Annotation of Emotions and Feelings in Texts

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Abstract. In this paper, a semantic lexicon in the field of feelings and emotions is presented. This lexicon is described with an ontology. Then, we describe a system to annotate emotions in a text and, finally, we show how these annotations allow a textual navigation.

1   Introduction

A semantic lexicon in the field of feelings, emotions and psychological states is presented here. This lexicon is described with an ontology, and a knowledge base. Our goal is to use this ontology for automatically annotating emotions in texts, in order to navigate through linguistic units with specific criteria.

2   Description of the Lexicon

We studied 950 French words for emotions and psychological states. Among them, 600 are verbs, like *aimer* (to love), *effrayer* (to frighten), and 350 are nouns, like *amour* (love), *colère* (anger), etc. We propose a semantic classification, in which verbs and nouns are split into 38 semantic classes, according to their meanings (cf. Table 1). Each class is labeled by the affect described, such as Peur (fear) class which contains nouns and verbs related to a sensation of fear (fear, to frighten, to fear, etc.).

Table 1. Semantic classes of French psychological words

Amertume	Amour	Amusement	Apaisement	Consternation
Déception	Dédain	Dégoût	Déprime	Dérangement
Désapprobation	Désir sexuel	Embarras	Émerveillement	Émotion
Ennui	Étonnement	Fascination	Haine	Indifférence
Indignation	Inhibition	Insensibilité	Intérêt	Irritation
Jubilation	Obsession	Offense	Orgueil	Passion
Peur	Pitié	Satisfaction	Tracas	Souffrance
Soulagement	Stimulation	Tristesse		

There are three clusters of words:

a -) Negative words which mean the experience or the causation of a rather unpleasant feeling, such as fear or disappointment. They are divided into 22 classes, like Peur (fear), Tristesse (sadness), etc.

b -) Positive words which mean the experience or the causation of a rather pleasant feeling, such as interest or love. They are divided into 14 classes like Intérêt (interest), Passion (passion), etc.

c -) Neutral Words which mean the experience or the causation of a feeling that is neither pleasant nor unpleasant. They belong to two classes: Étonnement (astonishment) and Indifference.

3   Relationships Between Semantic Classes

Semantic classes are linked by meaning, intensity and antonymy relationships, represented with simple graphs.
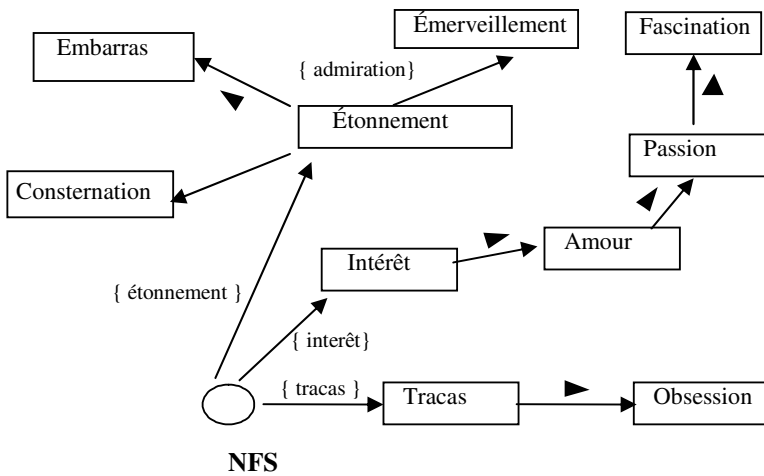

Fig. 1. Meaning and Intensity relationship between semantic classes

Meaning and Intensity graphs are connected graphs, oriented according to intensity of experienced feeling. A graph contains antonymy links between classes. These graphs are shown partially on Fig. 1 and Fig. 2.

There is a "no feeling state" represented by a white circle noted NFS. Labeled arcs join this state to semantic classes. For example, the arc labeled "intérêt" (interest) joins the no feeling state to the Intérêt class. These arcs can be labeled by intensity degree represented by the symbol ▶ or by more specific features like "admiration".

For example, an interest increase on Intérêt class words (interest, attraction, etc.), is described by Amour (love) class words. A stronger emotion of love is reflected by Passion (passion) class words (passion, excitement, etc.), and a stronger emotion of passion is reflected by Fascination class (fascination, to bewitch, etc.).

The antonymy between classes is represented with an arc and the symbol ↔. For example, the Irritation class is antonymous with the Apaisement (calm) class, meaning that each verb or noun in the first class is antonymous with at least one verb or noun respectively in the second class and vice versa.
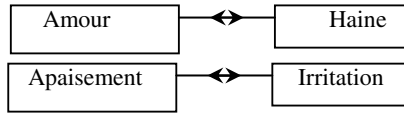

Fig. 2. Subset of Antonymy relationships between semantic classes

4   Semantic Properties of Verbs

We describe here a subset of properties, for a full description see [1], [2], [3].

