the capacity of the translator to interpret and infer relevant information in the *ST* and his- her linguistic ability, both semantic and pragmatic, are key to producing the source discourse in a new socio-cultural context.

The cognitive process in translation as the functional processing of information consists of three important moments: the input stimulus of the information and its input canals, which correspond to *the beginning of the process*. The processing of the information in the brain, which is the construction of the mental representation and the *process itself*, and finally the emission of a set of responses regarding the input stimulus which refers to the *product*. These stages do not happen in isolation, but simultaneously during the process of translation.

Translation is based on the activation and conjoining of different types of memory. The auditory or visual stimuli processed in the corresponding brain area activate a recall stored in the long-term memory (Shreve & Diamond, 1997). This first leads to the generation of an initial mental representation in the context of the source culture. This mental representation is then transferred as a whole to the target context, which marks the beginning stages of the planning and preparation for translation. During this stage of information processing, the translator does not only activate semantic and lexical memory of the source language, but also in the target language. The translator is then recalling information from their short term memory and using their working memory, which consists of a system of a visual-spatial sketch, phonological loop and central executive interacting with the storage of long-term memory. Although the systems of long term memory are largely the same for both languages, the areas of access in this process are distinct. The difference between this cognitive process involving translation and a normal cognitive process is that regarding translation the input stimulus the translator receives in a source language (*SL*) activates a mental representation and its conceptual representations which are associated with those in a target language (*TL*). Once the translator has processed the information, comes the moment to reproduce the micro-aspects of the discourse. This followed by the production and fine revision of

syntax, semantics, rhetoric and stylistics constituting the whole of the translation product.

### 3.2.6 Metaphor

In this section we begin our examination of metaphor by first examining the distinction between literal and figurative language.

“The traditional position, both in philosophy and in linguistics – and indeed the everyday view – is that (1) there is a stable and unambiguous notion of literality, and (2) that there is a sharp distinction to be made between literal language, on the one hand, and non-literal or figurative language on the other” (Evans & Green, 2006, p. 287).

Following this traditional view of language, there is a clear and unambiguous distinction between the two types of language. This perspective treats literal language as transparent and precise, while figurative language is imprecise and unscientific falling within only elevated and literary speech. Literal and figurative languages are truly complex concepts which are not readily distinguished. The complexity and subtle nature of their relationship can be seen in the plethora and variation of definitions that exist (see Gibbs, 1994; Lakoff and Turner, 1989; Lakoff and Johnson, 1980). Moreover, cognitive linguistics have attacked the idea that figurative language only pertains to the poetic and the literary by pointing out that everyday speech and ordinary expressions are highly metaphorical in nature.

The metaphor has been considered and studied as a linguistic resource for more than 2,000 years within the discipline known as rhetoric. First established in ancient Greece and focused on how to persuade others with the use of rhetorical devices. Metaphor was included as one of these devices, called *tropes*, and due to its central importance was considered the *master trope*. The term metaphor comes from the Greek “*metapherein*” which simply means “*to transfer*”; and was first postulated by Aristotle

in “*The Poetics*”. He defines metaphor as a change in the meaning of a word, from its normal use to that of another.

Aristotle, in his work meditates on metaphor and its emotional affect in humans while considering it from two perspectives: first, within literature specifically poetry, and secondly from its persuasive nature in specific contexts of judicial and political communication. His analysis of linguistic expression centers around the study of a fundamental lexical unit, names. Proposing a system of classification based on characteristics of morphology, style and conventionality. Within the classification of style appears the designation metaphor, which he differentiates between types of names *current* or *strange*, *dialectal*, *ornamental*, *newly coined* or *lengthened*, *contracted* or *altered*. He states that names, in and of themselves are not metaphors but are converted into metaphors when a name that designates one thing is transferred to refer to another. The principal of his definition is lexical necessity and within his classification he also considers *analogy* and *simile*.

Searle (1979) and Grice (1975) proposed an *indirect model* of the comprehension of metaphors that stipulates: the basic principal under which a metaphor makes sense is only after the rejection of the possible literal meaning. In other words, the metaphor is a departure from normal language use and therefore one that takes extra effort to understand. This model led to two important implications for the comprehension of metaphors; first, if metaphors are “*special*” then they are therefore processed quantitatively different than literal language, and secondly the computation of literal meaning precedes that of metaphorical meaning. For semanticists like Leezenberg, and Davidson (2001) the metaphor itself is a linguistic characteristic that relies on the pragmatic meaning to cancel some of the essential features of an object. The subsequent linguistic expression contains different meanings under different contexts. It is not the sentence, or type of sentence, but rather the sentence in context which is interpreted metaphorically. What this means is a metaphor is understood as what the words truly want to say.

Through the advent of cognitive science the study of metaphor has taken a new and distinct perspective. These theories consider metaphor as a cognitive phenomenon, not a purely linguistic or rhetorical resource, which is fundamental to the construction of concepts. Brugman (1988) considered metaphor as a tool to help linguistic mechanisms such as lexical polysemy while Sweetser (1990) studied the phenomenon in terms of explaining constructional polysemy as well as the historical changes.

In contrast, Lakoff and Johnson (2003) consider the fundamentals of our conceptual system in terms of which we both think and act are essentially metaphorical in nature. They propose that the underlying process of comprehension is automatic and without conscious effort. Furthermore, they state that metaphors are used to construct new concepts from those that already exist. This conceptual phenomenon forms a hierarchy which is characterized in a coherent system of metaphorical concepts and a correspondent system of metaphorical expressions of this basic concept.

Following this cognitive theory the majority of meaning is metaphorical, and we do not arrive at meaning by the reinterpretation but through conceptualization, which make them predictable by their conceptual nature. Metaphors conceptualize experience in terms of a cognitive mechanism which maps one domain of experience on top of another. This is to say, that the second domain is understood, at least partially, in terms of the first. The second domain receives its conceptual structure from the first and allows the listener or reader to understand the meaning in more specific and concrete terms (Lakoff & Johnson, 2003). The target domains are for the most part more abstract and therefore more difficult to conceptualize whereas the source domains are typically more concrete and physical. Within this perspective metaphors are not only a stylistic resource used to embellish a discourse, they become essential elements in the process of understanding, creating, and categorizing reality.

Taking this understanding of metaphor a step further Lakoff and Johnson (2003) postulate that if a concept is metaphorically structured. Therefore, the activity and the language which refers to them are also metaphorically structured. The metaphorical

expressions are characterized in a coherent system of metaphorical concepts and a corresponding system of expressions for these concepts. They propose that the underlying process of comprehension is automatic and without conscious effort, unlike Searle's model (1979) which states the necessity of the rejection of the literal meaning in order to reinterpret the sentence metaphorically.

The cognitive theory states that the majority of meanings are metaphorical and the adequate interpretation is reached by conceptualization, instead of reinterpretation. Lakoff and Johnson (2003) classified metaphors in 4 types: ontological, personification, structural and orientational metaphors.

#### **3.2.6.1 Ontological metaphors**

The principal characteristic of this first type of metaphor is the objectification of an abstract concept or phenomenon. There by, the ontological metaphors make the understanding of abstract features of experience more easily referenced and quantified. This type also serves as a way to attribute qualities and establish motivations by means of the new physical nature of an abstract concept.

#### **3.2.6.2 Personification metaphors**

This type of metaphor refers to the attribution of human qualities to objects and concepts. By this, the reader will be able to construct a familiar mental representation which will help them to understand the concept being explained.

#### **3.2.6.3 Structural metaphors**

Structural metaphors are those which structure one concept in terms of another. This characteristically takes one domain, usually more abstract, and maps onto another, hence the first receiving structure from the second. This structuralization allows a reader to understand certain aspects of a concept better via the more accessible physical domain.

### 3.2.6.4 Orientational metaphors

This type comes directly from our experience of the world around us. These new spatial relationships intend to make concepts clearer, by referencing easy to understand concepts like *up* and *down* for concepts related to emotion (happy is up, down is sad), quantity and quality (more is up, down is less).

### 3.2.7 Metaphor in translation

The metaphor as a linguistic and cognitive phenomenon should be understood, interpreted and translated adequately from its source language and culture to its target language and culture. As previously mentioned the translation of metaphor has traditionally been treated as a part of the larger problem of “*untranslatability*”. Within this discipline, taking into account this cognitive theoretical proposal of metaphors, the translator should understand not only the meaning of the metaphor, but decode the intentionality of its use in the source language to find either a metaphor or an equivalent expression in the target language that transmits the same message and the same intentionality.

The information mentioned above is true for all languages when translated, but it is compounded when the translator encounters the presence of metaphorical language. First, emerges the necessity to identify the domains of the metaphor, and the relationship that a specific culture and context assigns between these domains. This relationship between domains is the key to the meaning of any given metaphor based on the cultural significance and implications of the domains, and the relationship between them. Secondly, the translator must be aware of the significance of the domains themselves and furthermore of the relationship between these domains in the target language and culture. If the domains of the metaphor and the relationship between them are not conceptualized in the same way in the target language and culture, it is of the utmost importance that the translator shifts these domains to culturally appropriate symbols and

relationship in order to achieve the same effect in the target language and culture. This relationship between metaphorical domains within the discipline of translation studies calls “*similar mapping conditions*” and “*different mapping conditions*”, this observation builds upon the hypothesis that the more two cultures conceptualize experience in a similar way, the more a translator can preserve both the meaning and the image of a metaphor.

The materialization of the translation process is the product or text, which is made possible through this complex act of communication. Within this flow a number of cognitive processes that require both linguistic and cultural knowledge to complete the adequate transfer of a speech act from an original language in a specific situation of communication. The translation of metaphors is not different, only more complicated because the form of communicating concepts requires a process of analysis, comprehension, and interpretation of a specific linguistic device, metaphor, deeply rooted in the shared values of a culture. Snell-Hornby (1995, p. 41) expresses the same idea

"the extent to which a text is translatable varies with the degree to which it is embedded in its own specific culture, also with the distance that separates the cultural background of source text and target audience in terms of time and place."

Therefore, the translator has a double responsibility with the author of the text and the readers (of the translation) to re-express an adequate discourse, that satisfactorily communicates all the aspects mentioned above. This agrees with the observation of (Martínez, 2004, p. 16)

“The pragmatic elements appear in the act of communication and affect translation; equally it is necessary to consider the discursive elements and the form in which they operate in the corresponding textuality, as well as the origin as a result of product.”

It is essential to the labor of the translator to identify the intentionality behind the act of communication with an end to establish a strong relationship between languages, context and text. Furthermore, the multi-dimensional relationship between the three elements is just as important as the three elements themselves because this relationship bears heavily on the negotiation of meaning. This is how it is expressed in (Hurtado, 2007, p. 543) “This is how the meaning of the text is always a negotiation between the producer and the receptor. This negotiation of meaning is also produced in the translation and follows Hatim and Mason as a key functional element.” When we speak of meaning in translation there needs to be a careful consideration of the inferential process that a well formed translator realizes to unveil the significance of a speech act. Therefore, the translator confronts two visions of the world, the first from the source culture and language and those of the target culture and language. With this in mind, a skillful translator possesses both declarative and procedural knowledge which together with creativity and resourcefulness permits him-her the production of a contextual adequate text.

The metaphor as both linguistic discursive phenomena, and a conceptual mechanism, finds explanation in the proposal of Sperber and Wilson (2006) based on the work of Grice (1975) and Fodor (1983) which postulates that pragmatics and relevance of language in specific situations of communication is of the utmost importance. This theoretical proposal made a significant contribution to the understanding of meaning within specific contexts. If this proposal is seen as a point of departure, the translator should not only understand the metaphor in context, but the intentionality behind its use in the original language with a goal of finding a metaphor or expression in the target language that transmits the same message and intentionality. The translator must not only take into account the utterance, the un-verbalized beliefs, the context, the conditions which surround the speaker, and the syntactic construction that comprises an act of communication. But furthermore, the cultural significance of the metaphorical domains, the relationship between the domains which the meaning of the metaphor emerges from, and finally what the relationship between the domains would be in the new context. If this transfer of a preserved metaphorical image is not

adequate, he or she must then find new domains in the target culture which better approximate all the qualities of a speech act.

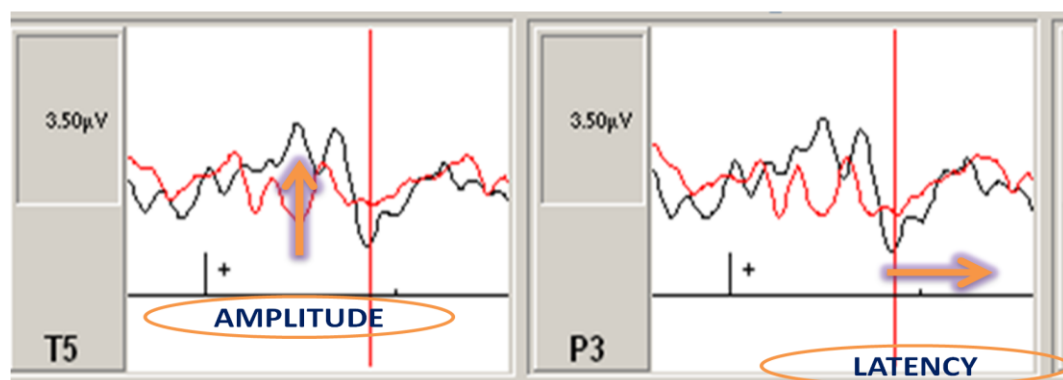
Katan (1999) proposes a cognitive approach to the study of culture, in terms of the specific way people conceptualize experience within a culture. He considers different cultural models for perceiving, relating to, and interpreting experience and subsequently the meaning of linguistic expressions. This view of culture suggests that, when translating a text to a target language (*TL*) of any other culture, one needs to be aware not only of the patterns of thinking, and acting in one's own culture, but also of the Target Language's cultural models of reality. Nida (1964) described the '*best*' translation as the one capable of evoking in the *TL* reader the same response as the *SL* text does to the *SL* reader. Although many believe that this is an idealized and unachievable goal. If considered together, the two theories shed light what could be considered an adequate translation of metaphor. An adequate translation of metaphor is one which relates the same way to the original receptors form or cultural model of experience within the new context, and cultural model, for the target receptors.

### **3.2.8 Event-Related Potentials (*ERPs*)**

In the past two decades the increase in interest in the investigation of language specific Event Related Potentials (*ERPs*) has opened a door to a new and objective way of studying such topics as lexical access, word class distinctions, phonological access, the nature of bilingualism, and the process of comprehension. The electroencephalogram (EEG) records the fluctuations of voltages in various scalp sites in reference to a common location, such as earlobes or eyes, and then is averaged across all scalp sites. The scalp voltage reflects primarily synaptic activity on the dendrites of the cortical pyramidal cells because pyramidal cells align their dendrites vertically and this allows the voltage potential to summate (Martin Bly, 1991). This parallel alignment allows for the scalp potential to reflect the pyramidal dendrites, but does not reflect the pre-synaptic activity (axon potentials) or much of the non-pyramidal neurons which are not aligned and therefore it is not a complete reflection of the neural activity as do the

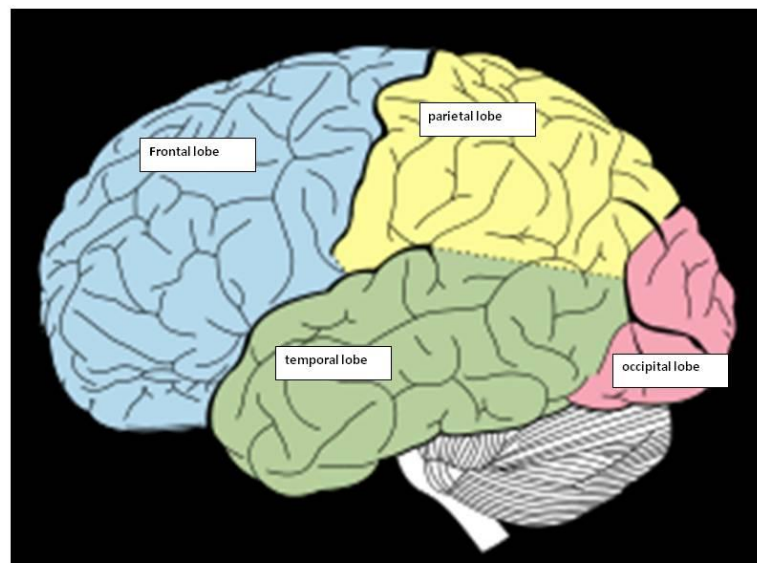
metabolically based methods such as the Positron Emission Tomography (PET), Single-Photon Emission Computerized Tomography (SPECT), Functional Magnetic Resonance Imaging (fMRI). Therefore the ERPs are not a reflection of all the neural activity but the brain activity that can be collected through a particular method of data collection. ERPs permit a high temporal resolution that fMRI and PETs do not (Segalwitz & Chevalier, 1998).

