# NLP Resources for the Analysis of Patient/Therapist Interviews

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## Abstract

We present a set of tools and resources for the analysis of interviews during psychotherapy sessions. One of the main components of the work is a dictionary-based text interpretation tool for the Spanish language. The tool is designed to identify a subset of Freudian drives in patient and therapist discourse.

## 1. Introduction

In recent years the field of Natural Language Processing (NLP) has seen a renewed interest on the analysis of non-factual, emotional discourse characterized by the presence of affective language and sentiments, and charged with subjectivity.

One area which has not been properly investigated, however, is that of NLP in the field of psychology and, more specifically, NLP in the analysis of interactions between patients and therapists during psychotherapy.

There has been substantial research in the development of methods to analyse linguistic input in the field of psychotherapy in order to measure a number of psychological variables such as emotion, abstraction, referential activity, etc. among them Bucci's Referential Activity (RA) non-weighted (Bucci, 2002) and weighted dictionaries (Bucci and Maskit, 2006) for the English language, or Höltzer and others' affective dictionary (Hölzer et al., 1997) for the German language.

We are developing a set of NLP tools and resources for the analysis of interviews framed on a psychoanalytic theory, the work presented being, to the best of our knowledge, the first to investigate the application of NLP techniques, including dictionary-based interpretation, for the automatic analysis of spoken transcriptions in Spanish (Argentinian variety) of psychoanalysis sessions between therapists and patients. In Figure 3 we show a fragment of a manually transcribed interview in Spanish (and its translation to English) from our development corpus.

The automatic analysis of the sessions, which is used as a tool for assessment and interpretation of the transcribed psychotherapy sessions is based on a theory developed by Liberman and extended by Maldavsky (Liberman and Maldavsky, 1975) and framed on Freudian theory (Freud, 1925). The automatic tools to be presented here aim at recognizing a subset of Freudian drives manifested in both patient's and therapist's discourse.

| Abbreviation | Drive Name |
|---|---|
| IL | Intra-somatic libido |
| O1 | Primary oral |
| O2 | Secondary oral sadistic |
| A1 | Primary anal sadistic |
| A2 | Secondary anal sadistic |
| UPH | Urethrae phallic |
| GPH | Genital phallic |

Table 1: Drives in Liberman and Maldavsky theory

The objective of the analysis is not to provide a full automated solution to discourse interpretation in this area, but a set of tools and resources to assist therapists during discourse analysis. Although work in text-based interpretation in psychology is not new, researchers in our project have identified limitations in current practices due to the fact that current text-based systems do not tackle ambiguity problems at lexical, syntactic, or semantic levels: for example systems that consider out-of-context superficial forms are unable to distinguish between different uses of the same lexical item ("para" as a preposition vs. "para" as a form of the verb "parar" (to stop); "rio" as a common noun vs. "rio" as a contextual clue for the identification of a geographical name; etc.). The use of advanced natural language processing techniques could help produce better analysis of the input material and therefore be used for a better diagnosis and follow-up.

## 2. Theoretical Framework Overview

Liberman's theory identifies 7 drives (i.e., a subset of Freud's drives) which are introduced in Table 1 we may

associate these drives with emotional or affective states such as: strong emotions associated with IL; ecstasy or trance with O1; sadness with O2; anger with A1; concrete language with A2; warnings, suspense, and premonition with UPH ; and congratulation, adulation, and promises with GPH.

The theory also associates lexicalizations to each of the drives (Maldavsky, 2003), thus creating a semantic dictionary with 7 categories, the main working hypothesis is that drives manifest through linguistic style, present at word level, phrase, and narrative. Lexicalisations for each drive have been carefully selected following a variety of methods:

- derivation of words from concepts (i.e., for example the GPH drive is associated with words linked to "beauty"; the drive A1 is associated with words that express vengeance, revenge, conspiracy, offense, etc.);

- study of texts in which a certain "scene" is clearly prevalent (for example, everyday activities can be associated to manifestations of the UPH drive, thus words such as "used to", "almost", "prudence", "ambition", "dignity", "friendship" are markers of this category);

- consult with judges, advisers, and use of a thesaurus.

