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§0. Overview

Currently, Mental Functioning Ontology (MF) precludes unconscious entities. In this paper

I explain the obstacles involved in developing an ontology of the unconscious, including a

literature review of diverse psychological fields which accept some notion of unconscious mental

activity. I offer some principles for deciding whether to include or exclude in the ontology those

entities to which different psychological fields are committed. In light of these considerations, I

propose revisions to the definitions of some entities within MF to allow room for unconscious

entities, then I argue in favor of adding those entities which involve unconscious mental

processes. Some of the entities require importing MF's companion suite Emotion Ontology (MF-

EMO). I discuss some applications of the revised MF ontology. Lastly, I explore outstanding

questions and some potential future developments.

§1. Introduction to Mental Functioning Ontology

Mental Functioning Ontology (MF) is an ontology suite constructed in conformity with the top-level, domain-neutral Basic Formal Ontology (BFO).[1] As a formal ontology, BFO is designed to create a controlled vocabulary based on specific principles of ontological development in order to have a consistent taxonomy, allow for interoperability between disparate organizations, and computer reasoning on aggregate data. MF's suite focuses on the psychological domain, especially where it intersects with physiological ontologies. The primary contributors to MF's development include: Janna Hastings, Barry Smith, J Neil Otte, Jeanette Candia, and Mark Jensen.[2] BFO has two basic categories: continuants, which are roughly entities that persist through time (e.g., a tree), and occurrents, which are roughly progressively changing events (e.g., growing). Within this basic framework the most common entities to which I will refer will be dispositions (a kind of continuant), and processes (a kind of occurrent).[3] MF is not only built on BFO, but is guided by the strategies expressed in a paper entitled "Foundations for a Realist Ontology of Mental Disease" by Ceusters and Smith.[4] To give a brief preview of the general view of the project, according to MF what is colloquially called 'mental activity' is defined precisely in terms of mental processes and mental dispositions, which are understood in terms of bodily

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[1] There are many existing ontologies which represent human behavior, including psychological processes, but for the purposes of this paper I am interested in developing an ontology that conforms to BFO. Among the nineteen ontologies provided by Blanch et al. (2017), only one is explicitly built upon BFO: Mental Functioning Ontology (MF). For a further survey of these different approaches, see Angel Blanch et al., "Ontologies About Human Behavior," *European Psychologist* 22, no. 3 (July 1, 2017): 180–97, https://doi.org/10.1027/1016-9040/a000295.

[2] Janna Hastings, *Mental-Functioning-Ontology: Ontology for All Aspects of Human Mental Functioning*, 2018, https://github.com/jannahastings/mental-functioning-ontology.

[3] Robert Arp, Barry Smith, and Andrew D. Spear, *Building Ontologies with Basic Formal Ontology* (Cambridge, Massachusetts: The MIT Press, 2015), 88.

[4] Werner Ceusters and Barry Smith, "Foundations for a Realist Ontology of Mental Disease," *Journal of Biomedical Semantics* 1, no. 10 (2010): 1–23.

processes which *realize* kinds of bodily dispositions, respectively. A mental function, then, is a mental disposition with some purpose or goal. Below I explain these notions and their nuances as they relate to the unconscious mind.

§2. Obstacles and motivations for an ontology of the unconscious

My project aims at adapting MF to allow for unconscious mental processes and functioning, and then propose the hierarchy and definitions to be included into MF. However, since the notion of an unconscious mind is admittedly controversial, I discuss here some unique problems facing my attempt to create a controlled vocabulary for unconscious entities.

Some principles guide the development of ontologies that conform to BFO's standards. An ontology should aim to represent real entities, and represent constructed classes only when necessary (and sufficiently useful). The reason is that ontologies are best in the long-run when they are truth-apt, referring to the way the world is structured. In a sense, the ontology to be developed will be conservative in its adoption of new entities; rather than admitting controversial entities (novel entities with which there is widespread disagreement, for which it is foreseeable that they be undermined or refuted), there is a healthy hesitation from committing to certain entities unnecessarily. Thus, ontologies are not to be populated for the sake of speculative completeness, but for the sake of use and having an empirical ground. Whatever entities an ontology enumerates in its taxonomy must be tethered to prevailing scientific models.