The ERP is a series of waves with positive and negative peaks, often referred to as components, which occur in milliseconds after a stimulus. These peaks reflect the neural activity in language comprehension and processing. The earlier potentials characterize many of the automatic aspects of processing the stimulus while the later waves reflect the subject's cognitive strategy. These components are actually a number of subcomponents which can be analyzed separately through their patterns across the scalp and by careful experimental design. The assumption is that language sub-processes are sub-served by different anatomical and physiological substrates that will generate distinct patterns of biological activity (Coulson, 2004). The principal aspect of study is the relationship between the ERP components and specific language stimuli that elicits them. This neurobiological activity is characterized by *latency*, the time which the wave reaches its largest amplitude, *scalp distribution*, the pattern of amplitude across all scalp sites, and *polarity (amplitude)*, whether the electrical signal is positive or negative (Coulson & Ven Petten, 2002).



**Illustration 1 N400 latency and amplitude**

The brain cortex is divided in four areas (see figure 1); the frontal, parietal, temporal and occipital lobules and divided between the two hemispheres, the right and the left. The frontal lobule is the closest to the forehead, since it contains most of the dopamine sensitive neurons is associated with attention, long term memory, and planning. The parietal lobule is in the lateral part behind the central sulcus and the caudal of the frontal lobule, it receives sensory information. The temporal lobule is on the base of the brain and ventral to the frontal and parietal lobules. The temporal lobe is important for the processing of semantics in speech and vision; it also plays an important role in the formation of long term memory. The occipital lobule is in the most posterior part of the brain, caudal to the parietal and temporal lobules, associated with the processing of visual information. (Carlson, 1999).



**Figure 2. Brain areas**

### **3.2.8.1 Relevant ERP components**

ERP components are generally categorized into six distinct groups or families. *Readiness potentials* associated with motor preparation and mental chronometry, *error*

*detection* 150 – 400 msec window responsible for error correction and detection. *Sensory-perceptual components* in the 2-200 msec window, including P20-50 an auditory component, N100 early attention selection, P100 visual, N180 sensory memory and the visual N200. *Discrimination and recognition* components elicited in the 150 – 500 msec window. This type includes the P300 and the N200, which are associated with: late attention selection, feature discrimination, pattern recognition classification and decisions, orienting to novelty. *Memory* components occur in the 200 – 600 msec window, these late positivities and late negativities are associated with the processes of storage and retrieval mechanisms, and explicit vs. implicit memory. Language related components also present in the 200 – 600 msec window comprised of the components: N400, syntactic positive shift, lexical processing negativity, left anterior negativity. These language related components relate to the processes of lexical, grammatical and semantic processing, sentence parsing, and semantic memory.

### **P300 and P600**

There is a significant amount of debate as to whether the P300 and the P600 components are truly distinct; although various studies have demonstrated that they respond differently to different types of stimulus (see Coulson & Van Petten, 2002). Some researchers have argued that the P600 is related, or even identical, to the P300 (Müntz, et al., 1998). Others have argued that they are neurally and functionally distinct (Osterhout, 1997). This debate centers on the nature of the latency shifting effects of the P300.

Certain ERP components are sensitive to the expectancies of the individual. The most common and thoroughly studied is the P300, characterized by a positivity peak 300 msec after a stimulus. This component is commonly defined as endogenous, because it depends greatly on the processing of the stimulus in context and the levels of attention. The classic task which elicits this component is the “*oddball*” paradigm. This task involves the detection of a semantic anomaly in a series of like stimuli. Although, studies show that there is no direct affect by the physical properties of the eliciting

stimuli. It typically reacts to the expectancy, or priming, of a stimulus within a series. Infrequent stimuli elicit larger amplitudes of the wave than frequent, and a linear decrease as the expectancy of any given stimulus increases. Also, the latency of the P300 has been shown to reflect the time taken for stimulus evaluation. This component is generally associated with the cognitive abilities; late attention selection, pattern recognition, classification & decision, orienting to novelty.

The P600 component does not have a clearly defined peak; rather it is a mean voltage within a latency window of 300 to 800 msec post-stimulus peaking at a midpoint of 600 msec (Osterhout & Holcomb, 1992). Some researchers consider the P600 is specific to syntactic processing of language (Osterhout & Mobley, 1995). Other ERP research, however, does not concur with this conclusion (Münte, *et al.*, 1998). Generally speaking the P600 is a positive long latency ERP and has duration of several hundred msec with a centroparietal positivity (Osterhout, 1997). Osterhout and Holcomb (1992) concluded that the P600 seems to act as an electrophysiological marker of the syntactic garden-path effect, and is clearly distinct from semantically inappropriate response, namely, the N400. Furthermore, previous studies have attributed a close association with semantic anomalies (Osterhout and Holcomb, 1992) and as an index of successful comprehension (Coulson, 2001).

### **N400**

It is generally accepted that the N400 component is a distinct neuro-physiological process different from the P300. Although there is debate to how much the N400 response to sentence final semantic anomalies may be influenced by latency shifting of the P300. Though several variables may affect the N400 ERP component, it is generally accepted to be associated with semantic processing.

Regarding the function, the N400 proves a sensitive measure of cognitive state, and responds systematically in amplitude, latency and topography to a wide range of psycholinguistics manipulations (Frishkoff & Tucker, 2000). Also the intensity

correlates with degree of semantic relatedness, regardless of congruence (Holcomb & Neville, 1991). The amplitude varies in correlation with a variety of factors. The amplitude demonstrates a corresponding linear decrease as the expectancy for a congruous sentence-final word increases. This implies that it is a relation of the degree of expectancy of a word, as a part of the prior context. Some studies suggest that the amplitude reflects the difficulty of accessing information in long term memory (Kutas & Federmeier, 2000). Furthermore, the amplitude has been shown to correspond to word length, frequency, concreteness, and familiarity (Frishkoff & Tucker, 2000; Van Petten & Kutas, 1990). Another important aspect of the N400 is the inverse relation with cloze probability (Kutas & Hillyard, 1984). The N400 has been elicited in both visual and auditory modalities (Holcomb & Neville, 1990) One difference in response for auditory versus visual stimuli includes an earlier and more prolonged effect of the N400 for auditory presentation, slightly lateralized to the right hemisphere (Holcomb & Neville, 1990).

Previous studies which examined the ERP responses to metaphorical language have found a number of different responses regarding the N400 component. Coulson and Van Petten (2002) when comparing the differences to sentence final words across three conditions, literal, metaphorical, and literal mapping, found that the N400 graded in amplitude. They interpreted this observation to correlate to the difficulty in sentence comprehension. Also, corresponding to purely metaphorical language they observed a larger and later positivity that accompanied a larger N400 effect. In contrast, Kazmerski, Blasko and Dessalegn (2003) did not find that the size of the N400 reflected response difficulty between metaphorical and scrambled sentence conditions. Their data suggested the interpretation that the N400 is an indication of semantic integration, because of the smaller N400 for metaphorical sentences could reflect the automatic semantic activation of the meaning.

### 3.3 Operational charts

#### 3.3.1 Qualitative categories

This table summarizes the categories identified within the short post-test interview. This interview was designed to collect some qualitative data from the participants after this experimentation. The categories identified emerged from their answers, and are examined in the qualitative analysis.

**Table 1.**

#### Categories of Analysis

Category
<b>1. Theoretical approach to translation Definition of the process of translation</b>
<b>2. Context</b>
<b>3. Cognitive functions activated: Attention and memory</b>
<b>4. Instrument</b>
<b>5. Habituation</b>

#### 3.3.2 Quantitative variables

The following table represents the variables analyzed regarding the type of data.

**Table 2.**

#### Variables of Analysis Method

Variable	Index
<b>1. Event Related Potentials : N400</b>	<ul style="list-style-type: none"> <li>• Amplitude</li> <li>• Latency</li> </ul>

### 3.3.3 Methodological design

The following is a figure containing the methodological design of the research project.

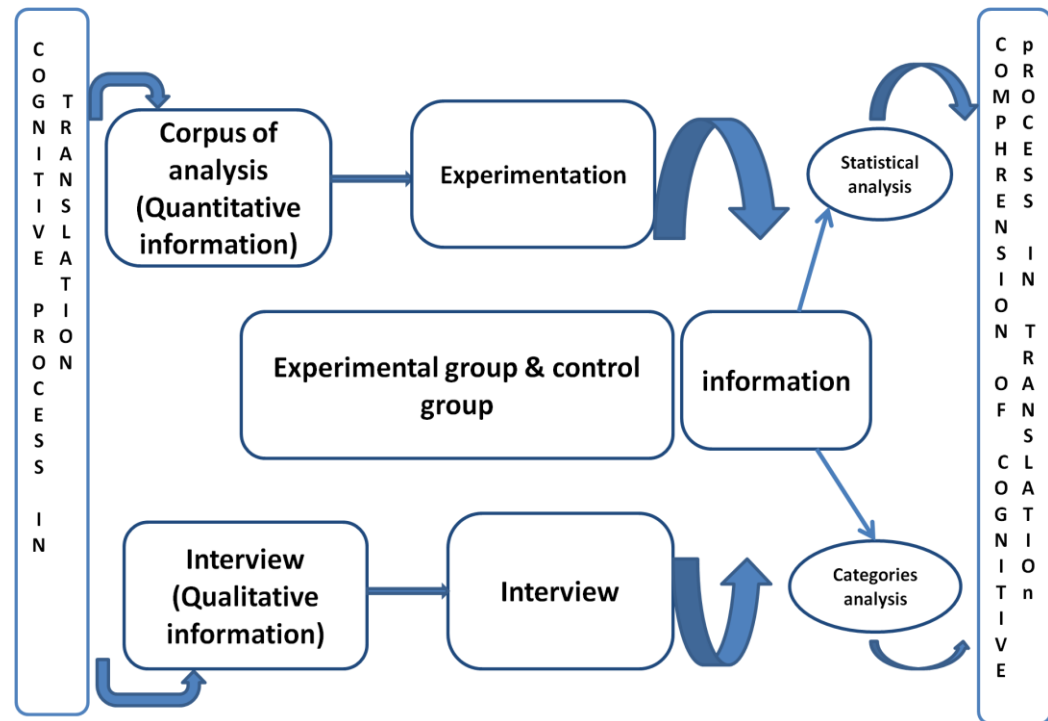


Figure 2. Methodological design

### 3.3.4 Type of study

This case study is framed within the mixed methodological approach; because of the description of a phenomenon which poses a technical interest and the type of information extracted is predominantly quantitative (variables) with qualitative (categories) inferences and recommendations for further research.

### 3.3.5 Population

This empirical-analytical project took place in the city of Medellin, Colombia. This is due to the kind and generous collaboration of the neurophysiology department of the

Universidad de Antioquia. The criteria considered to identify the potential candidates for the experimental group consisted on individuals with university translation studies or recognized experience in the area of translation. Participants for this experiment come from the Language and Translation Department of the “Universidad de Antioquia” in their final two semesters before receiving an undergraduate degree or subjects who hold a degree in translation and actively work as translators within the region. The control population comes from professors and undergraduate students within various majors.

### **3.3.6 Subjects**

Eleven native Spanish speakers (10 men, 1 woman) participated in the study who live and are professionally active, or study, in Medellin, Colombia. Data was collected from one more participant, but due to excessive eye movement is not included in any of the results. The mean age of all participants is 33.3 years old ( $SD=9.177$ ). All were first contacted by two of the professors within the translation program at UDEA, and university of Polilenguas. Students, professionals and alumni who expressed interest, had their information passed to the researchers and were then contacted to make an appointment for testing. Upon arrival the subjects were asked to read and sign a consent form, (see annex 1, in CD) which explained the possible benefits and risks associated with the tests. Afterward, a chart of important biographical information was completed, (see annex 2, in CD) which included all relevant educational and health information. All participants had normal or corrected to normal vision and reported no serious visual or reading disabilities and no psychological or physical health problems. All subjects participated on voluntary bases and were given no monetary compensation or course credit. The subjects were divided into two groups forming the experimental group and the control group. No subject was accepted who reported a history of psychological illness, or neurological disabilities.

The composition of the experimental group consists of 7 active translators, or Translation Majors, working or studying within the city of Medellin. All subjects possess at least bachelors or are in their final two semesters of study toward a

bachelor's degree, and all are active translators within the area. The mean age of participants is 35 years old (SD=6.75) and the ratio of men to woman is 6:1 or the females comprising 85% of the experimental group. The ratio of left handed participants to right handed is 7 to 0 or 100% of this group is right handed. 57.14% hold a BA, 42.86% hold a Master's degree in translation or related areas. 14.29% holds a PhD. Degree, 14.28% are a PhD candidate, and 42.85 % are candidates to hold a BA in translation. 57.14 % have 1 to 5 years of experience as a translator, 28.57% have 6 to 10 years of experience, and 14.29% have more than 10 years of experience. 42.85% dedicate 8 hours to translating a week, 14.29% spend 25 hours translating a week, and 14.29% spend 10 hours translating a week. 14.29% 6 hours, 14.29% 4 hours. 100% translate from Spanish to English and 42.85% also translate from French to Spanish. 100% are right handed dominant, 28.57% have lived in an English speaking country. The following tables represent the characteristics of the experimental group regarding its characteristics of the cases.

**Table 3.**

**Experimental Group Age and Sex Characteristics**

<b>Cases</b>	<b>Age</b>	<b>Sex</b>
<b>Case 1</b>	39	Masculine
<b>Case 2</b>	33	Feminine
<b>Case 3</b>	41	Masculine
<b>Case 4</b>	41	Masculine
<b>Case 5</b>	25	Masculine
<b>Case 6</b>	40	Masculine
<b>Case 7</b>	27	Masculine

**Table 4****Experimental Group Education and Translation Experience**

<b>Cases</b>	<b>Education</b>	<b>Experience</b>	<b>Week translating hours</b>	<b>Language combination</b>	<b>Dominant hand</b>	<b>Living English speaking country</b>
<b>Case 1</b>	BA in English-French -Spanish translation PhD candidate in Applied Linguistics	6-10 years	8 hours	English to Spanish	right	No
<b>Case 2</b>	Candidate of BA in English -French-Spanish Translation in UDEA	1-5 years	8 hours	English to Spanish French to Spanish	right	No
<b>Case 3</b>	Candidate of BA in English -French-Spanish Translation, UDEA	1-5 years	25 hours	English to Spanish	right	No
<b>Case 4</b>	BA in Modern Languages PhD in Applied Linguistics	More than 10 years	8 hours	English to Spanish French to Spanish	right	Yes (6 months)
<b>Case 5</b>	BA in English-French -Spanish translation.	1-5 years	10 hours	English to Spanish	right	No
<b>Case 6</b>	BA in English-French -Spanish translation	6-10 years	4 hours	English to Spanish	right	Yes 2 years
<b>Case 7</b>	Candidate of BA in English -French-Spanish Translation in UDEA	1-5 years	8-10	English to Spanish French to Spanish	Right	No

The control group was composed of three participants. The mean age of the participants is 29.3 years old (SD=14.433) and the ratio of men to women is 3:0. Control group consists of one professional and two undergraduate students from Medellin, who demonstrated considerable knowledge of English; considered advanced bilinguals. Informal oral interviews were conducted, to ensure a high quality oral production and dominance of English. The ratio of left handed participants to right handed is 2:1 or 66% is right hand dominant. All participants report studying English for more than 10 years. 33.33% of the subjects in this group reported living or visiting an English speaking country for more than two months. All reported their first exposure to the L2 taking place before the age of twelve. The following tables represent the characteristics of the control group regarding its characteristics of the cases.