Ambiguity is preserved and a lexicalisation can signal more than one drive. We show some lexicalisations in Table 2. The methodology for interpretation also includes the recognition of a subset of speech acts associated with Freudian drives (Saggion et al., 2010).

## 3.  Related Work

In addition to work by (Bucci and Maskit, 2006) and (Hölzer et al., 1997), the Linguistic Inquiry and Word Count (LIWC) tool has been used to detect different types of personalities in written self-descriptions (Chung and Pennebaker, 2008). Early work on dictionaries in the area of psychology include the General Inquirer psycho-sociological dictionary (Stone and Hunt, 1963) which can be used in various applications. For the Spanish language, (Roussos and O'Connell, 2005) present a dictionary in the area of psychotherapy and can be applied to measure referential activity, but not to detect drives.

Current work on lexical resources for identifying particular text variables – such as measuring strong/weak opinions, sentiments, subjective/objective language, etc. – include the SentiWordnet resource (Esuli and Sebastiani, 2006) derived from WordNet which has been used in various opinion mining works (Devitt and Ahmad, 2007; Saggion and Funk, 2009; Saggion and Funk, 2010); other lines of research include the derivation of word-lists (semi) automatically, for example (Turney, 2002) determined the semantic orientation of lexemes (by measuring collocation strength

| Drive | Lexicalisation |
|-------|----------------|
| IL | **verbs**: to throw up, to break, to add, to rent, to buy, to yawn, to speculate, to stagger, to daze, to knock out; **nouns**: hospital, throat, percentage, worth, medication, blood, nurses, quantity, addiction, cost, limp, kidney, wallet; **adjectives**: sick, fat, asleep, confused, tired, stoned, drunk; **adverbs**: fatally, greedily, sleepily, weakly |
| O1 | **verbs**: to sip, to suck, to abstract, to absorb; **nouns**: enigma, labyrinth, cosmos, quiz, research, supposition, lie, truth, eye glasses, microscope; **adjectives**: mystical, enlightening; **adverbs**: elliptically, enigmatically |
| O2 | **verbs**: to feel, to feel like, to be, to put up with, to stay, to happen, to miss, to need, to suffer, to reproach, to regret; **nouns**: feeling, victim, courage, use, grievance, blame, help; **adjectives**: sensitive, useful / useless, happy, sad, disappointed, family, protected; **adverbs**: fondly, obediently, tenderly |
| A1 | **verbs**: to bother, to kick, to kill, to patronize, to manipulate, to insult, to attack / defend, to harm, to suspect; **nouns**: violence, transgression, fight, guard, anger; **adjectives**: angry, locked, tied, threatening, aggravating, humiliating; **adverbs**: angrily, boastfully, boldly, crossly, cruelly, fiercely, furiously, violently |
| A2 | **verbs**: must, to know, to study, to investigate, to possess, to dominate; **nouns**: vice, doubt, uncertainty, idea, morals, obligation, oath, tradition; **adjectives**: good, bad, clean, dirty, guilty; **adverbs**: but, although, however. |
| UPH | **verbs**: to be able, to dare, to be accustomed, to cut, to interrupt, to avoid, to hide; **nouns**: friend, image, scar, precipice, wound; **adjectives**: coward, scared, tiny, dangerous; **adverbs**: almost, a bit. |
| GPH | **verbs**: to promise, to give, to offer, to receive, to fascinate, to delight, to shine, to seduce; **nouns**: beauty, ugliness, amazement, ornament; **adjectives**: wavy, pretty, deformed, huge; **adverbs**: more, even, besides, mainly, marvelously. |

Table 2: Sample of drives and associated lexicalisation

with *excellent* and *poor*); and (Ghose et al., 2007) investigate the issue of generating a lexicon for positive and negative opinion expressions based on an objective/economic measure.

## 4.  Text Analysis of Interviews

We have implemented a series of programs, lexical resources, and grammars to process interviews and other types of textual data in Spanish. We are using the GATE system (Cunningham et al., 2002) as an infrastructure or development framework; most developments are new, not

included in the GATE system, and they are packaged in a plug-in which can be accessed through the GATE system or used stand-alone. We have developed various programs to automatically annotate the interviews including segmentation of the transcription, word-based thematic segmentation, tagging, and dictionary-based interpretation and analysis.