§2.1. Philosophy of Mind: ontological status, models of how mind and body relate

These principles seem, *prima facie*, at tension with admitting a mind. Historically, committing to the existence of a mind has been contentious. Here I will survey, albeit briefly, the basic problem of admitting a mind, and some potential ways to resolve the problem. It seems

that the mind is an entity unlike anything else. Physical objects inhabit spatial regions, have mass, exhibit various qualities available a public way (anyone can observe them, in principle), etc. However, if the mind exists, it fails to fit the above description of bodies neatly, because a mind involves intentions and representations (being-about something), is difficult or impossible to locate precisely, and is inherently private to the individual. René Descartes (1596-1650) is famous for fundamentally bifurcating mind and body, a view called *substance dualism*. On this view there are two kinds of things in the world: material and immaterial. However, to the extent that the mind and body are different, a question becomes pressing: how could a mind and body even interact? How could an immaterial intention impact a physical event, or vice versa?

In the wake of Descartes's philosophy, there have been many proposals to answer this problem. One strategy is to flatten the ontology into only one kind (called *substance monism*), whether everything is material (*Physicalism*) or everything is immaterial (*Idealism*). Both routes aim to be more parsimonious than Dualism. But then the problem shifts: how could the world be basically mental or spiritual stuff? Or, how can mental life be explained solely in terms of matter, energy, and physical laws? Some form of physicalism is popular nowadays. In what follows is a brief overview of different models of the mental life sympathetic with physicalism: Eliminativism, Behaviorism, and Functionalism.

Eliminativism, associated with Patricia (b. 1943) and Paul Churchland (b. 1942),[5] claims that the basic concept of the mind drawn from folk psychology is not real, despite how obvious it *seems* to be. (They afford an error theory for our tendencies to believe in something that does not exist.) This reductionist approach attempts to re-understand all so-called mental entities as

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[5] John Heil, *Philosophy of Mind: A Contemporary Introduction*, 3 edition (New York, NY: Routledge, 2012).

physical, neurological structure. Strictly speaking, there is no such thing as a belief, thought, intention, memory, attention.

Behaviorism (traditionally associated in psychology with B.F. Skinner, 1904-1990) attempts to avoid commitment to a mind.[6] Since mental life is not publically observable, our best science should pass over in silence. Instead, since the structure of the brain is observable, efforts should focus on describing or explaining mental processes solely in terms of the brain's activity. The referent of the term 'mind' is best construed as a black box which takes in certain input stimuli and outputs certain behavioral responses. To have a mental state is just to have a certain output.

Functionalism allows that mental processes are real: they can by realized by different kinds of entities. This view the claim that mental processes are identical to, or can simply be reduced to, physical configurations. A common example of the strategy is that the mental experience of pain is not simply equal to c-fibers firing, but c-fibers can realize that process. Rather than being identical to some configuration, a mental process is *realized* by a configuration and is identical to the *function* of that configuration. (By 'function' the theory has a broad notion of basically causing an output given an input, not the term as defined in BFO.)

While remaining agnostic or uncommitted about some of these theories would be desirable for the sake of parsimony, the ontology I propose implicitly rejects Eliminativism and Behaviorism. The ontology will require a view that mental processes are properly said to be real entities (irrespective of how, precisely, they are construed to supervene), which may involve

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[6] Heil, 51-71.

being compatible, at least, with some variant of Functionalism. This decision is not without

precedent: Hastings et al. in developing MF have explicitly made this same choice.[7]

§2.2. Entities posited in Psychology: Depth Psychology, Social Psychology, etc.

Now, even for those who admit mental processes into their ontology as "first-class

entities in their own right,"[8] accepting the unconscious can be contentious. This is not without

historical reasons as well. Before psychology became a distinct science, some philosophers and

theologians made mention of mental activities which are not conscious to the agent undergoing

these processes.[9] However, the entities codified in early psychological theories have received

perennial criticism. Not all of these criticisms are without warrant.