4.1   Simple Properties

French verbs of feelings, and psychological states occur in two kinds of structures, as illustrated in (1) and (2), respectively:

(1)   *Paul irrite Mary*
      Paul irritates Mary

(2)   *Mary hait Paul*
      Mary hates Paul

These structures differ by the syntactic position of the person (*Mary*), called the "experiencer", who has the feeling or the emotion. In (1), the experiencer is the complement, and the subject (*Paul*) is the cause of her feeling (*irritation*). In (2), the experiencer is the subject and the complement *Paul* is the object of her feeling (*hate*). About 500 verbs belong to the first category and 100 to the second one.

This property is called [Experiencer], its value is "subject" for verbs like *aimer*, and "complement" for verbs like *irriter*.

The property "the subject is agentive or non agentive" indicates that *Luc effraye Marie* (Luc frightens Marie) has two possible meanings: that Luc frightens Marie because he wants it, or he frightens her unintentionally, by his behavior or his appearance, or something else. This property is called [Agentivity].

Some verbs have a psychological meaning only, like *aimer*, while others, such as *irriter*, have two meanings: one which is "basic" (3), and one psychological by metaphor (4):

(3)   *Le soleil irrite Mary* (sa peau)
      The sun irritates Mary (her skin)

(4)   *Paul irrite Mary* (par son comportement)
      Paul irritates Mary (by his behavior)

This property is called [Metaphor].

Intensity relationships link verbs and nouns inside each class. Thus, *exaspérer* (to exasperate) and *irriter* are in the same class, but *exaspérer* is stronger than *irriter*. These internal intensity relationships between words are described by the property [Intensifier] with the value "neutral" for *irriter*, and the value "high" for *exaspérer*.

A subset of these properties for Irritation class is shown in Table 2 . Each row is a verb (*agacer, énerver,* etc.), and each column is a property .

A plus sign indicates that a verb accepts the property.

Table 2. Simple properties of verbs

	Agentivity	*Experiencer*	*Intensifier*	*Metaphor*
agacer	+	complement	neutral	-
courroucer	+	complement	*high*	-
crisper	+	complement	neutral	+
énerver	+	complement	neutral	+
exaspérer	+	complement	*high*	-
horripiler	-	complement	*high*	-
irriter	+	complement	neutral	+
stresser	+	complement	neutral	-
trépigner	+	subject	*high*	+

4.2 Complex Properties

Whereas simple properties are attribute-value pairs, others are more complex such as arguments selection and arguments structure. For example, when the experiencer is complement, it is always a person, like Mary in sentence (1) *Paul irrite Mary*, or some metonymical expressions referring to a person. There are three main categories of expressions, according to how distant the metonymy is from the person ; it can be (1) a body part (or "soul part") like *coeur* (heart), (2) a feeling or quality name like *colère* (anger), *vanité* (vanity), etc., or (3) a noun such as *espoirs* (hopes) or convictions.

Some verbs select nouns of the first category only, like *briser* (to break) in *Mary a brisé le coeur de Luc* (Mary broke Luc's heart), Some verbs select nouns of the second category also, like *apaiser* ou *calmer* in *La chanson a apaisé/ calmé la colère de Mary* (The song calmed down Mary's anger), while others accept all nouns denoting psychological states, such as *satisfaire* (to satisfy) in *Les paroles de Mary ont satisfait les espoirs/ la curiosité de Luc* (Marie's words satisfied Luc's hopes / curiosity). Moreover, 110 verbs like *irriter* or *déconcerter* (to disconcert) accept non strictly human complement, although with difficulty.

5   Ontology of Emotions and Feelings

In order to make this semantic lexicon usable by people and software agents, it had to be described with an electronic and standard format. For this reason, we built an ontology and a knowledge base in this domain of emotion and feeling.

We consider an ontology as a formal explicit description of concepts, with a set of properties for each concept describing various features of the concept, and relationships between individual members of the class and other items [4].