## 4.1. Language Resources

One of the main components of the system is a dictionary which is taken as the basis for text interpretation. This has been implemented as a language resource in GATE. It is based on lists which have been created for each of the drives. The lists are organized according to their parts of speech. An instance of the dictionary is created from the set of lists and kept on-line for processing (human annotation or automatic analysis). The current version of the resource is updated manually, although we plan to incorporate in the future the possibility of semi-automatic enrichment of this resource.

An annotation tool has been implemented based on a schema for our dictionary, we use the graphical user interface functionalities provided by the GATE infrastructure allowing a researcher annotate words she may want to included in the dictionary or segment the text in units for further analysis. We are also extending the dictionary with synonym information we are extracting using the EuroWordnet Spanish lexical database. This expansion of the dictionary is being done manually at the time of writing.

## 4.2. Processing Resources for Interviews' Interpretation

The following pipeline of resources is used for the automatic analysis of the interviews:

- A wrapper to the TreeTagger parts of speech package (Schmid, 1995) has been implemented in order to call it from the GATE system and an alignment program has been developed to associate the output of the tagger to the actual text of the interview, therefore creating word annotations containing features from the TreeTagger and additional features computed by our programs. Note that the TreeTagger distributed with GATE was inappropriate for our purposes because it does require tokenisation of the input performed before invoking the tagger, this is the reason why we had to create our own wrapper.

- A sentence identification program is used to identify sentence boundaries and types of sentences and a segmentation program is used to identify patient and therapist interventions.

- A named entity recognizer and chunker for Spanish is being developed using Support Vector Machines and training data from the CoNLL evaluation programme, and extending recognition to the identification of family relations. We have created a trainable system using machine learning resources provided by the GATE framework. The CoNLL 2002 Spanish dataset

which provides information on named entities such as *Location*, *Organization*, *Person*, and *Miscellaneous* was analyzed using parts-of-speech tagging, morphological analysis, and gazetteer lookup in order to derive a set of features for learning. A supports vector machine was trained that uses gazetteer information, word level information, orthography, parts-of-speech, and lemmatization. We have collected a number of lists to assist the identification of names of organization, persons, locations, time expressions, etc. The performance of the current system is at 68% F-score. Note that named entity recognition is particularly important to track names in longitudinal analysis of interviews, but also to disambiguate names which in Spanish are ambiguous.

- A program uses the dictionary and interprets each word or complex term according to the drives in the dictionary;

- A topic segmentation program has been implemented to break the interview in fragments which can be selected for fine-grained interpretation. This module is based on tf*idf similarity between candidate segments;

- A processing resource has been implemented to generate an interpretation of the different languages or drives' variables for different segments chosen by the human analyst (therapist or patient or any other segment of interest);

- Statistics are computed for each of the segments.

In Figure 1 we show the dictionary-based interpretation of the text we presented in Figure 3; note that a word can be interpreted as associated with more than one drive in the theory. In Figure 2 we show statistics for each drive computed over a segment selected by the user. These can be compared to manual interpretation (no dictionary based) in order to validate the dictionary.