Since its inception, psychology has attempted to explain beliefs, behavior, and attitudes

in part by appeal to the underlying unconscious mechanism. Most famously are Depth

Psychologists such as Pierre Janet, Sigmund Freud, Carl Jung, etc. As is common on a popular

level, Freud's psychoanalytic approach is easily caricatured in terms of its preoccupation with

sexual drives, methodologically suspect dream analysis, "simple-minded" free association (to

quote Janet[10]), and excavation of traumatic memories (meanwhile susceptible to the criticism

that these therapies enable a patient to confabulate). Even so, depth psychologists invoke

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[7] "[M]ost modern biomedical researchers reject extreme views such as mind-body dualism or outright eliminativism in favour of some form of pragmatic embodied cognition, … The realism framework that MF is based on does not imply physicalist reductionism, since we allow that there are mental functionings which can be experienced in the first person, and which are first-class entities in their own right." Janna Hastings et al., "Representing Mental Functioning: Ontologies for Mental Health and Disease," in *Towards an Ontology of Mental Functioning (ICBO Workshop), Proceeedings of the Third International Conference on Biomedical Ontology*, 2012, 4.

[8] Ibid.

[9] Some identify it in GW Leibniz, e.g., *petites perceptions*; Immanuel Kant; and others, c.f. Perry and Laurence, "Mental Processing Outside of Awareness: The Contributions of Freud and Janet" in Kenneth S. Bowers, *The Unconscious Reconsidered*, ed. Donald Meichenbaum, First edition (New York: Wiley-Interscience, 1984), 9.

[10] Ibid., 37.

notions of repression (of memory, desires, etc.), with more empirical support, but not without

disagreement on the implications of the research.[11] Jung's project focused significantly more on

personality traits and various character tropes (archetypes) that a given bearer seems to express

unconsciously (i.e., not merely by habit, but by preexisting structure and influenced in ways not

available to introspection).[12] These psychological dispositions are, of course, unconscious, but

they also express desires, affects, and intentions, which, despite being representational, are

outside of the agent's consciousness. Since some of these theoretical entities have greater

empirical support in terms of personality tests and research in social psychology (e.g., OCEAN, or

Big-5, though only weak and unreliable results with the Myers-Briggs Type Indicator, and its

corresponding tests and profiles), their admission into an ontology nevertheless justifies some

caution and hesitation. It is for this reason I tentatively accept such entities as 'repressed

memory' and some unconscious desires, affects, and intentions.[13] However, without being

arbitrary, I intentionally pass over other entities such as Jungian archetypes, the Freudian

tripartite Id-Ego-Superego, and so on.

In social psychology, there is much greater success in measuring with validity and

reliability[14] unconscious mental processes. Among these are the entities I am most interested to

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[11] I have omitted here Pierre Janet's intellectual descendent Ernest Hilgard (1904-2001), who developed a Neodissociative account which saw some empirical success in the 1970s and is perhaps worthy of consideration for future developments in unconscious ontology (despite his emphasis on hypnosis), c.f., John Kihlstrom, "Conscious, Subconscious, Unconscious: A Cognitive Perspective," in Bowers, *The Unconscious Reconsidered*, 149.

[12] Jung also posited entities such as the Anima, Animus, Persona, Shadow, Collective Unconscious, etc. I do not explain these here nor am I including them in my ontology. William L. Kelly, *The Psychology of the Unconscious* (Buffalo, N.Y: Prometheus Books, 1991).

[13] See their cognate in social psychology below.

[14] I am using these two terms according to their technical meaning in psychological assessment literature. The former deals with measuring a real quality or quantity, whereas the latter measuring that concept consistently or predictably.

include: automatic processing,[15] different kinds of priming (semantic[16], perceptual and

conceptual[17]), different kinds of implicit memories,[18] and different kinds of implicit attitudes.[19]

All of these I include in my ontology. Their definitions and explanations are below, in the samples

of my proposed ontology.

However, one might criticize that the inclusion of such entities as implicit attitude, implicit

bias, and implicit stereotype. The Implicit Association Test[20] has been used to expose a myriad of

alleged unconscious discriminatory attitudes, especially applied in the context of racial relations.

The impact of these studies has reached a popular level, wherein it is cited in political discourse

as proof of biases for which one must actively accommodate. Unfortunately, much of the

application and social commentary based on this research is unwarranted. Recent criticisms of

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[15] John A. Bargh, ed., *Social Psychology and the Unconscious: The Automaticity of Higher Mental Processes*, 1 edition (New York: Psychology Press, 2006); John Jonides, Moshe Naveh-Benjamin, and John Palmer, "Assessing Automaticity," *Acta Psychologica* 60, no. 2 (December 1, 1985): 157–71, https://doi.org/10.1016/0001-6918(85)90053-8; Joseph Tzelgov, "Automaticity and Processing Without Awareness," *PSYCHE: An Interdisciplinary Journal of Research On Consciousness* 5 (1999).

