Outline of an Unconscious Extension of the Mental Functioning Ontology

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1. Introduction

There are a range of things that people refer to when they use the word 'unconscious,' including the psychological unconscious (the trove of repressed ideas), subliminal processes (that marketers hope to activate), reflexes, instincts, and many others. The goal of an unconscious ontology is to model these processes so that the relationships between these different kinds of unconsciousness can be understood. In this paper, I model a few use cases of different kinds of processes that researchers and clinicians are interested in, with the aim of integrating and enriching data by linking it together in a single taxonomic tree.

First, I begin with a brief overview of semantic technology, Basic Formal Ontology (BFO) and the Mental Functioning Ontology (MFO). Then, I model use cases for an unconscious extension of MFO and show how users can query data in useful and novel ways. Finally, I discuss terms I introduced in the use cases that go beyond MFO like 'repression' and 'automatic process.'

2. Ontology from BFO to MFO

Semantic technology refers to the linking, storage, and processing of data by machine processes. When tagged and defined well, data can be queryable, representable, and useful in aiding researchers, business people, scientists, and clinicians. Storing data in relational databases is a common practice, but ontology seeks to systematically link data between various organizations by tagging it with philosophically rigorous definitions and relations. By processing data according to a taxonomic ontology, the relations between items become more clear and useful. Data stored according to an ontology is made interoperable between different organizations.

Basic Formal Ontology is an upper-level ontology that sorts out the most general kinds of entities that exist. BFO first divides entities into continuants, which endure across time, and occurants, which are processes and events that take place over a given period of time. From there, material and immaterial entities are sorted out from each other, as well as entities that exist independently and those that depend on entities to exist (colors, for example, inhere in objects). BFO was developed by Dr. Barry Smith in the 1990s and BFO 1.0 was released in 2001. Inspired by Aristotelian metaphysics and Husserlian phenomenology, BFO is the world's most successful ontology, used primarily in bioinformatics.[1] The Gene Ontology is the most well-curated ontology, and it served as the backbone for human genomic research today.

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[1] For more on how BFO works, see J. Otte, John Beverly, and Alan Ruttenberg, "BFO: Basic Formal Ontology," *Applied Ontology* 17, no. 1 (2022): 17-43 (available here: https://philpapers.org/archive/OTTBBF.pdf).

A number of useful mid-level ontologies have been developed to aim medical research including the mental functioning ontology (MFO). Outlined by Smith and Werner Causters in 2010, and based on the Ontology for General Medical Science, Mental Disease Ontology (MDO) extends the biomedical suite of BFO based ontologies in the domain of mental functioning and disease.[2] MDO adheres to the BFO method of ontological realism: to describe structures in reality as they really exist, one begins with particular instances of entities and describes the classes of universal entities that must logically follow from the existence of these particulars. From the particulars, trees of taxonomically related terms can be inferred. A car, for example, is a machine, which is a human-built object, which is an object, which is a continuant. From the particular instance of a car, we can deduce a number of categories that must exist alongside that car which describe how that car got to exist in the way it did.[3]

Smith and Ceusters make important distinctions between fundamental kinds of entities in the mental disease domain in order to allow MDO to capture a wide range of changing data about mental entities. For example, mental disease is not the same as a mental disease course–Alzheimer's is a disease which is instantiated by the Alzeimer's disease course. If more research changes our understanding of the disease course, we do not have to change the cataloging of data about Alzheimer's disease. They also distinguish between the disease, the manifestation of the disease, and the representation of the disease in models and medical databases. The doctor notes (a 'Disease Picture') for a patient are not the same as the symptoms those doctor notes may describe. Figure 2 outlines Smith and Ceuster's initially proposed model for mental diseases.[4] Two years later, Janna Hastings et al. proposed a model of the Mental Functioning Ontology with MDO[5] with the goal of capturing the addiction process, displayed as Figure 3.[6]

3. Extending MFO into the Unconscious

A number of difficulties present a challenge to the representation of unconscious processes. It is not at all agreed upon what is meant by 'the unconscious': it may refer to anything from the fact that digestive processes are unconscious to a Freudian trove of repressed ideas. Rather than attempt to settle the debate, in accordance with the method of ontological realism, an unconscious extension of MFO models and enriches data that scientists, clinicians, and