**Table 5****Control Group Age and Sex Characteristics**

<b>Non Translators</b>	<b>Age</b>	<b>Sex</b>
<b>Case 1</b>	21	Masculine
<b>Case 2</b>	46	Masculine
<b>Case 3</b>	21	Masculine

**Table 6****Control Group Education Characteristics**

<b>Cases</b>	<b>Education</b>	<b>How long studying English</b>	<b>Dominant hand</b>	<b>Living in an English speaking country</b>
<b>Case 1</b>	BA candidate in International Business	More than 10 years	Right	No
<b>Case 2</b>	BA in education	More than 10 years	Left	Yes 10 years
<b>Case 3</b>	BA candidate in Languages	More than 10 years	Right	No

It is important to mention that although professors helped contacting participants for the two groups, there were some difficulties regarding time, availability of the laboratory, as well as vacation for the translation students at UDEA. Some participants were scheduled an appointment and either cancelled at the last minute or never showed up.

### 3.3.7 Corpus and instrument

We placed seven criteria for the selection of a parallel corpus (Baker, 1995); natural language, originally in English, from a public discourse, recent (from the last ten years), same identifiable speaker, containing popularized language, with cultural significance in the original culture. Also, one final criterion was placed on the metaphorical contexts; all fall clearly within the definition of *ontological metaphors* as postulated by Lackoff and Johnson (1980). Natural language, here, is understood as human language in its written or spoken use, as opposed to a computer language. Analysis of natural language corpora can provide a more accurate window into the processing of figurative language (Sikos, *et al.*, 2008). The use of natural language in place of a purely synthetic corpus allows for a more real world translation experience and enables the simulation of many of the pragmatic and cultural difficulties that arise in translation. Furthermore, the creation of context and a concrete situationality for the participants allow for a more complete mental representation that would not be possible with sets of synthetic contexts. This importance of context is further materialized by using the same identifiable speaker allowing the participants to visualize the speaker for a more complete mental representation. Moreover, requiring that it is a public discourse with popularized specialized language ensures that the discourse does not require specialized knowledge of the participants for a complete understanding of the discourse.

These criteria lead to the selection of three speeches by Barack Obama and their official translations; “*Discourse accepting the nomination of the Democratic Party* (Denver, Colorado. August 29, 2008) “*Inaugural Address*” (Washington D.C. Tuesday, Jan. 20, 2009) “*Noble Prize Acceptance Speech*” (OSLO, Norway. Dec . 10, 2009). (see annex 3, in CD) From this parallel corpus we manually analyzed and extracted sixty-four contexts, thirty-two metaphorical and thirty-two non-metaphorical; all ranging between six to nine words in length and accompanied by their Spanish translation. A

further control was applied that all metaphorical contexts fall clearly within the category of ontological metaphors defined by Lakoff and Johnson (2003) and the cognitive theory of metaphor and metonymy. Furthermore, we balanced the location of the metaphor between the second and fourth word of contexts with six words, and between the third and seventh words for contexts that have 9 words. (see annex 4, in CD)

The thirty-two metaphorical contexts were divided into two groups; the first group of 16 contexts accompanied by their adequate translation directly from the corpus, and the second group of 16 contexts where the translation were under a semantic manipulation making it an obviously inadequately translated context. This same manipulation of the translation also occurred in the non-metaphorical contexts. The manipulation of the Spanish contexts to group the contexts in 4 categories: Adequately translated metaphors, inadequately translated metaphor, adequately translated non-metaphor, inadequately translated non-metaphor. The metaphors were chosen in such a way that a complete domain shift from English to Spanish is not necessary for an adequate translation. The anomalies within the translation options that follow the original contexts have been limited to semantic inadequacies that do not agree in meaning to the original context. This will focus the data on the semantic representations activated between the two texts. (see annex 5, in CD)

Afterward, these sixty four contexts were analyzed by a panel of three experts, who measured each context whether it was obviously metaphorical, ambiguous, or non-metaphorical. Fifty contexts were chosen, 25 metaphorical and 25 non-metaphorical, all of which had been given the same qualification by at least two experts within the panel: either obviously metaphorical, or non metaphorical. (see annex 6, in CD)

The contexts selected were used to construct the instrument with the *Mind Tracer* software 2.0 (from Neuronics firm). The instrument consisted of 4 conditions: adequate metaphor, inadequate metaphor, non-metaphor adequate and non-metaphor inadequate. The difference in the adequate and inadequate conditions only regards the state of the translation, and was principally employed in identifying the number of correct and incorrect answers to evaluate the comprehension of the sentences by the translators. The other two conditions, the metaphorical and non-metaphorical, are the time-locked ERPs recordings comprising all of the quantitative data. It is important to note that the

adequate and inadequate were used for the habituation of the subjects to the test, while the second was used to collect data for the analysis. (See annex 7, in CD)

### 3.3.8 ERP recording

The EEG was recorded using a *Medicid V* Electroencephalogram with a 36 channel (SYNAMPS system) and acquisition software EP Workstation V. 1.4. 32 *Cadwell* copper electrodes individually placed under the requirements of the international 10-20 system (Jasper, 1958). To ensure optimum connectivity impedance abrasive gel was used for ECG and EEG (Nuprep) and EEG conductive paste (Ten 20). The tests were administered on a IBM desktop PC, using a 14 inch VGA monitor of the same brand.

A total of 23 electrodes were placed corresponding to the following derivations: FP1, FP2, F7, F3, FZ, F4, F8, T3, C3, CZ, C4, T4, T5, P3, PZ, P4, T6, 01, 02, PG1, PG2, ground and reference. As a reference we used a unipolar assembly in the nose, measuring all electrodes against the reference. In total for the analysis included the first 19 electrodes. The average time for assembly of electrodes was 1 hour per subject. The equipment was calibrated by five minutes after which the assembly is made of copper electrode impedance looking for a less than 10 Kohm.

ERPs were recorded using a 16-channel amplifier system from *precision instruments* with a 0.01 to 30 Hz bandpass and will be sampled at the rate of 200 Hz. The ERPs were digitalized on-line with a sampling rate of 200 Hz and stored on hard-disk for offline averaging. This opened the registration of each subject and was getting the windows marked with a pre-stimulus time of 200 msec post-stimulus and 800 msec. Once the windows were marked we proceeded to the manual correction of linear trends and design a digital filter for noise suppression EEG with a value of 35-65 MCV (average 50 MCV). The potentials of each subject were averaged for all accepted windows, across the 19 electrodes. Trails containing eye artifacts were corrected off line. ERPs were time-locked to the onset of stimulus words for each of the original contexts. Data analysis involved repeated measures analysis of variance (ANOVA). The average time for analysis was 1 hour per subject.



**Figure 3 Electrodes position**

### 3.3.9 Procedure

The experiment took place in an opportunely located room in the Lab of neurophysiology chosen for the windowless walls which allow for optimal darkening and soundproofing. All testing was scheduled between 10 am and 4 pm lasting about an hour and a half. Upon first arriving the participants were instructed that the test consisted of speeches given by President Barack Obama and after seeing the original context and the translation to answer only adequate and inadequate by pressing the left arrow for inadequate and the right arrow key for adequate. Participants received no further instructions on the nature of the test.

The subjects were seated in a comfortable chair 100 cm from the monitor. The experimental sentences were presented in the center of the screen 3 cm in height in black with a white background. The presentation of the sentences was organized into four parts; a *fixation point* for 500 msec, *context* corresponding to the first part of the phrase in English for 2000 msec, *stimulus* corresponding to the second half of the phrase in English which always started with the metaphorical word for 2000 msec, *translation* including the whole phrase translated into Spanish for 3000 msec. In the cases of the non-metaphorical contexts, the context was broken following the criteria of length for the metaphors. At this point, the participants had to choose whether the translation was adequate by pressing the right arrow key, or inadequate by pressing left

arrow key. ERP recordings were time locked to begin with the first word of the stimulus, the part of the phrase containing the metaphor. Accuracy on these questions was encouraged over speed. After each question, there were 2 sec of blank screen before the beginning of the next trial.

### 3.4 Results and quantitative data analysis

In this table we can observe the values according to each channel and brain region: frontal (F), central (C), parietal (P), temporal (T), occipital (O) as well as ground and reference across both conditions (metaphorical and non metaphorical contexts) for the experimental group.

GP7TMet		GP7TNM	
Canales	Valor ( $\mu$ V)	Canales	Valor ( $\mu$ V)
1. Fp1-REF	-0.06	1. Fp1-REF	-0.28
2. Fp2-REF	-3.05	2. Fp2-REF	-1.12
3. F3 -REF	-2.33	3. F3 -REF	-1.14
4. F4 -REF	-4.31	4. F4 -REF	-1.85
5. C3 -REF	-2.04	5. C3 -REF	-1.17
6. C4 -REF	-3.59	6. C4 -REF	-1.52
7. P3 -REF	-2.03	7. P3 -REF	-0.36
8. P4 -REF	-2.83	8. P4 -REF	-0.79
9. O1 -REF	-1.19	9. O1 -REF	0.39
10. O2 -REF	-1.73	10. O2 -REF	0.01
11. F7 -REF	0.24	11. F7 -REF	-0.26
12. F8 -REF	-4.82	12. F8 -REF	-1.67
13. T3 -REF	-0.03	13. T3 -REF	-0.09
14. T4 -REF	-3.06	14. T4 -REF	-1.65
15. T5 -REF	-0.82	15. T5 -REF	0.38
16. T6 -REF	-1.80	16. T6 -REF	-0.66
17. FZ -REF	-3.63	17. FZ -REF	-1.94
18. CZ -REF	-3.53	18. CZ -REF	-1.78
19. PZ -REF	-2.58	19. PZ -REF	-0.81
20. Pg1-REF	-6.59	20. Pg1-REF	-2.65
21. Pg2-REF	-5.32	21. Pg2-REF	-0.65

#### *Illustration 4. Amplitudes Experimental Group*

##### 3.4.1 Amplitudes experimental group (translators)

The following table represents the results for the amplitudes of the experimental group across both conditions, metaphorical and non-metaphorical.

**Table 7****Amplitudes Experimental Group**

<b>All Electrodes and Regions</b>					
<b>Condition Metaphor</b>	<b>Channel</b>	<b>Value</b>	<b>Condition No metaphor</b>	<b>Channel</b>	<b>Value</b>
	Fp1	0.06		Fp1	0.28
	Fp2	3.05		Fp2	1.12
	F3	2.33		F3	1.14
	F4	4.31		F4	1.85
	C3	2.04		C3	1.17
	C4	3.59		C4	1.52
	P3	2.03		P3	0.36
	P4	2.83		P4	0.79
	O1	1.19		O1	0.39
	O2	1.73		O2	0.01
	F7	0.24		F7	0.26
	F8	4.82		F8	1.67
	T3	0.03		T3	0.09
	T4	3.06		T4	1.65
	T5	0.82		T5	0.38
	T6	1.8		T6	0.66
	FZ	3.63		FZ	1.94
	CZ	3.53		CZ	1.78
	PZ	2.58		PZ	0.81
	Pg1	6.59		Pg1	2.65
	Pg2	5.32		Pg2	0.65
<b>Average</b>		2.65			1.01
<b>Standard Deviation</b>		2.68			1.31

This table demonstrates the averaged results for amplitudes of all electrodes within the experimental group across both conditions. The average of the amplitudes within the metaphorical condition is 2.65, exhibiting a greater average than in the Non-metaphorical condition, 1.01. Also, the metaphorical condition is more heterogeneous displaying a standard deviation of 2.68, in contrast to the more homogenous standard deviation of 1.31 in the non-metaphorical condition.

The electrodes which registered the largest amplitudes in the metaphorical condition were the F4 and the F8 located in the right frontal lobe. The latter registering

the largest result, 4.82 while the former resulting in a slightly smaller amplitude at 4.31. The next largest wave size occurred within the electrodes FZ, CZ, and C3 located in the central region.

Regarding the condition non-metaphorical the amplitude across all electrodes was never greater than two micro-vaults. The wave size was registered so small that there was no presence of wave form, and the voltage across the scalp is almost equal to the base line.

The analysis of variance (ANOVA) demonstrated a large statistical difference in this group between conditions  $P=0.00053$ .

### 3.4.2 Amplitudes by Region – Experimental Group

The following tables are the amplitudes of the experimental across both conditions separated by area.

**Table 8**

#### Amplitudes frontal region -experimental group

Frontal Region					
Condition Metaphor	Channel	Value	Condition No metaphor	Channel	Value
<b>F</b>	F3	2.33		F3	1.14
	F4	4.31		F4	1.85
	F7	0.24		F7	0.26
	F8	4.82		F8	1.67
	FZ	3.63		FZ	1.94
<b>Average</b>		3.1			1.4
<b>Standard Deviation</b>		3.47			1.32

This table represents the averaged amplitudes of the frontal region for the whole experimental group across the two conditions. The average amplitude across these

frontal electrodes within the metaphorical condition is 3.1, while the non-metaphorical condition demonstrates a much smaller average of 1.4. Interestingly this region within both conditions resulted in the largest standard deviation of all cerebral regions.

With the ANOVA results of 0.08 below the level of significance of 0.05 ( $p:0.05$ ). It can be concluded that significant differences were found in the experimental group, in the frontal region, between amplitudes of the translators between the two conditions, metaphorical and non metaphorical.

**Table 9**

**Amplitudes central region- experimental group.**

Central Region					
Condition Metaphor	Channel	Value	Condition No metaphor	Channel	Value
	C3	2.04		C3	1.17
	C4	3.59		C4	1.52
	CZ	3.53		CZ	1.78
<b>Average</b>		3.1		1.5	
<b>Standard Deviation</b>		1.59			0.55

The central region within the metaphorical condition has an average wave amplitude of 3.1 and a standard deviation of 1.565. The largest amplitudes in this region, regarding both conditions, occurred in C4 and CZ. The averages of the non-metaphorical conditions are significantly smaller when compared to the metaphorical condition. The non-metaphorical condition is much more homogenous in this region with a standard deviation of 0.556.

Between the two conditions, following the ANOVA analysis significant statistical differences were found resulting in 0.04 of 0.05 ( $p:0.05$ ). This data of 0.04 is above the statistical threshold of meaningful conditional differences.

**Table 10****Amplitudes parietal region- experimental group.**

<b>Parietal region</b>					
<b>Metaphorical condition</b>	<b>Channel</b>	<b>Value</b>	<b>Condition No metaphor</b>	<b>Channel</b>	<b>Value</b>
	P3	2.03		P3	0.36
	P4	2.83		P4	0.79
	PZ	2.58		PZ	0.81
<b>Average</b>		2.5			0.7
<b>Standard Deviation</b>		0.74			0.46

The parietal region shows close to base line activity across all electrodes regarding the non metaphorical condition averaging 0.74 in amplitude. The standard deviation for this condition remains small at 0.46. Pertaining to the metaphorical condition the data points to less activity than in the previously regions with an average wave form of 2.5 with a standard deviation of 0.74. The ANOVA yielded significant differences among the two conditions.

**Table 11****Amplitudes occipital region-experimental group**

<b>Occipital Region</b>					
<b>Metaphorical Condition</b>	<b>Channel</b>	<b>Value</b>	<b>Condition No metaphor</b>	<b>Channel</b>	<b>Value</b>
	O1	1.19		O1	0.39
	O2	1.73		O2	0.01
<b>Average</b>		1.5			0.2
<b>Standard Deviation</b>		0.65			0.46

In respect to the occipital region, the standard deviation for the metaphorical conditions was found to be the most homogeneous, 0.65 compared to all the other regions within the experimental group with amplitude averaging 1.5. Moreover, the average (0.2) in the non metaphorical condition was the most approximate to the base line when compared to all other regions. After the ANOVA analysis a relevant

difference of 0.06 of 0.05 ( $p:0.05$ ) although below the point of departure for significant statistical differences.