[16] Timothy P. McNamara, *Semantic Priming: Perspectives From Memory and Word Recognition* (Psychology Press, 2005).

[17] Dan J. Woltz, "Perceptual and Conceptual Priming in a Semantic Reprocessing Task," *Memory & Cognition* 24, no. 4 (July 1, 1996): 429–40, https://doi.org/10.3758/BF03200932; Juliana Burges Sbicigo, Gerson Americo Janczura, and Jerusa Fumagalli de Salles, "The Role of Attention in Perceptual and Conceptual Priming," *Psychology & Neuroscience* 10, no. 2 (2017): 117–31.

[18] Daniel L. Schacter, "Implicit Memory: History and Current Status.," *Journal of Experimental Psychology: Learning, Memory, and Cognition* 13, no. 3 (1987): 501–18, https://doi.org/10.1037/0278-7393.13.3.501; Scott A. Ottaway, Davis C. Hayden, and Mark A. Oakes, "Implicit Attitudes and Racism: Effects of Word Familiarity and Frequency on the Implicit Association Test," *Social Cognition* 19, no. 2 (April 1, 2001): 97–144, https://doi.org/10.1521/soco.19.2.97.20706; Melissa J. Ferguson, "On The Automaticity of Evaluation," in *Social Psychology and the Unconscious: The Automaticity of Higher Order Processes*, ed. John A. Bargh (New York, NY: Psychology Press, 2007), 11–50.

[19] Anthony G. Greenwald and Mahzarin R. Banaji, "Implicit Social Cognition: Attitudes, Self-Esteem, and Stereotypes.," *Psychological Review* 102, no. 1 (1995): 4–27, https://doi.org/10.1037/0033-295X.102.1.4; Anthony G. Greenwald, Debbie E. McGhee, and Jordan L. K. Schwartz, "Measuring Individual Differences in Implicit Cognition: The Implicit Association Test.," *Journal of Personality and Social Psychology* 74, no. 6 (1998): 1464–80, https://doi.org/10.1037/0022-3514.74.6.1464.

[20] Greenwald, McGhee, and Schwartz, "Measuring Individual Differences in Implicit Cognition: The Implicit Association Test."

the IAT have been acknowledged by the original researchers, especially as a meta-analysis was

published regarding the limited predictability of racial discrimination based on those measures.[21]

The greatest concern is that the wide ranging application and vast social implications drawn are

not justified given the limited strength of evidence (in terms of reliability, validity, and

predictability). While I agree with the critique, this does not show that the underlying entities do

not exist. Rather, the empirical support explains less phenomena than hoped, though it is still

legitimate to identify (by inference) those entities in clinical settings and refer to them. The

underlying mechanism in automaticity is analogous to that posited in the case of affect. It is not

without warrant that I accept these entities provisionally; I merely concede that they are *less*

useful than researchers previously thought.

What have I tried to show thus far? I have motivated reasons one might hesitate to

develop an ontology of the unconscious. Not only is a 'mind' contentious, an unconscious one is

doubly so. Throughout this I have enumerated entities worthy of consideration, and I have

offered a principled approach for inclusion or exclusion in light of legitimate worries. The chief

insight gained here is that social psychology's empirical methodology is far more adequate than

depth psychology, and thus, insofar as both refer to the same or similar entities with the same

terms, I will favor the one for which we have the best empirical support. In cases where there is

weak or controversial support, I have rejected for the sake of parsimony or accepted for the sake

of coherence. My definitions below will aim for the least common-denominator among

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[21] Frederick Oswald et al., *Predicting Ethnic and Racial Discrimination: A Meta-Analysis of IAT Criterion Studies*, vol. 105, 2013, https://doi.org/10.1037/a0032734.

psychological fields, such that my classes can be most useful to social psychology, yet serviceable

to depth psychology.