We built our ontology using Protégé-2000, a framed-based system where concepts are described by classes, and properties by attributes of each class [5]. An ontology with a set of individual instances of classes constitutes a Knowledge base. The classes are linked by a inheritance relation. All subclasses of a class inherit attributes and relationships of that class. A subset of this ontology is given in Fig. 3.
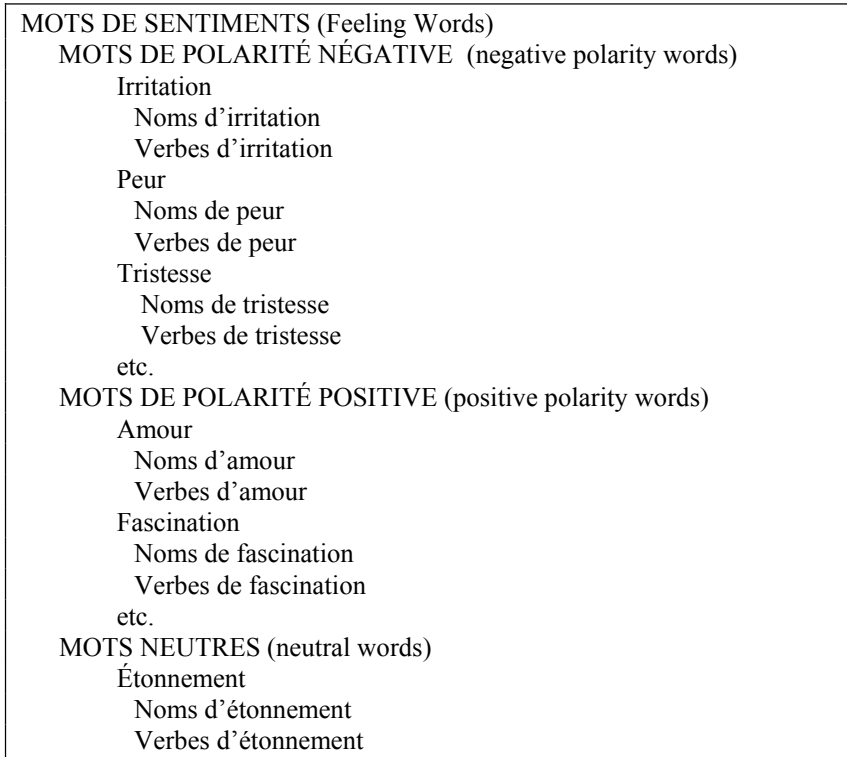
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MOTS DE SENTIMENTS (Feeling Words)
    MOTS DE POLARITÉ NÉGATIVE  (negative polarity words)
            Irritation
              Noms d'irritation
              Verbes d'irritation
            Peur
              Noms de peur
              Verbes de peur
            Tristesse
               Noms de tristesse
               Verbes de tristesse
            etc.
    MOTS DE POLARITÉ POSITIVE (positive polarity words)
            Amour
              Noms d'amour
              Verbes d'amour
            Fascination
              Noms de fascination
              Verbes de fascination
            etc.
    MOTS NEUTRES (neutral words)
            Étonnement
              Noms d'étonnement
              Verbes d'étonnement
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Fig. 3. Ontology of Emotions and feelings

To the root MOTS DE SENTIMENTS is associated a set of attributes [category, word, metaphor, antonymous class] inherited by each subclass.

MOTS DE POLARITÉ NÉGATIVE are words of unpleasant feeling such as Irritation, Peur, etc., which are divided into nouns and verbs. To each of these class is associated a set of specific attributes. For example, the class Irritation contains the property [higher class] inherited by its subclass "Verbes d'irritation", which contains the properties [experiencer, higher verb, agentivity].

Verbs of irritation (*agacer, énerver, irriter, exaspérer,* etc.) are the instances of this class "Verbes d'irritation". They inherit all the attributes and relationships of the hierarchy.

6   Annotation in Texts

Our goal is to use this ontology for annotating emotion in texts, in order to propose a navigation through a text, with specific criteria. The example given here has been implemented in *NaviTexte* [6],[7], a workstation dedicated to textual visualization and navigation.

NaviTexte applies to a text model based on typed units (TU), marked using XML format. Each unit has one type and an unlimited number of attributes. Navigation is carried out by operations which links two typed units, a source and a target. Furthermore, *NaviTexte* allows us to specify several conditions and a span of text.

Each operation must specify a type of moving by using one of these pre-definite instructions: {*First, Last, Forward(i), Backward(i)*}. *First, Last,* indicates that the search of the target is absolute: the TU displayed will be the first or the last TU, in the specified span, which checked the conditions. *Forward(i), Backward(i),* indicates that the search is carried out relatively to the source (before or after) and indexed by the integer *i*. For example, {*Forward(3)*} is interpreted as the search of the third TU located after the source, provided that its attributes match the conditions. It must be emphasized that all this navigation knowledge (the set of navigation operations), which are declared in specific cartridges, are independent of the annotated text.

For navigating through the text, we have chosen one type of textual units, which specifies navigation operations and makes it possible to establish feeling links between them. Thus, the navigation allows us to track different types of feeling and to identify their linguistic realization in a given language.