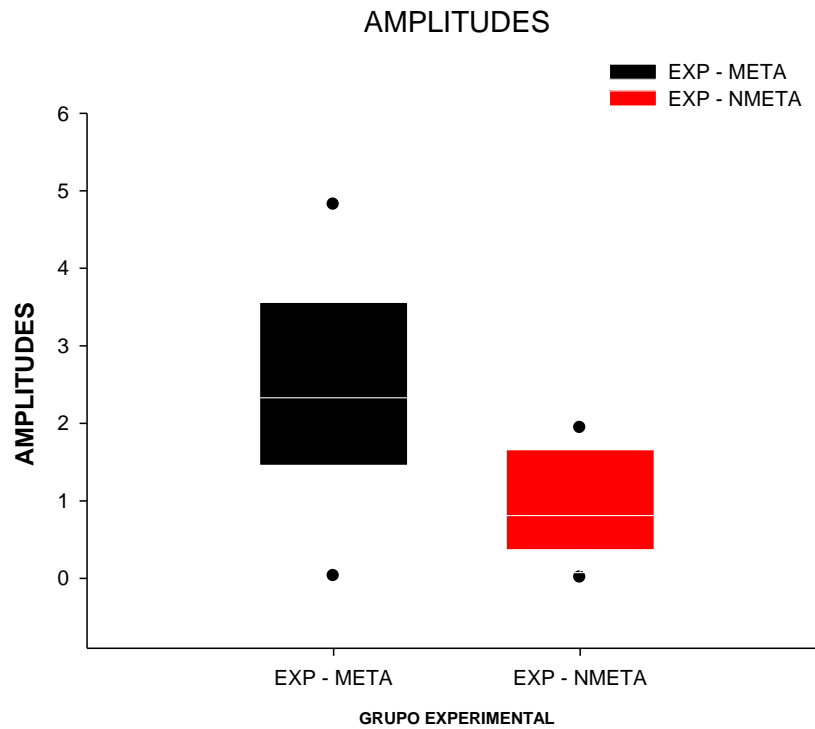
**Table 12**

**Amplitudes temporal region- experimental group**

<b>Temporal region</b>					
<b>Condition Metaphor</b>	Channel	Value	<b>Condition No metaphor</b>	Channel	Value
	T3	0.03		T3	0.09
	T4	3.06		T4	1.65
	T5	0.82		T5	0.38
	T6	1.8		T6	0.66
<b>Average</b>		1.43			0.70
<b>Standard Deviation</b>		2.43			1.26

The large standard deviation  $s$  between the two conditions 2.43 for the metaphorical and 1.26 for the non metaphorical is undoubtedly due to the concentration of activity in the T4 electrode. In contrast, electrodes T3 and T5 are remarkably inactive in both conditions. The averages in the two conditions 1.43 and 0.70 respectively. ANOVA analysis shows important differences between conditions 0.358 ( $p:0.05$ ).

The following is a chart containing the amplitudes of the experimental group within the two conditions.



### 3.4.3 Amplitudes – control group (non-translators)

In this table we can observe the values according to each channel and brain region: frontal (F), central (C), parietal (P), temporal (T), occipital (O) as well as ground and reference across both conditions for the control group.

Canales	Valor ( $\mu\text{V}$ )	Canales	Valor ( $\mu\text{V}$ )
1. Fp1-REF	-0.30	1. Fp1-REF	-0.83
2. Fp2-REF	-1.57	2. Fp2-REF	-2.37
3. F3 -REF	0.40	3. F3 -REF	-0.62
4. F4 -REF	-1.12	4. F4 -REF	-2.92
5. C3 -REF	0.72	5. C3 -REF	-0.23
6. C4 -REF	-0.46	6. C4 -REF	-2.04
7. P3 -REF	0.52	7. P3 -REF	-0.72
8. P4 -REF	-0.26	8. P4 -REF	-1.52
9. O1 -REF	-0.12	9. O1 -REF	-1.45
10. O2 -REF	-0.11	10. O2 -REF	-1.42
11. F7 -REF	1.47	11. F7 -REF	1.96
12. F8 -REF	-1.44	12. F8 -REF	-2.83
13. T3 -REF	2.15	13. T3 -REF	1.67
14. T4 -REF	-0.04	14. T4 -REF	-2.01
15. T5 -REF	1.41	15. T5 -REF	0.50
16. T6 -REF	0.65	16. T6 -REF	-0.92
17. FZ -REF	-0.96	17. FZ -REF	-2.82
18. CZ -REF	-0.70	18. CZ -REF	-2.41
19. PZ -REF	-0.24	19. PZ -REF	-1.65
20. Pg1-REF	0.66	20. Pg1-REF	0.78
21. Pg2-REF	-0.29	21. Pg2-REF	0.47

*Illustration 5. Amplitudes Control Group*

The following table is the results of the amplitudes for the control group across both conditions for all electrode sites.

**Table 13**  
**Amplitudes Control Group**

<b>All Electrodes and Areas</b>					
<b>Condition metaphor</b>	<b>Channel</b>	<b>Value</b>	<b>Condition no metaphor</b>	<b>Channel</b>	<b>Value</b>
	Fp1	0.3		Fp1	0.83
	Fp2	1.57		Fp2	2.37
	F3	0.4		F3	0.62
	F4	1.12		F4	2.92
	C3	0,72		C3	0.23
	C4	0.46		C4	2.04
	P3	0.52		P3	0.72
	P4	0.26		P4	1.52
	O1	0.12		O1	1.45
	O2	0.11		O2	1.42
	F7	1.47		F7	1.96
	F8	1.44		F8	2.83
	T3	2.15		T3	1.67
	T4	0.04		T4	2.01
	T5	1.41		T5	0.5
	T6	0.65		T6	0.92
	FZ	0.96		FZ	2.82
	CZ	0.7		CZ	2.41
	PZ	0.24		PZ	1.65
	Pg1	0.66		Pg1	0.78
	Pg2	0.29		Pg2	0.47
<b>Average</b>		0.70			1.5
<b>Standard Deviation</b>		1.23			1.65

This table demonstrates the averaged results for amplitudes of all electrodes within the control group across both conditions. Interestingly the amplitudes in the non-metaphorical condition are clearly larger and more homogeneous than the metaphorical condition. This evidenced by the average wave amplitude on non metaphorical at 1.5 compared its counterpart within the metaphorical condition of 0.70. This data is also present in the results of the standard deviation, which is notably smaller in the metaphorical condition which was not observed with the experimental group, 1.23 and 1.65 respectively.

This is in stark contrast in the previous results, where the metaphorical condition always elicited greater amplitude in the experimental group and always appeared more heterogeneous. Here, the findings are quite the opposite, the non-metaphorical condition is clearly more homogeneous and with greater amplitudes. The electrodes that register the highest amplitudes are found in the non-metaphorical condition: F8, F4, CZ, FZ, all ranging above 2.5 microvolts.

The ANOVA analysis revealed a significant difference between the two conditions in the control group with a statistical difference of  $P=0.003$ .

**Table 14**

**Amplitudes frontal region – control group.**

<b>Frontal Region</b>					
<b>Condition metaphor</b>	<b>Channel</b>	<b>Value</b>	<b>Condition no metaphor</b>	<b>Channel</b>	<b>Value</b>
	F3	0.4		F3	0.62
	F4	1.12		F4	2.92
	F7	1.47		F7	1.96
	F8	1.44		F8	2.83
<b>Average</b>		1.1			2.1
<b>Standard Deviation</b>		0.93			1.99

As in the experimental group, this region is the most active of all the regions pertaining to both conditions. But as mentioned, the non-metaphorical condition is

clearly the more active of the two registering the largest amplitudes of both conditions in the electrodes F8 and F4 at 2.83 and 2.92. There is greater variation of the wave size in the non-metaphorical condition with a standard variation of 1.99 when compared to its counterpart in the metaphorical condition at 0.93. The ANOVA analysis showed no significant statistical difference between the two conditions  $P=0.15$ .

**Table 15**

**Amplitudes central region- control group**

<b>Central Region</b>					
<b>Condition metaphor</b>	Channel	Value	<b>Condition no metaphor</b>	Channel	Value
	C3	0.72		C3	0.23
	C4	0.46		C4	2.04
	CZ	0.7		CZ	2.41
<b>Average</b>		0.63			1.6
<b>Standard Deviation</b>		0.26			2.12

Again this region follows the trend that has been observed within the control group. The non-metaphorical condition is clearly more active and heterogeneous as evidenced by the greater average wave form of 1.6 and the larger standard deviation of 2.12. This is in contrast to the smaller registers within the metaphorical condition which averaged .63 and has a standard deviation of 0.26. This region was remarkable more active in the non-metaphorical condition where two electrodes registered above 2 microvolts, CZ and C4, while no electrode in the metaphorical condition went above 1 microvolt. The ANOVA analysis demonstrated no meaningful statistical difference between the two conditions  $P=0.25$ .

**Table 16****Amplitudes parietal region-control group**

<b>Parietal region</b>					
<b>Condition metaphor</b>	Channel	Value	<b>Condition no metaphor</b>	Channel	Value
	P3	0.52		P3	0.72
	P4	0.26		P4	1.52
	PZ	0.24		PZ	1.65
<b>Average</b>		0.34			1.30
<b>Standard Deviation</b>		0.31			0.50

Here we observe close to base line activity in the metaphorical context with an average wave size of 0.34, and a standard variation of 0.31. Also, this region is the most inactive of the regions pertaining to the non-metaphorical context, the electrode with the highest amplitude; PZ at 1.65, and an average wave form of 1.30. The standard deviation of the non-metaphorical condition remains larger as found in the other regions at 0.503. The ANOVA analysis demonstrated a significant statistical difference between conditions  $P=P=0.03$ .

**Table 17****Amplitudes occipital region-control group**

<b>Occipital region</b>					
<b>Condition metaphor</b>	Channel	Value	<b>Condition no metaphor</b>	Channel	Value
	O1	0.12		O1	1.45
	O2	0.11		O2	1.42
<b>Average</b>		0.12			1.44
<b>Standard Deviation</b>		0.007			0.021

Here we observe the most inactive region pertaining to the control group within the metaphorical condition averaging a wave form of 0.12. The standard variation, in the metaphorical condition, remains small as in the other regions at 0.007. In contrast, the non-metaphorical condition is relatively active with an average wave form of 1.44, and

a remarkable small standard deviation of 0.021. The ANOVA analysis demonstrated a significant statistical difference between conditions  $P=0.00014$ .

**Table 18**

**Amplitudes temporal region-control group**

<b>Temporal region</b>					
<b>Condition metaphor</b>	<b>Channel</b>	<b>Value</b>	<b>Condition no metaphor</b>	<b>Channel</b>	<b>Value</b>
	T3	2.15		T3	1.67
	T4	0.04		T4	2.01
	T5	1.41		T5	0.5
	T6	0.65		T6	0.92
<b>Average</b>		1.10			1.3
<b>Standard Deviation</b>		1.49			0.69

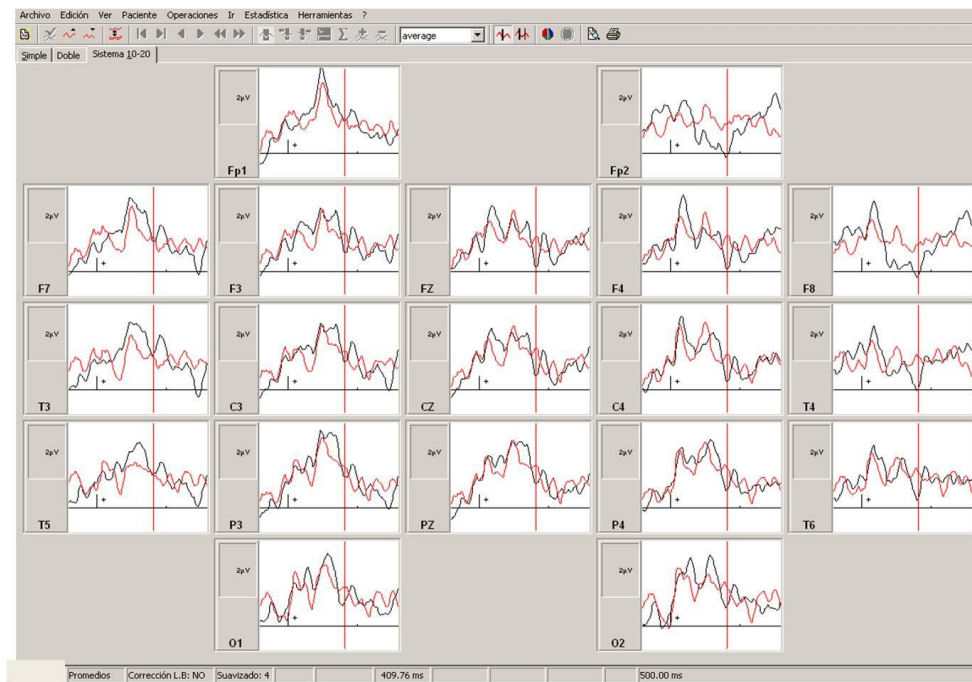
Here we observe a great amount of variation in the activity of the electrodes within the metaphorical condition ranging from the largest T3 at 2.15 to the smallest T4 at 0.04 with a average wave form of 1.10. The standard deviation regarding this condition is the largest within the control group at 1.49. The non-metaphorical condition has a much greater range of activity, the largest in the T4 electrode at 2.01 and the smallest in electrode T5 at 0.5. The standard deviation is relatively small for this group at 0.69. The ANOVA analysis demonstrated no meaningful statistical difference between the two conditions  $P=0.7$ .