§3. Mental Functioning Ontology

How does MF describe mental processes, and how might an unconscious process fit

within the existing ontology? Here I discuss an overview of the universals relevant to unconscious

ontology. Many of these would be parent-classes for the entities I introduce. In the first part of

this section, I hone in on MF's characterization of the basic mental framework and the role of

consciousness in mental processes. In the second part, I motivate why this is problematic.

§3.1. Mental dispositions, mental processes, and consciousness

MF enumerates universals for some basic concepts such as mental dispositions, which are a kind of bodily disposition. MF here relies on an external ontology to define bodily disposition.[22] Under this universal are sub-classes such as belief, memory, and mental capability. Memory itself only includes four sub-classes:

Figure 1. Fragment of MF: Mental Dispositions (from MF's OWL file)

anesthesia-resistant, long-term, medium-term, and short-term.

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[22] Mental disposition =def "[A] bodily disposition that is realized in a mental process"

MF's definition of a mental process might seem at tension with an unconscious: it says that a mental process is a bodily process that "can of itself be conscious." However, if an unconscious process is a type of mental process, it need not imply a contradiction since the process
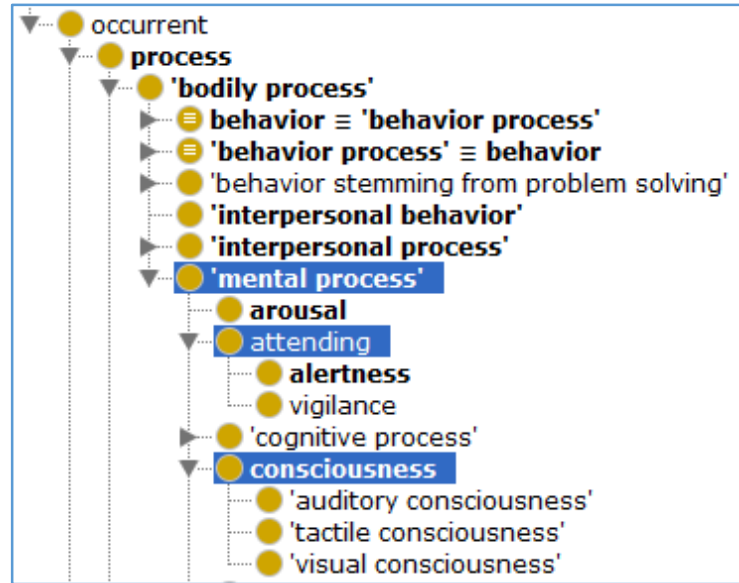

Figure 2. Fragment of MF: Mental Processes (from MF's OWL file)

can be characterized as conscious and then unconscious (and vice versa) at different stages.[23]

More problematic, however, is the definition of 'consciousness,' which asserts that it is "an inseparable part of all mental processes."[24] This precludes the possibility of a mental process which has no conscious parts, and effectively blocks an effort to include a mental process that is entirely unconscious, as I intend to allow. Rather than replace that claim with an alternative conception, I simply propose its removal.

§3.2. Unconscious representational mental process?

In order to motivate this correction, I will offer an alternative account of mental processes which need not have a conscious part. It seems plausible that a mental process could have representational content without the bearer being aware of the relevant perceptual phenomena

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[23] Mental process =def "[A] bodily process that is of a type such that it can of itself be conscious. Examples include thinking, feeling pain, remembering and emotion as occurrent experiences."

[24] It continues: "It is that part of the mental process that: a) confers a subjective perspective, a phenomenology, an experience of the mental process of which it is a part; and b) intends the object or event that the mental process is about, should such exist; i.e., it confers intentionality on the mental process" (emphasis mine)

or the cognitive representation. Consider the following three cases. First, in split-brain trials, where the corpus callosum between brain hemispheres is severed, and the individual is given disparate tasks for the left and right hemispheres (which control different hands, eyes, speech center, etc.). In such trials, the subject is not conscious of certain cognitive tasks completed by part of the subject's body. A commonly held view is that there are two independent streams of consciousness in such individuals, and that these tests show those streams can diverge. Such a view might suggest that such mental processes not only have representation, they necessarily have consciousness as a part (the question is *which* consciousness takes part which task). However, recent studies suggest that there is no division in consciousness,[25] but rather a significant impairment in performance, which, by extension, makes the case that there are mental processes involving perception and representation, yet without consciousness.