## 5. Evaluation

Evaluation of the tools investigated here represent a challenging research question, specially when extrinsic evaluation is considered. Where the statistical distribution of types of languages (associated with the 7 drives) is concerned, patients discourses can be automatically analyzed by the tools and this result compared with the interpretation given by a therapist. We are working on a set of transcriptions which are being manually analysed by various experts, these will be compared with the output of the automatic program in order to compute correlation metrics. The dictionary, which is mainly used for the analysis of sessions, has also been used to derive interpretations of other types of discourse such as for the analysis of news and the analysis of political discourse: for example, in a recent application of the dictionary to articles referring to the 2008 financial crack, it has been noticed a clear tendency for a language IL which is associated to strong emotions. We are also investigating the applicability of our tools to
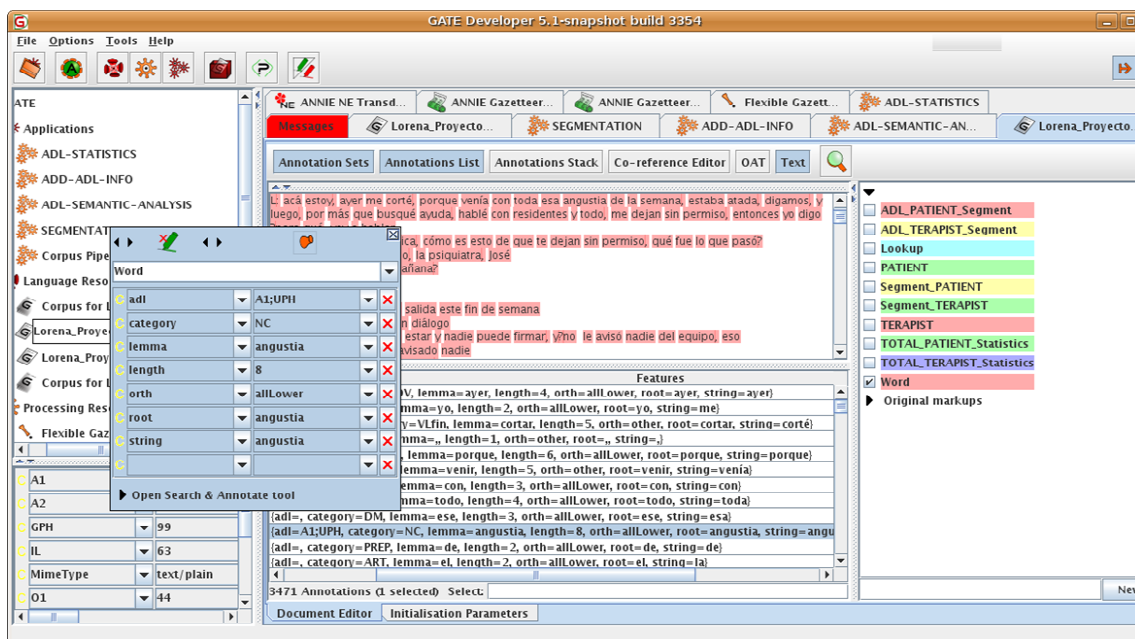
Figure 1: Word Analysis using the Dictionary

the analysis of different sections of news sources (economy/business, sports, politics, etc.) in order to identify cross-source similarities and tendencies.

## 6. Current Work

The paper has described a number of tools we are developing for the analysis of transcribed psychotherapy interviews in the Spanish language including the implementation in GATE of a dictionary for the identification of drives in the context of a Freudian theory. We are currently developing a module for speech act recognition and classification in order to identify a subset of speech acts categories associated to the theory's drives. In induction sessions with psychotherapist we have managed to capture ways in which speech acts in the adopted framework are expressed and we are using the information to start implementation of a rule-based speech act detection program (with regular expressions and a dictionary) based on use of syntactic and lexical information. We are also annotating the development corpus of interviews (a total of 30 will be annotated with a minimum of 2 annotators per interview) with speech acts categories and semantic information. The annotated corpus will be used for the development of a trainable speech act recognition program based on lexical clues and syntactic information. The set of resources developed in the project will be made available to the computational linguistics community for research purposes.