**Latency – experimental group (translators)**

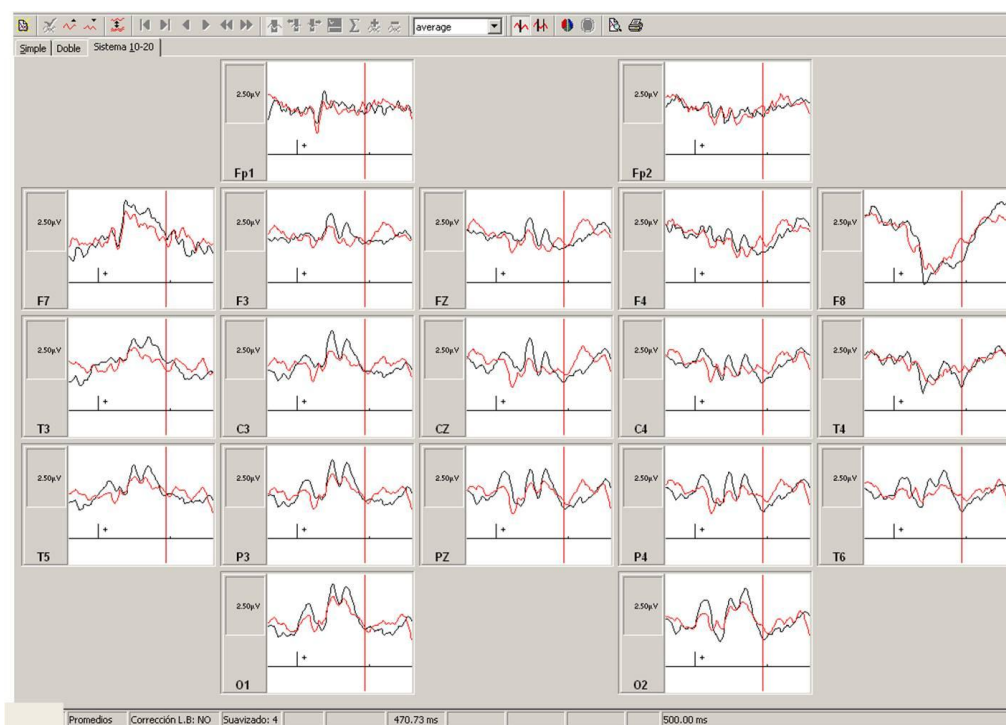
The following are the latencies of the experimental group:

Red: Metaphorical Condition

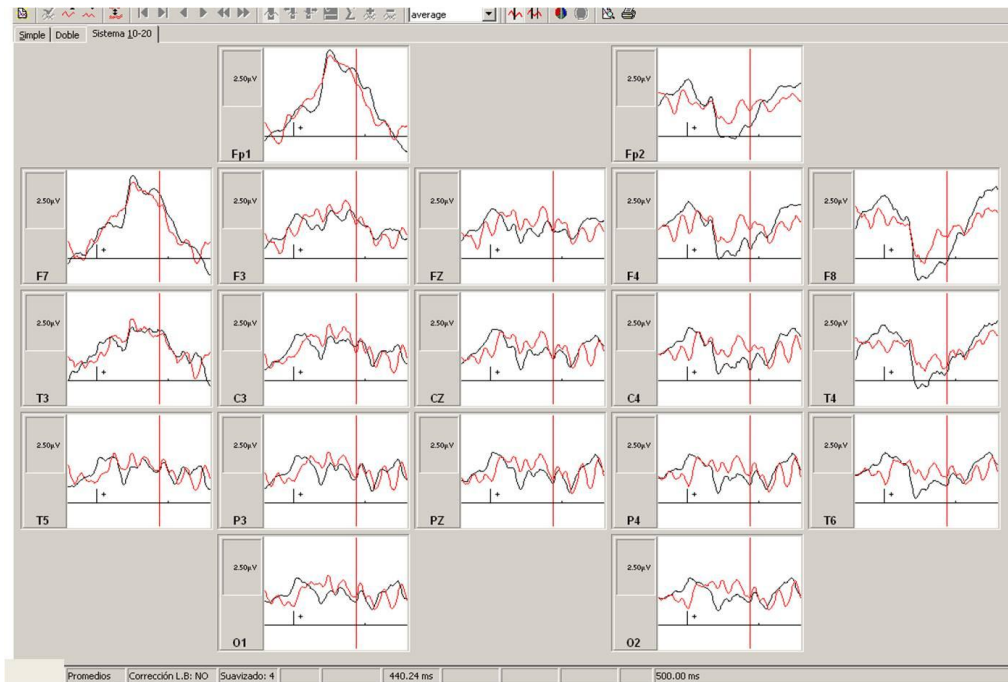
Black: Non-metaphorical Condition



**Illustration 6. Amplitudes-latency case 1** Case 1

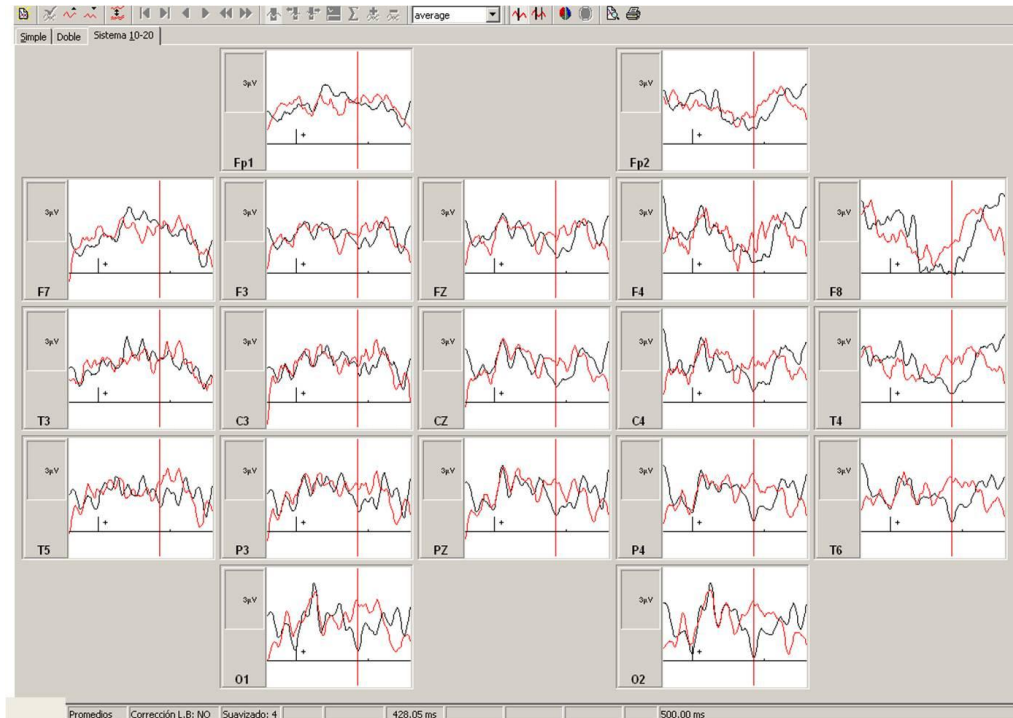


**Illustration 7. Amplitudes -latency case 2** Case 2



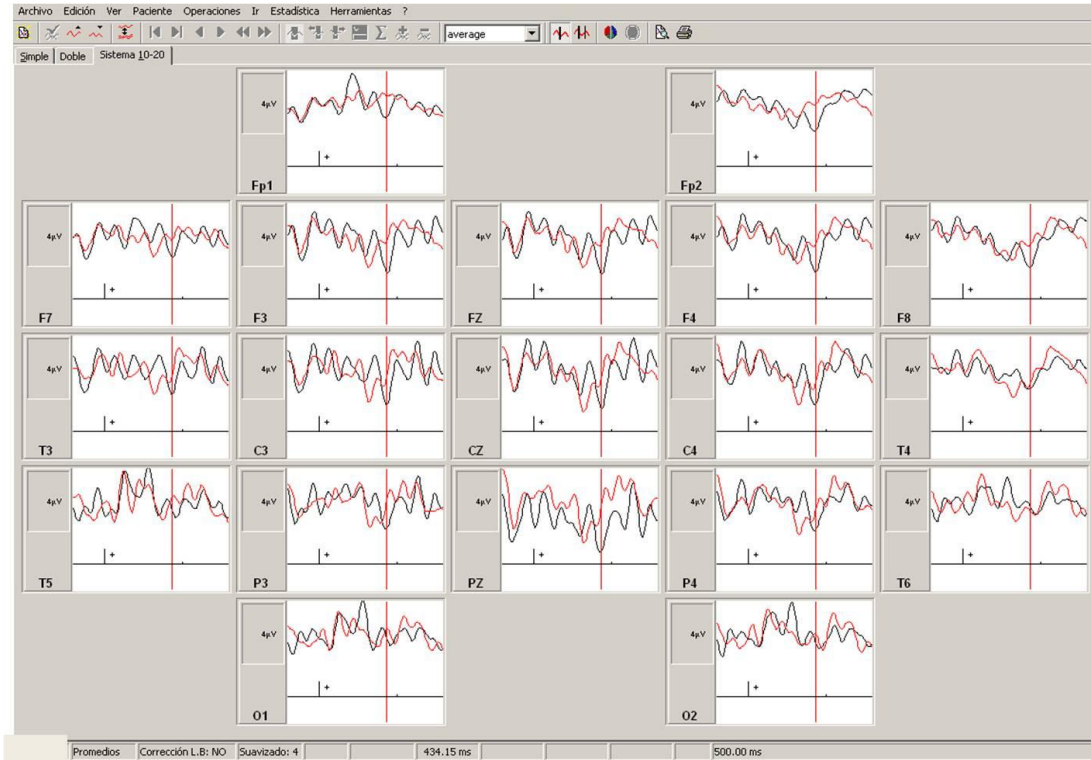
Case 3

Illustration 6. Amplitudes -latency case 3



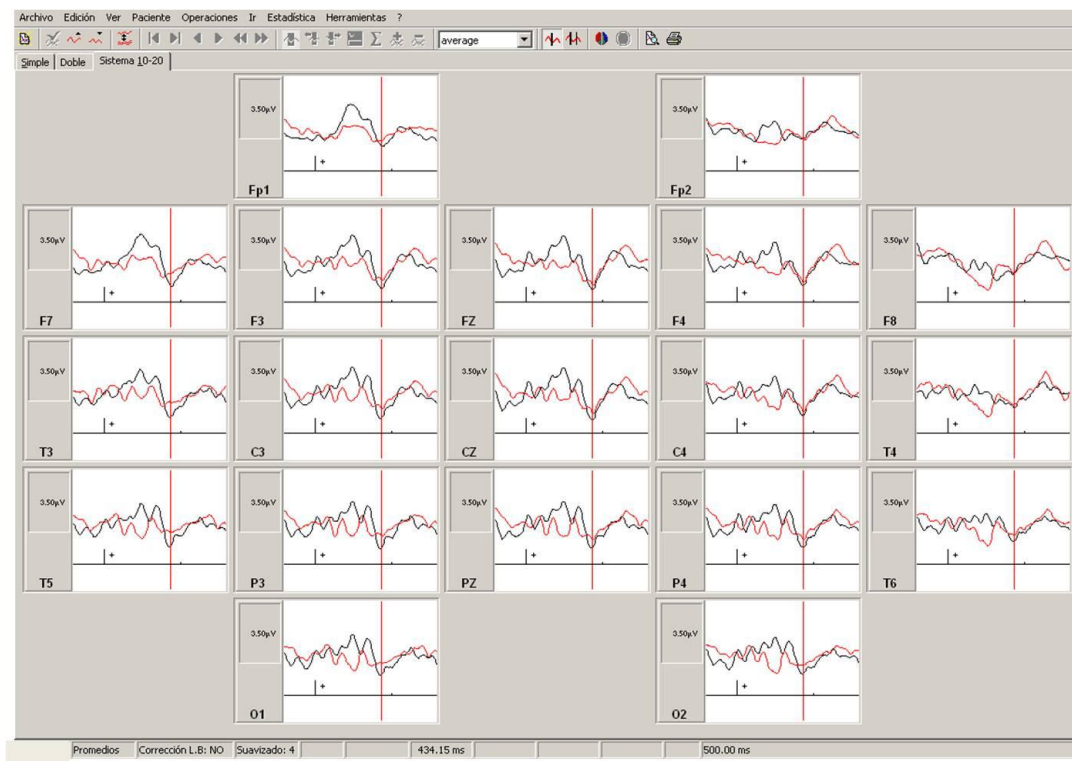
Case 4

Illustration 8. Amplitudes-latency case 4



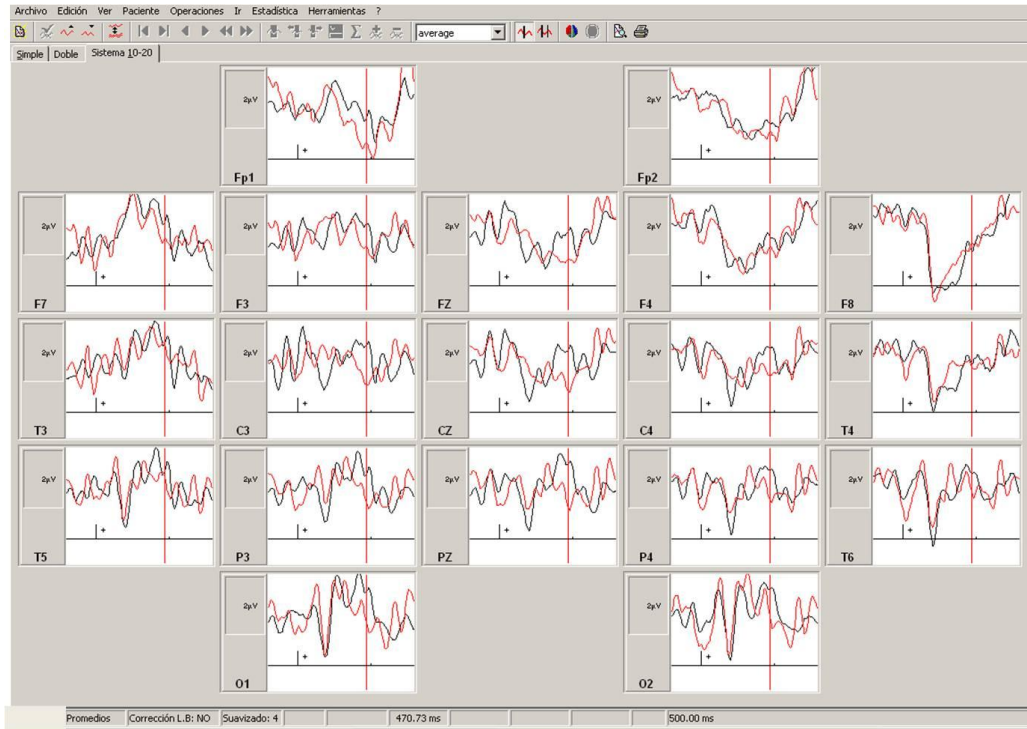
Case 5

**Illustration 9. Amplitudes -latency case 5**



Case 6

**Illustration 10. Amplitudes -latency case 6**



**Case 7**

**Illustration 11. Amplitudes -latency case 7**

The following table demonstrates the latencies of the N400 for the experimental group.

**Table 19.**

**Experimental Group Latencies**

<b>Case 1</b>	409.76
<b>Case 2</b>	470.73
<b>Case 3</b>	440.24
<b>Case 4</b>	426.05
<b>Case 5</b>	434.15
<b>Case 6</b>	434.15
<b>Case 7</b>	470.73
<b>Average</b>	440.83
<b>Standard Deviation</b>	22.58

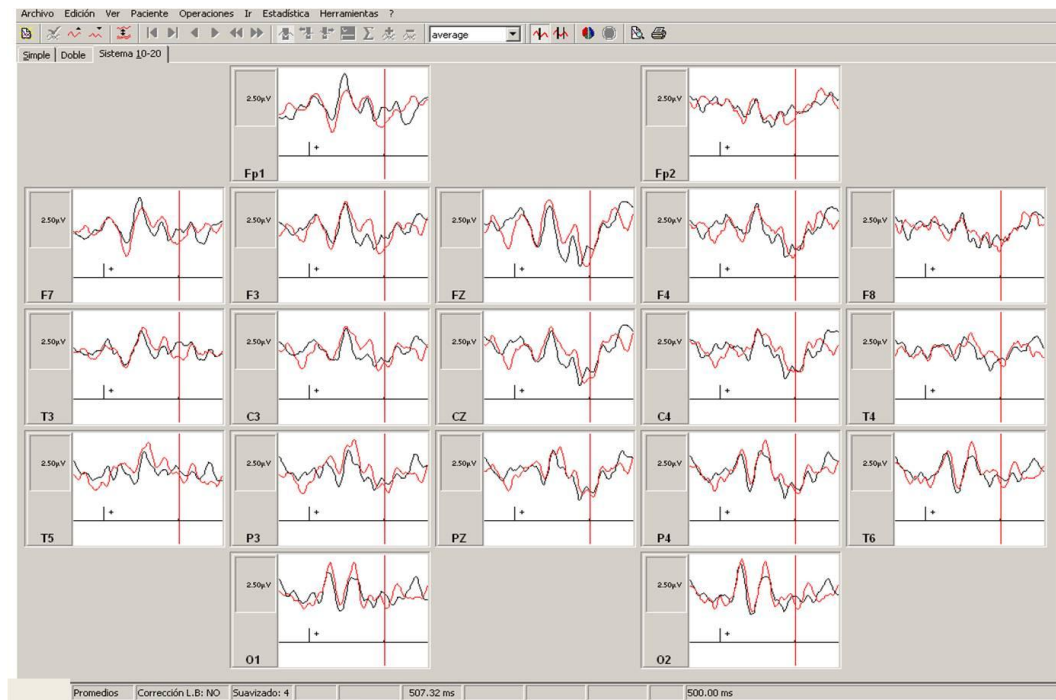
This table shows the latency across both conditions for the experimental group. All latencies range between 409.00 and 470.00 averaging 440.83. The standard deviation of this group is 22.58.

### Latency - control group (non-translators)

The following are the latencies of the control group.