The text we consider here is extracted from *Madame Bovary* by Gustave Flaubert [8]. The navigation through this novel allows a reader to follow, for example, the evolution of Emma's feelings to her husband Charles, or to her lovers (Léon, then Rodolphe). An example of dynamic interface proposed by *NaviTexte* is shown in Fig. 4. In this part of text, we focus on the irritation Emma feels to Charles. Given a textual unit, a verb of irritation, here "exaspérée", the system proposes an oriented navigation towards verbs of the same emotion with the same intensity level: <Continuer vers même intensité> (Going to the same Intensity), or with a lower or higher intensity level: <Continuer vers diminution d'intensité> (Going to lower Intensity), <Continuer vers augmentation d'intensité> (Going to higher Intensity).

To realize this example, we first define two attributes: {Semantic Class, Intensity}, and a set of navigation operations which apply to these attributes. A subset is given below:

{<Continuer vers même intensité (Going to same intensity), Semantic Class Irritation ILN (Intensity Level = Neutral), NEXT Semantic Class Irritation ILN>.

<Continuer vers diminution d'intensité (Going to a lower intensity), Semantic Class Irritation ILH (Intensity Level = High), NEXT Semantic Class Irritation ILN>.

Then, to each verb inside the text, we associate the value of the semantic class it belongs to, and its intensity level. The definition of attributes, navigation operations and text annotations are written in XML format. An example of annotations is shown in Fig. 5.

Given the verb source ("exaspérée") and the navigation operation <Continuer vers diminution d'intensité>, *NaviTexte* find out automatically which first target satisfies

the condition: a verb with the same meaning (same semantic class) with a lower intensity, and it proposes "irritée".

In order to be usable by *NaviTexte*, we had to rewrite the ontology knowledge into a specific format. Our goal is to allow the system to use this ontology for automatically annotating emotions in texts, and automatically navigate through the text with specific conditions. For instance, by consulting the ontology, the system will know that the verbs *exaspérer* and *irriter* are in the same semantic class, and that *exaspérer* is stronger than *irriter*. And given the operation <Continuer vers diminution d'intensité > (Going to a lower intensity), the system will use the ontology to find out between which classes this operation applies.
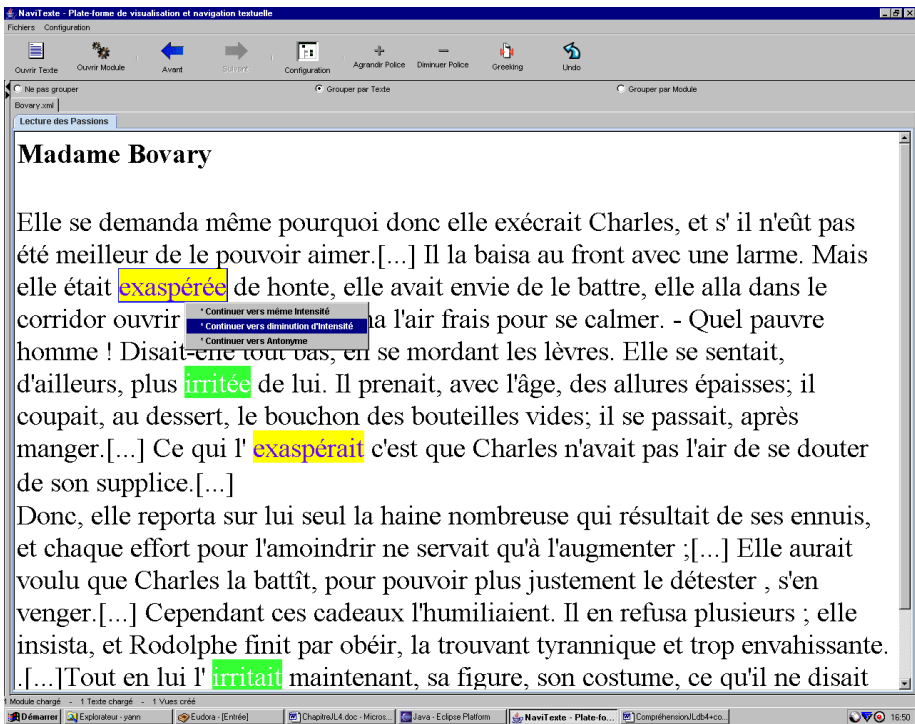

Fig. 4. Example of dynamic interface

[...]-<UT Type="segment" Nro="15"> <Chaine>Il la baisa au front avec une larme. Mais elle était </Chaine></UT>
-<UT Type="verbe" Nro="2">
<Attribut Nom=" Semantic Class ">Class Irriter ILH</Attribut>
<Attribut Nom="Intensity">2</Attribut>
<Chaine>exaspérée</Chaine> </UT>

Fig. 5. Annotations of the unit "exaspérée"

7   Conclusion

We have presented a semantic lexicon in the field of feelings and emotions, as well as its representation into an ontology. Then, we described a system to annotate emotions in texts semi-automatically and, finally, we have shown how these annotations make a textual navigation possible. Our goal is to offer a system which uses an ontology to annotate and navigate through a text automatically.

Acknowledgments

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