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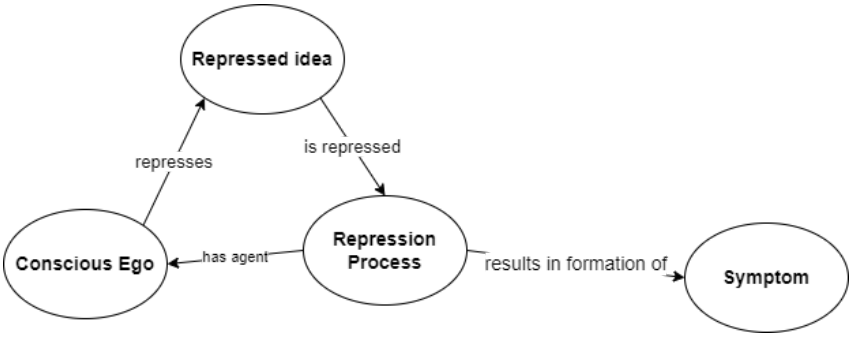
[2] Werner Ceusters and Barry Smith, "Foundations for a realist ontology of mental disease," *Journal of Biomedical Semantics* 1, 10 (2010).
[3] For more on the method of ontological realism, see Barry Smith and Werner Ceusters, "Ontological realism: A methodology for coordinated evolution of scientific ontologies," *Applied Ontology* 5 (2010): 139-188 (available here: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3104413/).
[4] In Smith and Ceusters (2010).
[5] The history of the relationship between the Mental Disease Ontology proposed by Smith and Ceusters and the Mental Functioning Ontology proposed by Hastings is not investigated here.
[6] Janna Hastings, Nicolas le Novere, Werner Ceusters, Kevin Mulligan, and Barry Smith, "Wanting what we don't want: Representing addiction in interoperable bio-ontologies," in *Proceedings of the Third International Conference on Biomedical Ontology* edited by Ronald Cornet and Robert Stevens, *CEUR* (2012): 56-60.

researchers are already interested in whatever they mean by unconscious entities. In this section, I have outlined some hypothetical use cases for an unconscious extension.

A. Suppose a depth psychologist has a patient who is exhibiting trauma symptoms, but it is not clear if the patient experienced trauma or some closely related event. They would be able to query the ontology to return a model of a ‘trauma process’ that shows the relations between things like a ‘traumatic experience,’ and ‘repressed memory.’ More importantly for this case, the psychologist might find ‘trauma process’ listed with other similar kinds of processes in a taxonomic tree. While models for traumatic processes exist, there is no standardized model, only standardized diagnostic criteria.[7] The MFO, with an unconscious extension, would provide models which have been linked to DSM criteria and up-to-date qualitative and quantitative research on specific terms and disease courses.

B. A hypothetical database carries clinical notes which have been tagged such that the symptoms, disease course, and processes have been tagged with the Mental Unconscious Functioning Ontology, and a clinician is unsure exactly what kind of disease course their patient is experiencing. They can query the database to return any disease processes that have the parts that they know. For example, a clinician might know a patient is repressing something, but they don't know what. They can set up a query such that the main term is ‘repression_process’ which has the relation ‘has_symptom’ to ‘agnosia’ for example, which is defined in MFO and the Disease Ontology as “a communication disorder that is a loss of ability to recognize objects, persons, sounds, shapes, or smells while the specific sense is not defective nor is there any significant memory loss.” A query would return a model such as the following:



The term ‘repression’ is defined currently in MFO as “the basic defense mechanism by which painful or guilt-producing thoughts, feelings, or memories are excluded from conscious awareness,” but it does not have an agent or a relation to the class ‘repressed idea,’ nor does it ‘result in formation of’ a symptom.

[7] For a typical model, see Figure 3.

C. A clinician might want to query a research database to find the latest research on automatic reflexes as a response to trauma. MFO can return the terms ‘trauma’ and ‘post-traumatic stress disorder disease course’ but also a model of the course so the clinician can click on all of the terms and find up-to-date research. If there is a disagreement in the literature on the exact etiology of post-traumatic stress disorder, then an ontology would return all of the proposed models of the disease course.

5. Problems with MFO

There are a few key issues with definitions that currently exist in MFO that need to be revised before an unconscious can be properly captured and defined. I will outline some issues in this section that I will propose ameliorations for.