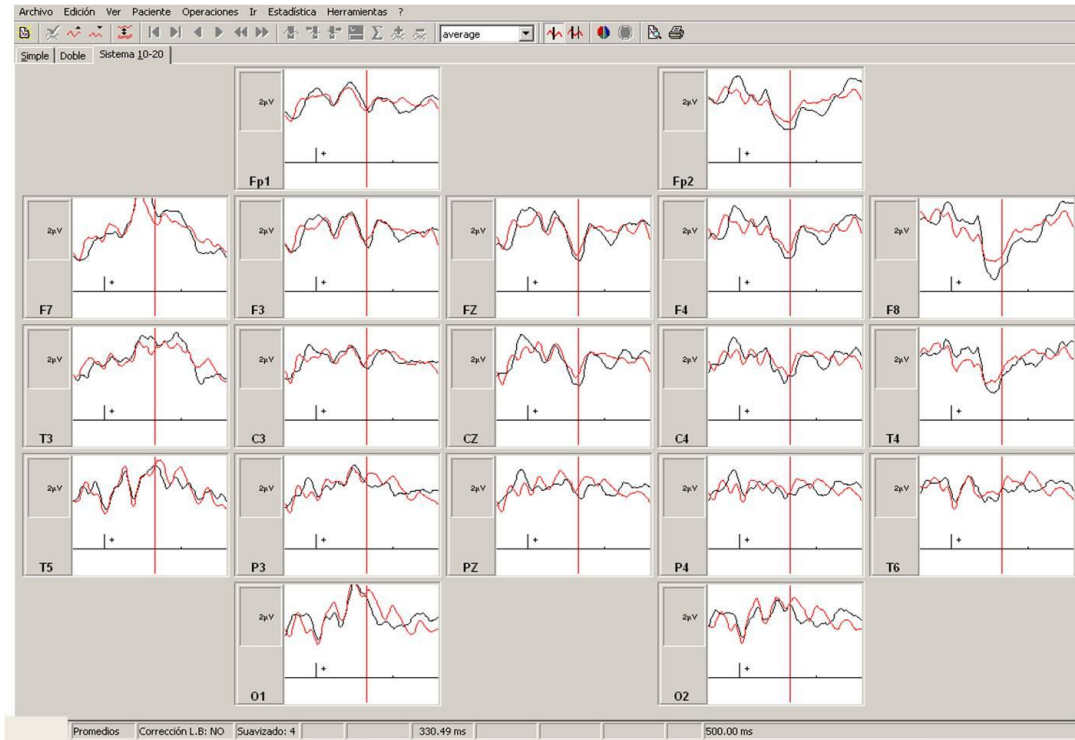
Red: Metaphorical Condition

Black: Non-metaphorical Condition



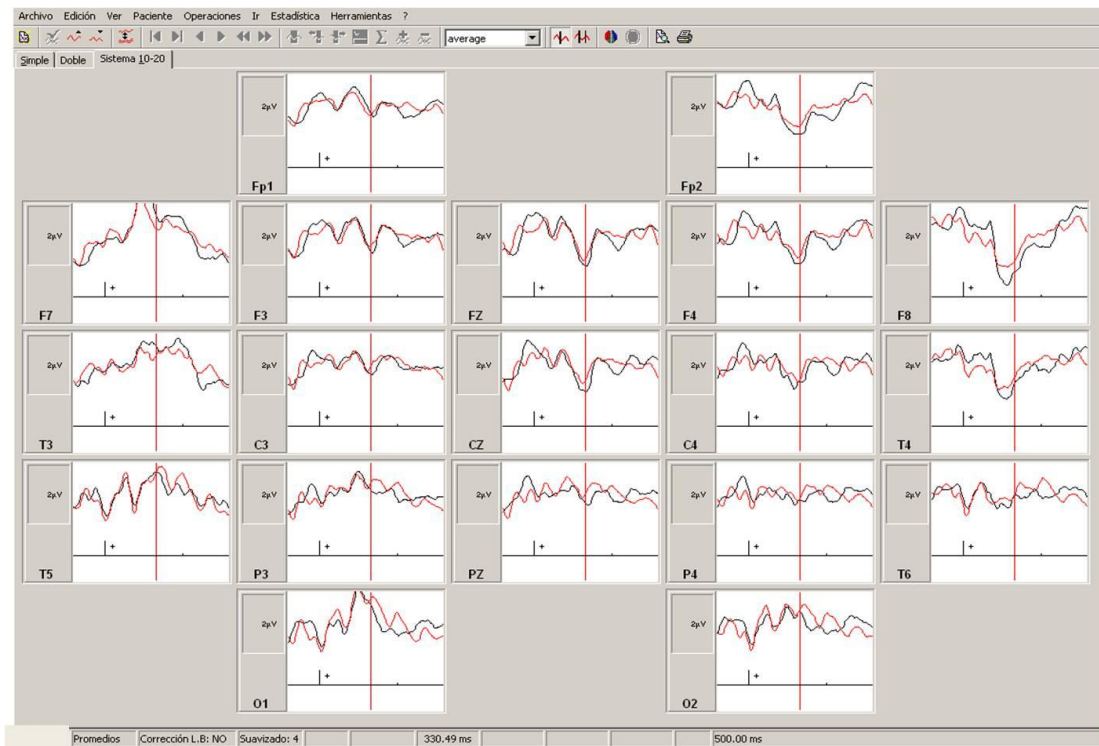
Case 1

**Illustration 12. Amplitudes -latency case 1**



**Case 2**

**Illustration 13. Amplitudes -latency case 2**



**Case 3**

**Illustration 14. Amplitudes -latency case 3**

The following table demonstrates the latencies of the N400 for the control group.

**Table 20.**

**Control Group Latencies**

<b>Caso 1</b>	507.32
<b>Caso 2</b>	330.49
<b>Caso 3</b>	428.05
<b>Average</b>	421.95
<b>Standard Deviation</b>	88.57

This table shows the latency for the control group. The range of the latencies is much larger than the previous group ranging between 330.49 to 507.32. The average of the latencies is 421.95 and the standard deviation within the group is 88.57.

The analysis of variance (ANOVA) of the latencies between groups revealed no statistical difference between the two groups  $P=0.49$ .

Analysis of variance (ANOVA) of Amplitudes between Groups

**Tabla 21.**

**Analysis of variance**

<b>Condition</b>	<b>Statistical Difference</b>
Metaphorical Condition	$P=0.000076$
Non-Metaphorical Condition	$P=0.016$

This table shows the Analysis of variance (ANOVA) of both conditions between groups. Within the metaphorical condition a large statistical difference was found

$P=0.000076$ . In contrast, the non-metaphorical condition did not demonstrate a statistical difference  $P=0.016$ .

### **3.5 Quantitative analysis of data collected**

#### **3.5.1 Experimental group**

The data from our experimental groups shows a N400 peaking on average 440.83 milliseconds (STD=22.588) after the onset of the experimental stimulus. Also, evoking average peak amplitude of 2.65 in the metaphorical condition and 1.01 in the non-metaphorical condition and demonstrating a topography that is clearly placed in the frontal lobe and central region of the brain. This topography is no surprise as the frontal part of the brain is associated with higher cognitive tasks and decision-making. Both of which are fundamentally important within the process of translation.

Between the two sentence conditions, the metaphors evoked higher amplitudes across all cerebral regions. Interestingly, although the frontal lobe is clearly the most active region in the two conditions, no significant difference was found between the two sentence conditions. While, on the other hand, ANOVA analysis yielded significant differences between four areas across the two conditions: Central Region, Parietal region, Occipital region, and the temporal region. This difference highlights the quantitative difference between the processing of meaning in the two conditions.

The non-metaphorical condition is clearly more homogeneous than the metaphorical condition across all sites. This data suggests distinct differences in abilities within the group regarding the elaboration of metaphorical meaning when compared to non-metaphorical meaning.

#### **3.5.2 Control group**

The data from our control groups demonstrates a N400 peaking on average 421.95 milliseconds (STD=88.572) after the onset of the experimental stimulus. The N400 displaying average peak amplitude of 0.70 for the metaphorical condition and 1.5 in the

non-metaphorical condition. The topography of the N400 coincides with the other group, clearly in the frontal lobe and central region of the brain.

Between the two sentence conditions, the non-metaphorical context yielded reliably higher amplitudes in this group than the non-metaphorical context. The largest amplitudes of the N400 occurring in the frontal region and the parietal region. ANOVA analysis demonstrated statistical differences across the two sentence condition in two regions: the parietal and the occipital region.

### **3.6 Between groups**

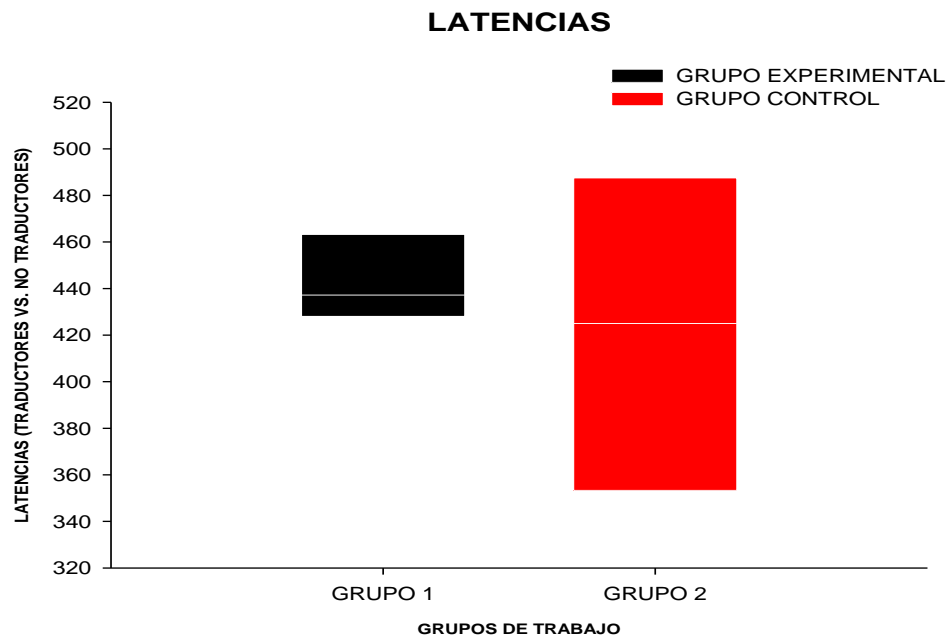
The two groups, experimental and control yielded surprisingly contrasting results. The metaphorical condition evoked larger amplitudes in the experimental group across all regions [amplitude-2.65 (STD- 2.68)]. In contrast, the control group responded with larger amplitudes for the non-metaphorical condition [amplitude 1.5 (STD-1.65)]. This data can be interpreted in a number of ways. First, the larger amplitudes in the translators can be due to a more robust elaboration of meaning in the more difficult and abstract metaphorical contexts. Although, the standard deviation of the metaphorical context within the experimental group shows striking differences between translators, none fall within the response amplitudes of the control group.

This more complete elaboration of meaning is suggested in the behavioral results: the translators remarked on the inter-relationship of the contexts and the importance of the speaker, while no participant from the control group did the same. More evidence for this difference in meaning construction is found in the standard deviation of amplitudes between conditions and groups. The translators demonstrated a clearly more heterogeneous response regarding the metaphorical condition, while the translators yielded a highly homogenous response within the metaphorical condition.

Thierry & Jing Wu (2007) found that the N400 amplitude is an indication that during comprehension in the L2 there is an accompanied activation of lexical items in the L1 language unconsciously. If this interpretation of the N400 is correct, it permits even more detailed interpretation of the N400 elicited in this case study can be regarded

as reflecting two important processes: the activation and elaboration of complex meaning, and the activation of a “*global meaning*”.

The following is a chart containing the amplitudes of the control group within the two conditions.



### 3.7 Qualitative results and analysis of behavioral data – category identification

The following are the answers collected from the participants during the interview. This interview aimed at identifying how the test was regarding the process of translation as well as their opinion about metaphors in translation.

### 3.8 Experimental group

#### Case 1:

1. How would you define the process of translation you went through during the experimental test?

*This test was more like a consecutive interpretation test, since it was necessary to remember the contexts in English to retain the information necessary to select the adequate translation. It was an interesting test.*

2. What processes did you most rely on while doing the task assigned (reading the contexts in English and choosing the adequate translation)?

*There was some new vocabulary that made me think of the answer. The time to process the info was o.k. The contexts made interpretation easy.*

3. What do you think of translating metaphors?

*It is a process which involves culture and context.*

4. What is it important or different in the process of translating metaphors?

*Reading the contexts one more time let me understand better.*

Case 1 compares this test with an interpretation one, (“*this test was more like consecutive interpretation...*”) and tries to explain this comparison (“*...since...*”) referring to the memory which is a basic cognitive function (“*...remember...*”). Case 1 reinforces it when saying (“*retain information*”). It is also perceived a making decision process (“*...in order to select...*”) linked to a translation conception. Case 1 assesses this test in terms of “*interesting*”. Case 1 also refers to some lexical aspects (“*... there was some new vocabulary...*”) when talking about the test and states how the “unknown vocabulary” leads to the discrimination and comprehension cognitive functions. (“*...that made me think of the answer...*”). Later, case 1 goes beyond the lexical aspects and considers a bigger translation unit from the pragmatic perspective, (“*The context*”), which is associated to the cognitive functions of comprehension and identification when stating (“*the contexts make interpretation easy*”). After that, there is an operational phase when talking about the time to do the translation task. This is at the same time associated to the an information processing phase (“*...the time to process the information..*”), that is also linked to the cognitive function of comprehension or in terms of the theory of sense with comprehension, and de-verbalization. Finally, case 1 mentions the “context” one more time, but in this case

related to a process of reading the information again for a better comprehension, (*“reading the contexts one more time let me understand better”*).

**Case 2:**

1. How would you define the process of translation you went through during the experimental test?

*It was a process of interpretation of meaning of the contexts in English to agree or disagree with the given translation.*

2. What cognitive process did you most use while doing the task assigned (reading the contexts in English and choosing the adequate translation)?

*First of all, I understood the meaning of the contexts in English. Secondly, I produced an equivalent in Spanish establishing a relationship of equivalence between the given translation and mine. Finally, I decided which of the translations communicated the source message.*

3. What do you think of translating metaphors?

*Translating metaphors is a process in which the translator needs to be aware of the cultural behaviors, both the source culture and the target culture. That is, the metaphors are social and individual conventions about a concept. For this reason, the translator needs to convey and adapt the meaning of metaphors to the reader reality.*

4. What is it important or different in the process of translating metaphors?

*In this process is important searching for not equivalent words or expressions but an image or a referent with a similarity in meaning.*

Case 2 refers to this process in terms of meaning interpretation in a source language, (*“it was a process of interpretation of meaning...”*), this is associated to the cognitive function of comprehension related to a process of decision making in a target language (*“...to agree or disagree with the given translation...”*). Case 2 makes emphasis in the process of meaning comprehension, but this time refers to a translation unit in a source language (*“... meaning of the contexts in English...”*), then refers to

the target language from the perspective of making a decision (“ .. *I produced an equivalent in Spanish..*”), but this time in the sense of what it was written and the previous knowledge activated during the translation task, (“... *establishing a relation between the given translation and mine...*”), again reinforces a making decision process when stating (“...*I decided which of the translations ...*”). Case 2 refers to the translation as communication when saying (“...*communicated the source message...*”). Then, case 2 refers to the metaphor translation process as a process in which culture plays an important role as well as the translator knowledge of the languages involved (“...*translator needs to be aware of the cultural behaviors, both the source culture and the target culture...*”) and the importance of knowing the intention of metaphor (“...*That is, the metaphors are social and individual conventions about a concept...*”) as well as the process of meaning adaptation to a real context. (“...*the translator needs to convey and adapt the meaning of metaphors to the reader reality...*”). Case 2 makes emphasis on comprehension in order to be able to identify the adequate equivalents in a target culture in terms of meaning understanding. (“...*searching for not equivalent words or expressions but an image or a referent with a similarity in meaning.*”).

