The Emotion Ontology: Enabling Interdisciplinary Research in the Affective Sciences

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Abstract. Affective science conducts interdisciplinary research into the emotions and other affective phenomena. Currently, such research is hampered by the lack of common definitions of terms used to describe, categorise and report both individual emotional experiences and the results of scientific investigations of such experiences. High quality ontologies provide formal definitions for types of entities in reality and for the relationships between such entities, definitions which can be used to disambiguate and unify data across different disciplines. Heretofore, there has been little effort directed towards such formal representation for affective phenomena, in part because of widespread debates within the affective science community on matters of definition and categorization. To address this requirement, we are developing an Emotion Ontology (EMO). The full ontology and generated OWLDoc documentation are available for download from https://emotion-ontology.googlecode.com/svn/trunk/ under the Creative Commons – Attribution license (CC BY 3.0).

Introduction

High quality ontologies in the biomedical sciences enhance the potential for integration of the exploding quantities of experimental and clinical data that have become available on-line. When appropriately designed, ontologies allow annotations of data to be unified through disambiguation of the terms employed in a way that allows complex statistical and other analyses to be performed which lead to the computational discovery of novel insights [8].

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Affective science is the study of emotions and of affective phenomena such as moods, affects and bodily feelings. It combines the perspectives of many disciplines, such as neuroscience, psychology and philosophy [2]. Emotions have a deep and profound influence on all aspects of human functioning, and altered or dysfunctional emotional responses are implicated in both the etiology and the symptomology of many pathological conditions. Depression, for example, which is characterised by abnormally low affect and generally flattened emotional reactions, is one of the fastest-growing public health problems in many countries, corresponding to massive growth in sales of pharmaceuticals (and other substances) which target human affect [6].

Research in affective science faces the need to integrate results obtained on the basis of subjective reports and those obtained by neuroscientific or other methodologies, and to compare results across disciplines, requiring a shared, disambiguated and clear reference terminology for the domain [3,9]. To address this, we are developing an Emotion Ontology (EMO).

1 Ontology Overview

An overview of the organising upper levels of EMO, aligned with the Basic Formal Ontology (BFO) [12,4] and the Ontology of Mental Disease (OMD) [1] is illustrated in Figure 1.

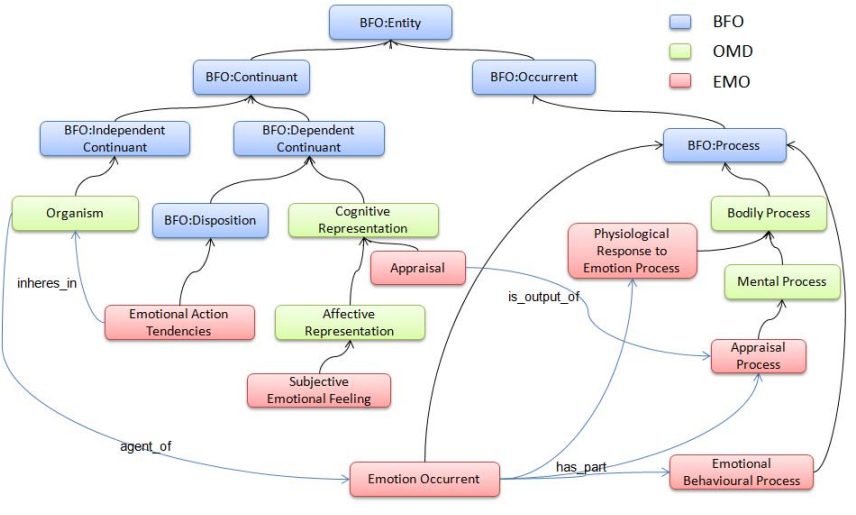

Fig. 1. An overview of the Emotion Ontology. Unlabelled arrows represent 'is a' relations.

Each aspect of the ontology from this upper level is then developed further with specific subtypes annotated and defined beneath them. Figure 2 gives an illustration of some of the entities in the ontology.

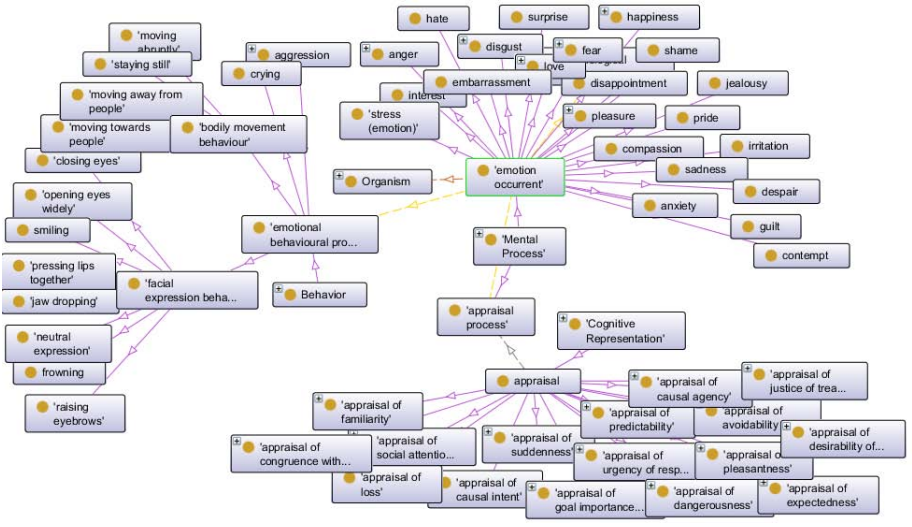

Fig. 2. Example expanded subtypes of upper level entities

2 Requirements and Future Work

The proper formal characterisation and standardisation of descriptions of mental processes in ontologies is increasingly being recognised as essential to advance many research agendas in the brain and mind sciences [7]. Recognising the need for clear categorical distinctions in support of research design, the accumulation of research findings, and linking affective science to the biomedical science of affective disorders, emotion researchers have long been proposing typologies and lists of emotions and affective phenomena [3]. Thus far, a broad shared agreement on definitions for emotion terms has not been achieved, although there is agreement on many of the relevant constituent elements [3].

Requirements in computing and artificial intelligence have led to the development of ontology-like resources for emotions. *Affective computing* aims to integrate emotional responses into computer interfaces in order to produce more realistic systems which are able to respond to the emotional communication of their users. To facilitate affective computing, Lopez *et al.* propose a slim ontology schema for describing emotions in *human-computer interfaces* [5]. Also motivated by affective computing requirements, the W3C's emotion markup language (EML)[1] is an XML-based standard for markup of emotions in text or databases. Another computing application which has led to developments in this domain is natural language processing, for which Valitutti and Stock developed an emotion lexicon [14] and Triezenberg has developed an emotion terminology which categorises emotion types and related behaviour [13].

[1] `http://www.w3.org/TR/emotionml/`

Effectively marking up references to emotions relies on an unambiguous shared understanding of what emotion terms denote. All of the ontology-like resources that have thus far been developed make use of emotion terms assumed to be defined elsewhere. The formal and unambiguous scientific definition for terms in this domain is therefore still an open requirement, and it is to fill this gap that the power of shared community-wide ontologies is required.

Our approach, following best practices promoted by the OBO Foundry [10] and the principles of Ontological Realism [11], will be to engage each of the different sub-communities, both scientific and computational, at every stage in the development of EMO in order to address and reconcile, rather than ignore, fundamental terminological and definitional disagreements. This will allow the application of the developed ontology to multiple application scenarios both in support of scientific research and in support of intelligent computing.

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