Conscious, unconscious, and externally observed symptoms need better documentation. Currently, MFO defines a symptom as “a process experienced by the patient, which can only be experienced by the patient, that is hypothesized to be clinically relevant.” While MFO allows professionals to create clinical data items, they cannot strictly speaking declare something to be a symptom. A variety of mental diseases include the inability to recognize something as a symptom as a key feature, including but not limited to addictive behaviors and personality disorders in which an individual will adamantly deny that they exhibit any symptoms. The Symptom Ontology defines a symptom as “a perceived change in function, sensation, loss, disturbance or appearance reported by a patient indicative of a disease,” which is a step in the right direction.

MFO needs a better account of memories, thoughts, and ideas that a patient is subjectively experiencing. While processes of thinking and remembering are defined, the things that are thought and remembered (thoughts and memories) are not.

Reworking terms in the class ‘defense mechanism’ is a worthy project. A defense mechanism is defined as an “automatic psychological process that protects the individual against anxiety and from awareness of internal or external stressors or dangers.” We should redefine the term to note that these dangers are *perceived* dangers. A patient might have a kind of phobia that perceives something innocuous like a bottle of water as a stressor because of past experience.We can drop the term phrase ‘external or internal’ from this definition by making that clarification. ‘Danger’ should be dropped from the definition, since it implies some kind of harm which goes beyond the mental protection of an individual; perhaps it should be replaced by ‘harm.’

Repression is defined as “the basic defense mechanism by which painful or guilt-producing thoughts, feelings, or memories are excluded from conscious awareness,” and can be improved in a few simple ways: ‘basic’ should be dropped, unless repression is made a superclass of other mechanisms like substitutions and projection, and there is good reason to do this. The function of a defense mechanism is to ‘protect the individual’ from stressors or dangers, which implies in some way that those stressors and dangers are distanced from consciousness, whether partially or wholly. Repression is defined as the process of distancing some memory,

thought, feeling, or belief from consciousness *via* projection, active forgetting, substitution, regression, and so on. The definition also implies that only ‘painful or guilt-producing’ thoughts can be repressed; a better definition allows all kinds of thoughts to be repressed including pain-inducing, anxiety-producing, guilt-producing, and so on.

6. Conclusion

MFO is a powerful ontology, and a few improvements can make it much better. By modeling disease courses (putting relations between more terms), and linking it to the DSM and up-to-date research, it could serve as a foundational data structure and reference guide for its users.

Appendix of Figures

Figure 1:

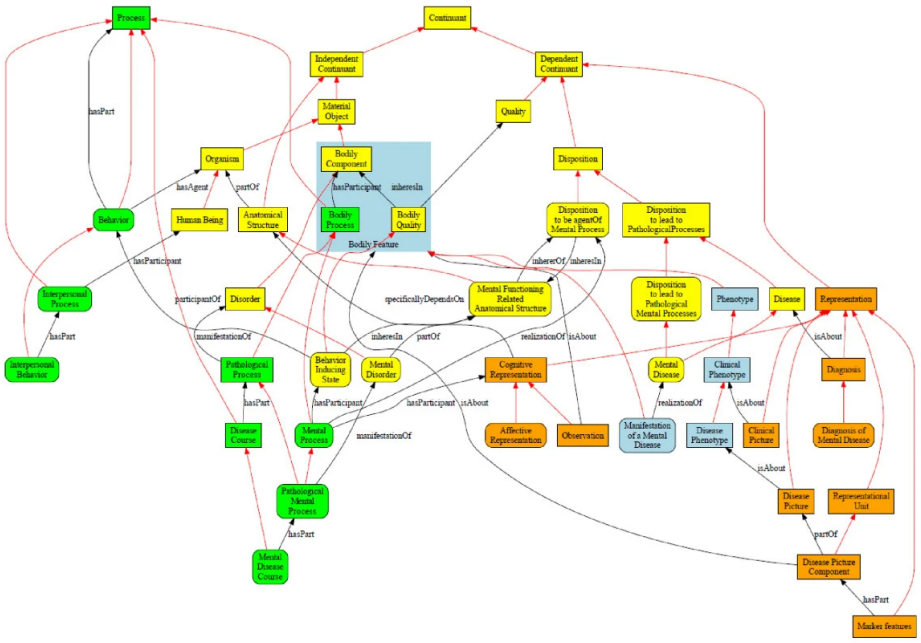


Figure 2:

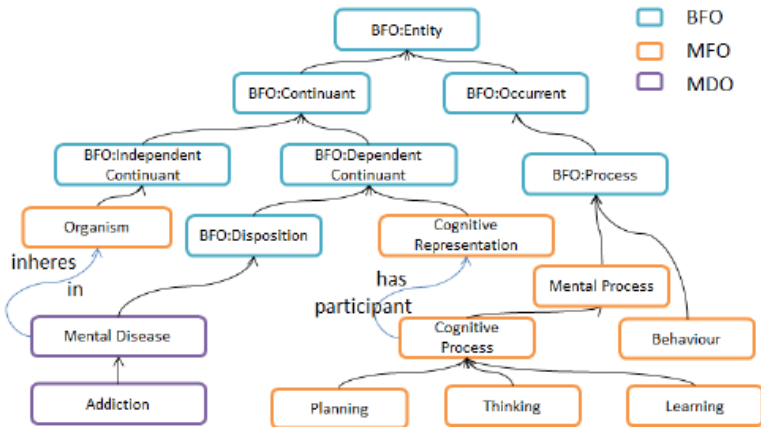
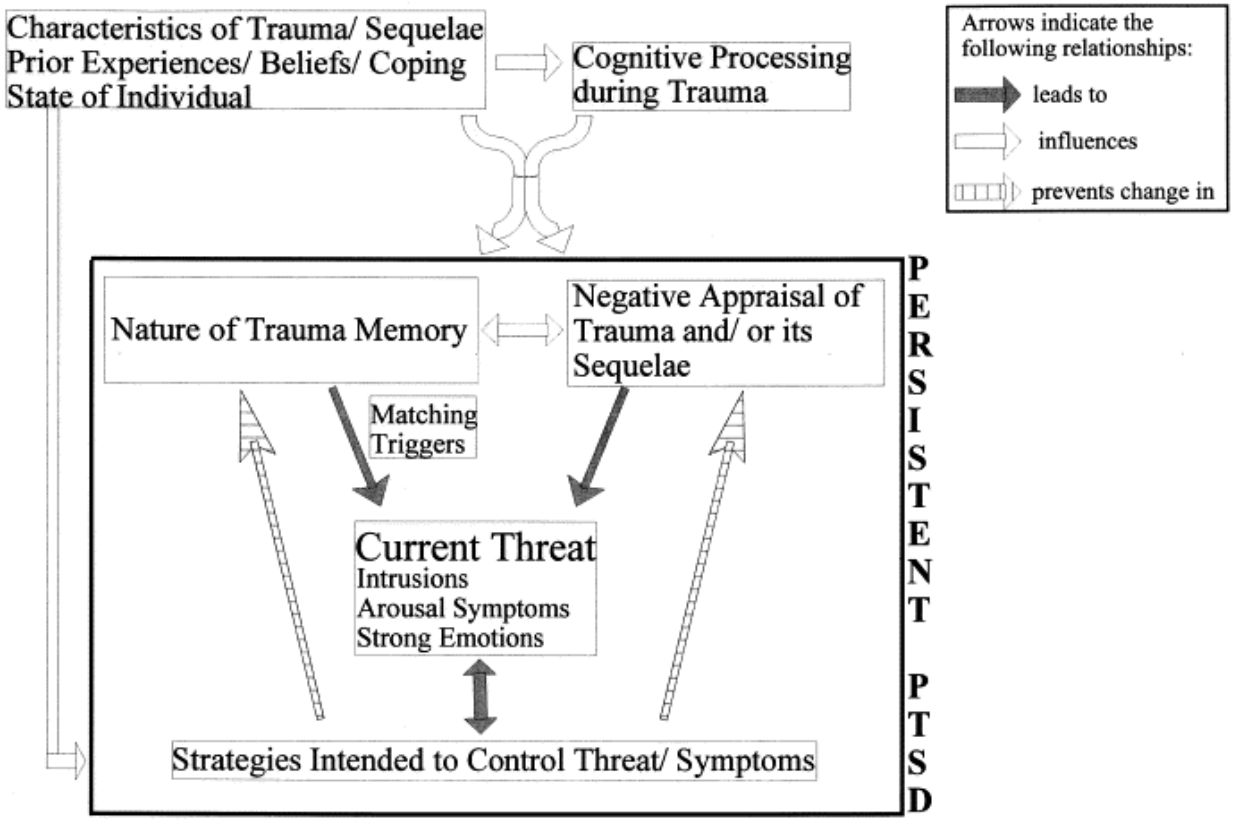


Figure 3:



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[8] Anke Ehlers and David Clark, "A cognitive model of posttraumatic stress disorder," *Behavior Research and Therapy* 38, no. 4 (2000): 319-345.