### Case 3:

1. How would you define the process of translation you went through during the experimental test?

*The test was simple one. It was an interesting test.*

2. What cognitive process did you most use while doing the task assigned (reading the contexts in English and choosing the adequate translation)?

*The time to read and process the information was o.k.*

3. What do you think of translating metaphors?

*It is an important aspect in translation which needs attention.*

4. What is it important or different in the process of translating metaphors?

*It is important to consider the new vocabulary.*

Case 3 assesses the test in terms of both uncomplicated and interesting, (“...*the test was simple...*”, (“*interesting test*”).) Then, case 3 refers to a procedural phase when talking about the time to the translation task (“... *the time...*”) linked to a reading and processing information phase, which in turn is directly related to a cognitive function of comprehension. (“... *the time to read and process the information...*”). Finally, case 3 thinks of the time in terms of enough and adequate, (“... *the time to read and process the information was o.k...*”). When referring to metaphors, case 3 considers them as relevant in a translation task, and as something that cannot be neglected. (“...*It is an important aspect in translation which needs attention....*”). Finally, case 3 refers to a lexical aspect when mentioning the unknown vocabulary. This aspect is related to the cognitive function of discrimination.

#### Case 4:

1. How would you define the process of translation you went through during the experimental test?

*The test was fast. It was not a long one. I found an affinity between contexts.*

2. What cognitive process did you most use while doing the task assigned (reading the contexts in English and choosing the adequate translation)?

*The second time the contexts were presented was easier because I was already familiarized with them.*

3. What do you think of translating metaphors?

*It is a cultural process.*

4. What is it important or different in the process of translating metaphors?

*The new vocabulary that should be inferred from the context*

Case 4 refers to a procedural aspect which implies the time to do the test and assesses it in terms of fast, (“...*the test was fast...*”), case 4 reinforces this aspect when stating that this type of test did not require a long period of time. (“... *it was not a long one...*”). This is associated to a cognitive function of cognitive efficiency to do something. Case 4 inter-relates the test contexts test when stating the relation found

between, (“...*I found and affinity between contexts...*”), this leads to considering the discourse as a whole from a pragmatic perspective instead of considering it as a mere organization of words, case 4 refers to the affinity in terms of (“...*contexts...*”), a big translation unit. Again, case 4 makes emphasis on the procedural aspect of time, but linked to a phase of re-reading the contexts (“... *the second time the contexts were presented...*”), and through a comparison he states how reading two times makes easy the process of information understanding. (“...*The second time.... was easier...*”). This comparison is supported when saying (“... *I was already familiarized with them...*”). The information just mentioned is directly related to the cognitive functions of comprehension and identification. Then, case 4 refers to the cultural aspect involved in a translation task of metaphors (“...*It is a cultural process*”), that relates to a lexical aspect (“... *there were some new vocabulary...*”) and the contexts containing it, which permit an understanding. This makes think of the cognitive functions of memory, comprehension, interpretation, and discrimination due to the information analysis within a context. (“... *that I inferred from the context...*”)

#### Case 5:

1. How would you define the process of translation you went through during the experimental test?

*The test was very interesting, even though I felt very uncomfortable with the dark room. I associate this test with a consecutive interpretation process.*

2. What cognitive process did you most use while doing the task assigned (reading the contexts in English and choosing the adequate translation)?

*Repeating the contexts permit to have a clearer idea about them.*

3. What do you think of translating metaphors?

*It is an aspect that requires attention because of the cultural aspects involved.*

4. What is it important or different in the process of translating metaphors?

*It is necessary to read the contexts again in order to understand the metaphors.*

Case 5 assesses the test in terms of very interesting (“... *it was very interesting...*”) then mentions a feeling of discomfort due to the dark room condition to do the task. (“... *I felt very uncomfortable with the dark room...*”). After that, he compares this texts with a test of consecutive interpretation (“...*I associate this test with a consecutive interpretation process..*”) and relates this aspect to the importance of reading the contexts one more time to clearly understand the idea. (“...*repeating the contexts permit to have a more clear idea...*”). The word context makes us think of considering bigger translation units from a pragmatic perspective. Case 5 considers metaphors as cultural aspects that need to be taken into account. (“...*It is an aspect that requires attention because of the cultural aspects involved.*”), and emphasizes on the necessity to read the metaphor context in order to be understood. This is associated to the cognitive function of comprehension. (“... *it means it was necessary to read the contexts again in order to understand...*” )

#### Case 6:

1. How would you define the process of translation you went through during the experimental test?

*A little scary, but interesting. I never thought this kind of studies were able to be done in translation.*

2. What cognitive process did you most use while doing the task assigned (reading the contexts in English and choosing the adequate translation)?

*Mainly memory, concentration and attention.*

3. What do you think of translating metaphors?

*it is a difficult task since it involve socio- cultural factors and the reinterpretation of the author`s ideas.*

4. What is it important or different in the process of translating metaphors?

*I guess that the use of appropriate register and vocabulary is essential since we need to reinterpret the author´s ideas and changes in the syntax are likely to happen.*

Case 6 refers to this test as one causing him fear but at the same time interesting (*“A little scary, but interesting”*). Case 6 thinks of this test as something unimaginable in translation. (*“...I never thought this kind of studies were able to be done in translation”*). Case 6 considers that a translation process is a process that requires cognitive functions such as memory, concentration and attention. (*“mainly memory, concentration and attention”*). When referring to metaphor translation, case 6 refers to the degree of difficulty one may encounter, due to the cultural aspects within metaphors. (*“...it is a difficult task since it involve socio- cultural factors...”*), and associate this aspect to information reinterpretation, necessary in a translation task like this, (*“...the reinterpretation of the author’s ideas”*). Case 6 reinforces this reinterpretation aspect linked to searching for adequate lexical registers in a target language to translate the discourse producer’s ideas. (*“...I guess that the use of appropriate register and vocabulary is essential since we need to reinterpret the author’s ideas...”*). Case 6 also notes the differences between languages and points out the morphosyntactic changes necessary to communicate a message, (*“...changes in the syntax are likely to happen.”*) This is associated to the cognitive function of comprehension.

#### Case 7:

1. How would you define the process of translation you went through during the experimental test?

*Well, you must take into account the idea you get when you read the test and what you are going to write down when translating that idea into a different language.*

2. What cognitive process did you most use while doing the task assigned (reading the contexts in English and choosing the adequate translation)?

*Reading the contexts one more time helped to translate the same idea.*

3. What do you think of translating metaphors?

*It is a difficult process because some metaphors just do not exist in one language or another or they just don’t make sense.*

4. What is it important or different in the process of translating metaphors?

*Knowing the metaphors help the process.*

Case 7 refer to this test in the sense of understanding an idea in a source language (“...*you must take into account the idea you get when you read the test ...*”) with an objective to be translated in a target language (“...*you are going to write down when translating that idea into a different language...*”). This activates cognitive functions such as comprehension, and discrimination. It also states that translation requires understanding ideas instead of isolated words. Then, case 7 talks about the process of reading two times, which it is assessed in terms of helping the comprehension process (“...*Reading the contexts one more time helped to translate the same idea...*”). Case 7 also refers to contexts which lead to think of a more elaborated conception of the translation process; however it is referred as translating the “same” idea in a target language. Case 7 considers metaphor translation a more difficult process (“...*It is a difficult process ...*”) since this linguistic resource can be made up (“... *some metaphors just do not exist in one language or another...*”) and it can sometimes be unique in one language. Therefore metaphors may not make any sense (“...*some metaphors just do not exist in one language or another ...*”). Finally, case 7 states that previous knowledge about metaphors help translating them. (“...*Knowing the metaphors help the process...*”). This activates the cognitive function of memory.

### 3.9 Control group

#### Case 1

1. How would you define the process of translation you went through during the experimental test?

*Most of the different moments of the test in which I needed to translate a sentence were automatic, as there was no need to give thorough analysis to the structure of the sentence but rather capture its meaning and seeing if it would fit in the translated text.*

2. What cognitive process did you most use while doing the task assigned (reading the contexts in English and choosing the adequate translation)?

*I think it's more of a deal of interpretation than anything else, memory plays a part by providing adequate terminology, but interpretation clearly defines which words to use and where to emphasize.*

3. What do you think of translating metaphors?

*I think it should not affect the translating process for someone with good English knowledge, able to understand the underlying meaning of what is being said. For me, not being a professional translator, the metaphor translation and the literal translation are not very differentiated.*

4. What is it important or different in the process of translating metaphors?

*Something to be noted, though, is the lack of an appropriate context per sentence, since there were occasions in which the sentence could be interpreted in several different ways depending on what it was referring to.*

Case 1 refers to the process as an automatic one (“...**Most of the different moments of the test in which I needed to translate a sentence were automatic...**”), since there was no necessity to identify the morphosyntactic structure of the sentences (“...**as there was no need to give thorough analysis to the structure of the sentence...**”). This idea leads to think of translation as an automatic process without considering what it is necessary to express the messages: a combination of different aspects such as syntax, morphology, and semantics among others. However, after that case 1 refers to understanding a meaning in a source language (“...**capture its meaning...**”) to identify how it fit in a translation given (“...**seeing if it would fit in the translated text...**”). It makes us think case 1 does not consider syntax and meaning as integrated aspects of a language. Case 1 thinks of the cognitive function of memory as important in a translation process to identify terminological aspects (“...**memory plays a part by providing adequate terminology...**”), for case 1 interpreting is the essential process, (“...**I think it's more of a deal of interpretation than anything else...**”). Case 1 reinforces the process of interpretation as the one leading comprehension and discrimination (“...**interpretation clearly defines which words to use and where to emphasize...**”). When referring to the metaphor translation, case 1 states the importance of knowing the source language, (“...**it should not affect the translating process for someone with good English knowledge...**”), knowing the language leads metaphor comprehension and interpretation adequately (“...**understand the underlying meaning of what is being said...**”). Case 1 states that since he is not formed in translation metaphor and literal translation are basically the same (“...**the**

*metaphor translation and the literal translation are not very differentiated...”).* Finally, case 1 points out that context is important when dealing with metaphors due to the different kind of meaning that they can imply (“...*there were occasions in which the sentence could be interpreted in several different ways depending on what it was referring to...*”). Case 1 states that the contexts should be complete in order to fulfill comprehension (“...*is the lack of an appropriate context per sentence ...*”).

**Case 2:**

1. How would you define the process of translation you went through during the experimental test?

*I found this test very interesting.*

2. What cognitive process did you most use while doing the task assigned (reading the contexts in English and choosing the adequate translation)?

*Reading the contexts twice helped to understand.*

3. What do you think of translating metaphors?

4. What is it important or different in the process of translating metaphors?

Case 2 assesses the test in terms of very interesting (“...*I found this test very interesting...*”), and relates understanding with being exposed to the contexts two times (“...*Reading the contexts twice helped to understand.*”). This is associated to the cognitive function of comprehension.

**Case 3:**

1. How would you define the process of translation you went through during the experimental test?

*Sometimes these ideas are similar the one you get when you read the original text and the one you write down when doing the translation but we must be loyal to the original sense of the idea.*

2. What cognitive process did you most use while doing the task assigned (reading the contexts in English and choosing the adequate translation)?

*I repeated the sentences to check out if I got the same idea when repeating it in English and then in Spanish.*

3. What do you think of translating metaphors?

*It is difficult.*

4. What is it important or different in the process of translating metaphors?

*Knowing the metaphors of course, some metaphors are really obscure and that's why they're mistranslated at times.*

Case 3 refers to the process of translation in terms of comprehending ideas in a source language and finding similar ones in a target language (“...*ideas are similar the one you get when you read the original text and the one you write down when doing the translation...*”). However, case 3 thinks of translation in terms of being loyal to the source language (“...*but we must be loyal to the original sense of the idea ...*”). This makes us think of an old fashion conception of translation. For case 3, reading the sentences one more time let him verify whether the original idea in a source language was the same in a target language (“...*I repeated the sentences to check out if I got the same idea when repeating it in English and then in Spanish...*”). Case 3 reinforces the idea of correctness instead of adequacy. The cognitive function of comprehension was done in the sense of verifying an idea in a source language. When referring to metaphor translation, case 3 just refers as it is difficult (“...*It is difficult.*”). However, case 3 states that the knowledge (“...*Knowing the metaphors of course...*”) about them avoids translation inadequacies (“...*some metaphors are really obscure and that's why they're mistranslated at times..*”) due to the ambiguity within metaphors.

These categories were identified and extrapolated from the participant's answers to the post test interview which was conducted immediately after the exam. (See annex 8, in CD)

### 3.10 Theoretical approach to translation

The first category identified from the behavioral results is a theoretical approach to translation. The concept of *interpretation* arose in two distinct concepts. Interpretation as a sub-field of translation, the principal distinction between the two is the simultaneous and often oral medium which it takes place. This definition and concept without question related to the successive and temporal nature required by an ERP exam. Translators during the test did not find they had the ordinary time for reflection which is usually present during unexamined translation. The fact that only translators made this observation provides further support that translators have developed a plasticity to adapt their special skill and abilities that many of the non-translators found hard to cope. It is important to point out that this is not a short-coming in the design of these types of tests but an advantage. The high temporal resolution allows the observation of the unconscious and instantaneous activation of meaning.

The second concept of interpretation emerging from post exam discussions from the subjects: the more everyday use of the word which simply refers to the meaning of a message. This concept of interpretation arose in both groups during the discussion of the time need for understanding and translation. Interpretation from this perspective of understanding concepts relates to what Wills (1996) stated about the importance of knowledge and skills regarding information processing and procedures. These procedures guide translators to identify strategies that allow them to determine all the necessary conditions, both linguistic and extra-linguistic, to translate a discourse. This analyzed from the perspective of the results obtained, makes obvious the fact that during the information processing stage, translators find the way to skillfully converge knowledge and expertise on the subject to do the translation task.

An obvious fact is that in any translation task, meaning is an essential aspect - and meaning construction is directly related to cognitive functions activated during a translation task. From a linguistic point of view, meaning constituted the core of communication; this was evidenced by the group of translators, who knew that during the phase of information processing they were clear they had to understand meaning in context. More importantly, since they were also instructed that the contexts were

extracted from a parallel corpus within the domain of politics, they used that previous information to interrelate meanings. In contrast with the group of non translators who were instructed with the same information, but concentrated on the much more superficial task of translating words not mentioning any kind of interrelatedness between experimental contexts and seemingly forgetting about the speaker. This observation follows translation models theorist postulated by scholars such as Hurtado (2007), Shreve & Neubert (1997), Wills (1996), who define translation as primarily a communicative process. Requiring a well defined communicative situation, in which knowledge from the producer and knowledge from the receptor interact to make comprehension possible.

### **3.11 Context**

Bell (1996) has defined translation as act of *communication* requiring as well contextual and discursive features of normal monolingual communication such as; a specific situation, a speaker emitting a discourse, a listener, and a cultural context in which this complex interaction takes place. According to Shreve and Koby (1997), translation goes beyond just considering languages, but deals with a relationship between texts and situations, which means context plays an important part in the comprehension of a said discourse. We observed in this case study, that context not only permits the identification of certain cultural aspects in the source language, but more importantly provides the bases for the transfer of important non-linguistic information contained within the context which is of supreme importance within any adequate translation. This takes a special and more important role when considering the translation of metaphors because of their socio-cultural roots and the need for context to properly understand them.

This concept of translation was paramount in the minds of our experimental group during the tests. While many of the non-translators struggled on a context by context bases seemingly to forget the speaker, the translation group made important inferences from the context created by the speaker and more telling; interrelating the contexts themselves. This is a new aspect for this method of empirical investigation because the majority of the literature deals with either word pairs or synthetic contexts with no speaker, listener, or larger context. Unlike this case study using a contextualized

instrument comprised completely of natural language within a familiar public context. This important distinction allows for the inferential understanding of important vocabulary and more importantly the simulation of the cultural and contextual transfer of information which is a key aspect within the concept of translation.