## Acknowledgements

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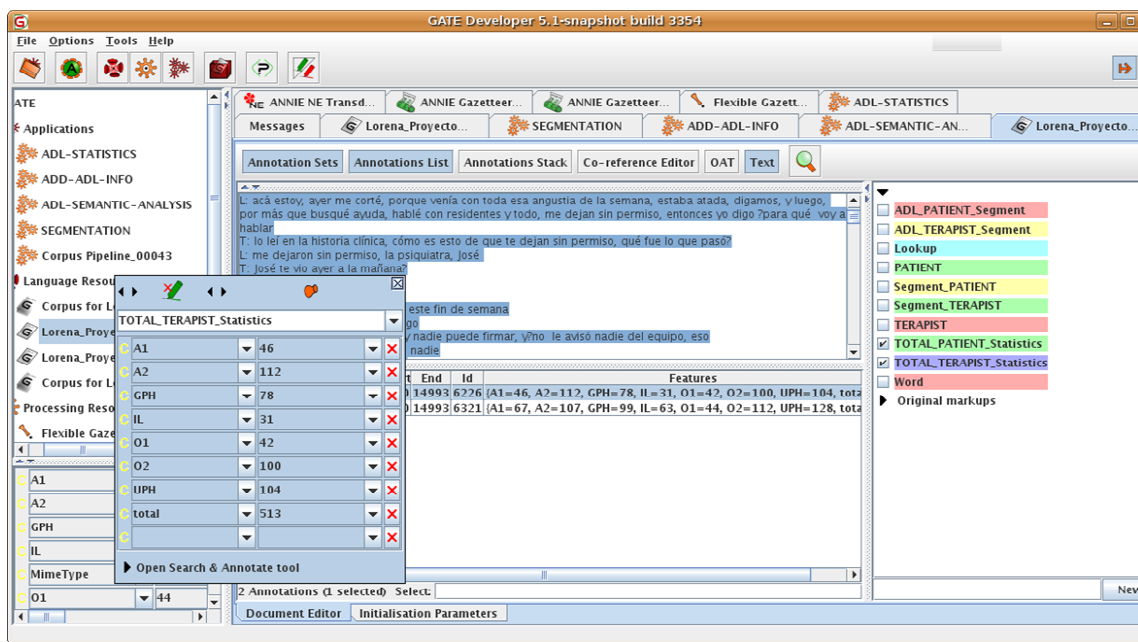
Figure 2: Drives' Statistics over Patient and Therapist Segments

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| Transcribed Session (Spanish Version) | Transcribed Session (English Translation) |
|---|---|
| T: ¿con que te cortaste? | T: What did you cut yourself with? |
| L: con un vidrio que encontré en el patio | L: With glass I found in the patio. |
| T: ¿donde lo tenías? | T: Where did you have it? |
| L: en el locker, en la puertita del locker, y después lo puse en la jabonera cuando baje a bañarme | L: In the locker, in the locker's small door, and then I put it in the soap box when I went down to have a bath. |
| T: o sea, ya tenías un vidrio escondido | T: That is to say, you already had a hidden piece of glass. |
| L: síí, ayer lo encontré | L: Yes, yesterday I found it. |
| T: ¿ayer a la tarde? | T: Yesterday afternoon? |
| L: sí, sí, de ayer a la tarde | L: Yes, yes, from yesterday afternoon. |
| T: ¿lo buscaste? | T: Did you look for it? |
| L: sí, sí lo busqué | L: Yes, yes I did |
| T: buscando encontraste. | T: Looking you found. |
| L: ¿eh? | L: Eh? |
| T: buscando encontrás | T: Looking you find |
| L: sí | L: Yes |
| T: y lo guardaste | T: And you kept it. |
| L: guardé, síí uno, pero tenía mucha necesidad de cortarme aparte me cuesta mucho estar acá adentro, me está costando, extraño mucho afuera y no doy más | L: I kept, yes one, but I had a huge need to cut myself apart from that it's very costly to be inside this place, it's costing me, I miss the outside a lot and can't stand it any more. |
| T: esto que me estás diciendo que te la mandaste callada unida a la necesidad de cortarte te hace olvidar lo que hemos hablado nosotras el miércoles | T: What you're telling me about going about your business wordlessly together with the need to cut yourself makes you forget what we talked about on Wednesday. |
| L: sí. Tal vez que sí | L: Yes. Maybe so. |
| T: ¿te acordás cómo terminamos la sesión el miércoles? | T: Do you remember how we ended the session on Wednesday? |
| L: sí algo me acuerdo, que me dijo que quisiera que pensara, y ahora no me acuerdo la pregunta final que me hizo pero que estuve hablando de mi papáq pero la última pregunta no me acuerdo muy bien | L: Yes I do remember something, that you told me you wished I would think, and now I don't remember the last question you asked me but that I was talking about my dad but the last question I don't remember very well. |

Figure 3: Interview in Spanish and its translation to English. **T** indicates therapist and **L** indicates patient.