Although the word context can be used indistinctly in many situations, from the results obtained in this case study, context in a translation process can be the combination of linguistic knowledge of the two languages involved and the situational knowledge (Wills, 1996) emerging from the said message or discourse to be translated. It is, in many ways, context that allows translators to activate the linguistic resources used, and through context translators are able to construct and unambiguous meaning, solving problems and making decisions. Both linguistic knowledge in the languages involved and situational knowledge converge to make understanding possible. Without a careful balance of both, meaning remains unclear, and translation becomes a superficial process.

### **3.12 Cognitive functions: attention and memory**

Attention and memory are the principal underlying functions of mental representations in both the source and target languages. The N400 elicited here, is more evidence that the N400 is a reflection of the activation of “*global meaning*” in both languages. The syntactic, semantic, and pragmatic memory systems account for aspects such as perception, information processing and memory processing in translation (Bell, 1991). The higher amplitudes and later latencies observed suggest that the N400 is an indication of meaning elaboration and semantic cohesion.

Within the experimental group memory played an important role in the inter-relationship of the contexts. Translators relied on memory to develop large meaning and discourse through assuming a relationship between the contexts presented. More importantly, translators stored meaning in memory to compare with the translations presented. Attention and memory served the experimental group in such a way that they were able to carry out an inter-relationship of contexts exploited for better comprehension and used as a means of completing the task.

Memory and attention not only motivate mental representations necessary for discourse comprehension but they also allow recalling information within a context that leads information organization in contrast with the knowledge frames. The knowledge frames are the ones that serve to establish links and associations that in turn lead to produce the discourse. The two types of memory permit the activation of information and knowledge in specific communicative situations. The translators activated the short term memory the second time the test was passed, and the long term memory because they were interrelating the contexts they read the first time of the test. The results from the two groups show that although the stimulus they received was a syntactic stimulus, they converted into semantic through the cognitive functions involved in the information processing.

### **3.13 Methodology and process of examination**

In exams of this nature it is important the participants have enough time to perform it. According the results, the 90% of the participants agreed the time to read the contexts and to make the decision was sufficient. Most of them found it simple, without a high level of complexity, which made them feel at ease with the time assigned. Given the fact that almost all the participants found that they had enough time to carefully read and understand both the contexts and their translation. This observation adds further weight to the data, because of the necessary conditions which this exam requires.

### **3.14 Reflections on habituation**

The concept of habituation is understood as the exposure to the stimulus in order to diminish the unnatural and new experience in the experimentation. For this case study all the participants were habituated to the task by presenting it two times. The first time was done to expose participants to the stimulus, and the scientific way the stimulus was presented, in order to lessen the effects of the new and un-habitual way the information was presented. The second time that the test was administered, immediately after the first, was done in such a way to limit noise from the scientific and sterile atmosphere of the test. All of the participants agreed that being exposed to the stimulus twice made them feel more comfortable doing the task and permitted a more natural performance.

### 3.15 Discussion

The interpretation and qualitative analysis of this empirical test strives to look at two important phenomena. The first regarding the primary question pertaining to this research: What are the changes that the translator experiences within the cognitive process, in a translation task of metaphorical and non metaphorical contexts using event-related potentials (ERPs) as measure? To re-articulate more precisely, we are looking at the quantitative differences in the target language process of comprehension within the group of translators and the possible qualitative implications from this data regarding the theoretical models of translation. Secondly, this research aims to look at the differences in the cognitive processes between the groups of translators and non-translators within both types of languages, in hope of providing much needed evidence for translation scholars and professors in the development of new theories and teaching techniques.

Like previously mentioned in the theoretical framework of this experiment, the concepts of metaphor or metaphorical language as opposed to non metaphorical language are highly complex ones. Following this complexity within the related disciplines of philosophy of language and linguistics, there are two diametrically opposing paradigms which try to describe the underlying functions and reasons that comprehension of metaphorical language is possible. The first is the “*specialness*” paradigm developed by John Searle, which holds that metaphorical language is only understood after the rejection of the literal meaning of the sentence. Therefore, metaphors are special because their comprehension implies a different process than normal comprehension. In contrast, cognitive linguists such as Lakoff and Johnson and Turner hold that our conceptual system is metaphorical in nature, and therefore the comprehension of metaphor is unconscious and automatic. They cite as evidence the abundance of metaphors in every type of language and the hierarchy exploited between domains and concepts which are grounded in culture and experience.

Much of the recent empirical evidence has tended to support the cognitive model and make the specialness theory seem more and more unlikely. A variety of reaction time measures have pointed to the fact that metaphor interpretation is neither slow nor optional, casting doubt on the second tenet of the specialness model. When the

metaphorical interpretation of a sentence has adequate contextual support, metaphors are read no more slowly than literal language (Gibbs, 1994, Kutas, M., & Hillyard, S. A. 1984, Kutas, M & Federmeier, K.D, 2005). Furthermore the current processing models of metaphor comprehension all assume that literal and non-literal language comprehension invokes the same mechanisms (Gibbs, 1994).

These same findings have placed the authenticity of the CTMM in question. Although there is empirical evidence that the activation of meaning is simultaneous as proposed by Lakoff and Johnson (1980), there is mounting data that suggests meaning construction regarding metaphors is more complex. As mentioned above although it is now assumed that certain processes and functions are made possible by the same mechanisms, they are not entirely the same as Lakoff proposes. Moreover, the effortlessness that Lakoff and Johnson (1989) describe seems to be contradicted by the data, demonstrated by both the difference in amplitudes between metaphorical and non metaphorical conditions. The data reveals that indeed the difference in meaning construction has some differences and certainly is more complex. Moreover, Tzuyin Lai *et al* (2006) observed that the comprehension of all metaphors is not necessarily equal, more novel metaphors exhibiting greater amplitudes, and a higher N400 gradient while more conventional metaphors show statistically significant smaller amplitudes and N400 gradient.

The results of our data fall clearly within the trends of recent data as discussed above. The differences in the amplitude of the N400 between groups and across conditions suggest that the process of comprehension shares certain mechanisms, although they are not identical processes. Furthermore, if the N400 is a marker of L1 lexical activation (Thierry & Jing Wu, 2007), and therefore related to meaning understanding, this larger N400 amplitude is more evidence of a more complete comprehension within the experimental group, because the activation of the L1 not only implies direct understanding of the context in the native language, but the beginning stages of planning in the working memory for the translation.

There are two important findings from Kazmerski *et al*, (2003) which relate to our data. The first is the significant differences in N400 response regarding metaphors and intelligence. They found greater N400 amplitudes in subjects who scored higher on a

standard intelligence exam than those subjects who scored lower and therefore have lower IQs. This data relates to our data in the observation of a much greater variation within the responses of the experimental group regarding the metaphorical condition. Furthermore, these heterogeneous qualities in the response may not only be due to the difference in intelligence of the subjects but the differences in the abilities and level of knowledge pertaining to the L2 language and translation itself. This implication is further supported by the data within the control group, which demonstrated close to base-line activity for the metaphorical condition indicating very little meaning understanding. As oppose to this same data within the experimental group which evoked the largest of all amplitudes observed in this study.

Another important observation by Kazmerski *et al*, Dawn (2003):

“Neither direct nor indirect models of metaphor comprehension can completely explain the findings. Therefore, we propose abandoning this distinction and, instead, developing a new approach based on the concept of constraint satisfaction. Constraint satisfaction is the assumption that, in natural language understanding, all of the information in the discourse and the social setting (including the demands of the task) will provide constraints on understanding.”

This conclusion finds further evidence within our data and we are compelled to agree with the proposal of abandonment of this theoretical distinction for a new one. This concept of constraint satisfaction finds support in both our qualitative and quantitative data. First, the translators all reported the necessity of relying on context, and the relation between contexts, for the adequate understanding of meaning. Within the terms used here, the context provides the constraints which the subject looks to satisfy while comprehending a metaphor. This necessity of constraint satisfaction does not seem evident within the non-metaphorical contexts, and is evidenced by the much lower amplitudes. On the other hand, the control group who barely relied on the context as useful for meaning construction demonstrated near base-line activity within the metaphorical condition because of their lack of constraints and therefore constraint satisfaction during the construction of meaning. This is further evidenced by the fact that analysis of variance (ANOVA) revealed no statistical difference in latency across the two conditions and two groups, supporting the automaticity hypothesized by Lakoff

and Johnson (1989) and contradicting the “*specialness*” model. The observable difference in amplitudes, and need for context, contradicts the unconscious and effortlessness which is fundamental to the CTMM.

Regarding the differences between groups, the second objective of this case study, the amount of empirical evidence and published studies is drastically poorer when compared to the previous subject. Notably, we cannot find any study which attempts to gather data of the same type here. A method where studies do exist, and data has been collected, is the TAP tests. A method borrowed from psychology. And although, in almost all respects these tests are not analogous to ERP studies, in neither temporal orientation nor the difference between unconscious and conscious cerebral activity, they have demonstrated notable and important difference between translators and non-translators. Key cognitive difference emerging from these descriptions, is the difference between units of translation; natural translation following word to word as the primary unit, while professional translation the unit is much larger from meaning to meaning. Another and very important observation is the difference in *error detection*; translators seem to have developed critical thinking skills which allow them more accurate detection of inadequacies and discrepancies in their work. One more difference that has come to light is the deletion of important information. Non-translators in during their process of comprehension and analysis have demonstrated a tendency to delete and misinterpret important information.

In the light of these observations made through TAP tests, some general conclusions can be made regarding “*why*” these differences exist between translators and non-translators. First, if the N400 is an indicator of the elaboration of complex and subtle meaning, which following our data translators have developed this ability to a much higher level. This more global meaning activation allows translators not only to construct a much more subtle meaning for later comparison to the translation and the subsequent detection of errors. In contrast, to a non-translator who struggles with the much smaller unit within translation – words – where inadequacies go easily unnoticed. This observation made through TAPs, and the evidence found in this case study encounters more support within translation theory. Translators first develop a mental representation of a text in the source language (*SL*) which is later replaced by the same mental representation, however, in the target language (Shreve & Diamond 1997, Bell

1991). This more “*global*” representation of meaning facilitates the storage of information in the memory of the translator so that it can later be compared and contrasted with the translation. The translators in the experimental group reported their process as trying to remember the overall meaning of the experimental context, for later comparison and detection of errors in the accompanying translations. In contrast, the non-translators did not report developing a similar or analogous method.

Another important observation from the data is the meaning of translation itself and the conceptualization about theory (discourse analysis, translation theory, textual analysis), and how these concepts serve a translator in his or her task. The translators in this case study relied on context to make important inferences about meaning, and to also aid them with understanding unknown vocabulary. The non-translators, on the other hand, seemed to disregard the context and the speaker and struggled with each context individually. Following the data, and considering the large difference in amplitudes between groups, this method of translation employed by non-translators, does not allow for a more subtle elaboration of meaning which metaphors require. This concept of translation: “What is required is a cognitive, hermeneutic, associative way of thinking, one seeks to capture translator performance in a dynamic way and regards translation as a specific form of linguistic information processing” (Wilss 1996, p. 31), permits translators to carry out the process in a more dynamic and associative way, which is evidenced by the overall greater cerebral activity during the construction of meaning within the frontal, occipital, parietal, and central region of the brain. Based on the evidence from these empirical tests this concept of translation as a dynamic, and intercultural process allowed the translators to construct meaning based on the importance of context, and more importantly, an overall – or global – mental representation of the text. This important representation of the text was constructed by the translators based not only on the knowledge of the languages involved, but more importantly knowledge of the cultural context, or intercultural context, and through their more complete concept of translation. As opposed to the non-translators, where no evidence of a global representation could be found in either the quantitative or qualitative data, in contrast during the interview the translators consistently referred to their reliance on the mental representation.

Relating this discussion between the groups to the discussion of the evidence against the CTMM, there seems to be a link between the evidence. The overall near base-line amplitudes in the non-translators we interpret as an indication of a clear lack of meaning construction and therefore constraints within this group. If there is a lack of constraints to define the lexical change that is characteristic in metaphor, then there is no real and discernible meaning to the context and therefore no mental representation developed. This logic following the data would explain the observation from the TAP test analysis that non-translators delete important information. From this we can conclude that they tend to delete important information because the information was not understood, and therefore never found its place within the mental representation developed. Furthermore, this observation is related to the importance of context and the overall definition of translation. This lack of context, and therefore lack of constraints on meaning, is undoubtedly due to the non-translators treatment of translation as a purely linguistic transfer, and not as a complex transfer of cultural, pragmatic, and situational information.

Moreover if one considers the N400 as an indication of L1 lexical activation, these same conclusions remain true, although for different reasons. The relationship between the two languages that this interpretation of the N400 represents is evidence of two important things the translators are doing which the non-translators are not. The first is the primitive stages of planning for the translation. This instantaneous activation allows for a more complete picture within the memory of the translator. Secondly, it indicates a more complete and complex understanding of the L2, because this activation is not interpreted as a “*crutch*” to understand better, but a reflection of the normal reliance all bilinguals and translators place on their first language. This interpretation of the N400 also relates directly to Bell’s theory regarding the replacement of mental representation in one language by the mental representation in another. This lexical activation of the target language, within this view of the N400, one interprets as the beginning stages of the replacement of the original representation for that in the target language.

Wilss (1996) stressed the importance in the distinction between the concepts of *skills* and *abilities*. Also, he makes an important theoretical distinction between two types of knowledge; declarative and procedural. This theoretical divergence and definition of “*what*” a translator does and “*how*” he or she does it finds considerable

evidence within this case study. The translators and non-translators both have the same basic ability, according to Wilss definition – bilingualism. But the translators have developed a certain set of *skills* which allows them to complete their task more quickly and adequately. The higher amplitude and later latency of the N400 points to greater engagement, and effectiveness, of the working memory of the translator when compared to non-translators. This capacity to process complex information quickly and adequately, while storing a mental representation seems a unique skill among translators. More importantly, the interweaving of theory and its subsequent application was apparent within the translation group in both the qualitative and quantitative data.

## 4. Conclusions and recommendations

### 4.1 Conclusions

There are significant cognitive differences between translators and non translators while carrying out a specific translation task. The results may be due to a number of reasons, among which are: differences in information processing, the different skills and abilities developed, greater cognitive control, and the concept and meaning of translation itself.

The significant differences between latency and amplitude found in the experimental group (translators) in contrast with the control group (non translators) suggest that when faced to metaphorical contexts the process is more complex due to the number of neurons involved in this type of translation task. Translators carry out a more conscious, regulated and planned process because they are aware a translation process involves two languages and two cultures.

The quantitative results make us think that the brain areas most involved in a translation process might be the frontal, central-parietal areas, since these were the areas that reported higher amplitudes in the experimental group, and they are responsible for a great cognitive activation. If we consider N400 is related to meaning understanding, we may say translators develop skills and abilities to a large extent due to their translation studies and experience.

Qualitative results show the importance on the conceptualization about discourse analysis, translation theory, textual analysis, and how these concepts serve translators in their adequate translation process. The translators consider translation from a communicative perspective in which it is of the utmost importance to understand the message linguistically and extra linguistically well, in order to communicate a message adequately to a socio cultural context. This in turn makes translation a dynamic discipline.

## 5. Recommendations

We recommend more empirical testing to determine which of these possible variables, and the interaction between them, need to be designed and carried out taking advantage of interdisciplinary methods of investigation, new technology, and knowledge from related disciplines. This will lead to better understand why these differences exist, and to assist in the development of new theories and models of translation.

This case study broadens new pathways to keep on carrying out similar research projects with samples statistically significant and with other translation tasks.

We also recommend the abandonment of the theoretical distinction between the specialness model of metaphor comprehension and in its place a model based on constraint satisfaction and semantic cohesion. This case study is now one of many within a variety of disciplines, which seem to contradict essential elements within both theories of metaphor discussed. Also, this test has demonstrated that although the TAP tests have been highly criticized within the discipline they have demonstrated that there subjective observations have value and are worth theorists taking a closer look at the results and their possible implications regarding the models of translation. Moreover, during the training and education of future translators that a greater emphasis on the importance of context and habituation of the source text. Most importantly, that new methods and technology are employed to help translators develop the necessary skills pertaining to memory and attention.

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