Second, somnambulism (aka sleepwalking) involves interacting with the world represented spatially, but the individual is asleep rather than conscious. One might say that the individual has a sort of phenomenal experience of which they are aware and attend, namely the dream which may incidentally correspond to the walker's memory of the world. It is not clear that this reply is both relevant and plausible (is someone conscious in some sense with every dream?); instead, the reply seems to be question-begging, since the intuition that the somnambulist must be phenomenally conscious is the same one which needs to be justified.

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[25] Yair Pinto et al., "Split Brain: Divided Perception but Undivided Consciousness," *Brain: A Journal of Neurology* 140, no. 5 (May 1, 2017): 1231–37, https://doi.org/10.1093/brain/aww358.

Lastly, one might appeal to "philosophical zombies."[26] These zombies are identical to human organisms in every way, except that they have no corresponding consciousness or phenomenal experience. Despite the silence and darkness between the ears, these zombies are stipulated to be able to represent the world around them in order to move around and act like anyone else. Thus, one might say that they have mental processes and cognitive representations, but nevertheless no attention or consciousness. Of course, these zombies are not claimed to be actual but rather merely metaphysically possible in order to show that the concepts can come apart. With these three considerations, we can coherently understand the notion of a mental process without any conscious parts. MF's aforementioned assertion in the definition of consciousness may be removed legitimately in order to allow for expansion as I propose in the next section.

§4. Expanding MF

Here I enumerate each entity I am including into my ontology. The following format will denote the relevant information for each entity: a proposition after the indicator ("$=_{def}$") is the proposed definition; the term after the "*is_a*" indicator is the parent-class to which the entity belongs; source, if applicable; and lastly, the accompanying paragraph offers a fuller explanation of the entity and relevant citations.[27]

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[26] This notion is made famous by David Chalmers. I mention this last, lest I be accused of relying on sophistry. David J. Chalmers, *The Conscious Mind: In Search of a Fundamental Theory*, Revised ed. edition (New York: Oxford University Press, 1997).

[27] In what follows I will use 'universal' and 'class' synonymously, but this is not a theory laden claim of equivalence. While normal connotations for a class is that it is pragmatic or perhaps an arbitrary grouping of entities (say, as a set), my intention is to consider here only those classes which are not merely pragmatically or arbitrarily collected but rather universals discoverable in the world. I only treat these terms synonymously for the sake of salvaging the useful and common terminology of 'child-class' and 'parent-class', which is to denote a universal that is lower or higher in the ontology, respectively; i.e., every child-class universal is a type under a parent-class universal, such that an instance of a child-class is an instance of the parent-class. No further synonymy is implied.

§4.1. Unconscious memory and belief
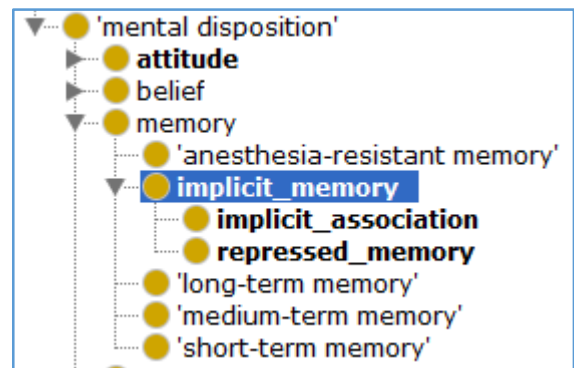
- **Implicit Memory**

=_{def}   *A memory that is stored and can have an influence on a mental process, but the agent neither introspects the content thereof nor is aware of this influence.*

is_a: Memory

Memory can be distinguished in terms of implicit and explicit. Explicit involves a conscious recollection, whereas implicit memory is realized in a recollection that is not conscious to the agent. For example, a student who performs well on a test may not be cognizant of the recollection involved in the test performance.[28] While such recollection is often conscious, it need not be; when it is not, it is implicit memory. Implicit memory involves a recollection process that occurs below the threshold of the agent's active attention

process. Two examples of implicit memory include *implicit association* and *repressed memory*. As will be discussed below, these mental dispositions enable the bearer for automatic processing; thus, implicit memory dispositions are realized in automatic processes.

- **Implicit Association**

=_{def} *An implicit memory distinguished by the agent's realization of (automatic) association between different cognitive representations of objects.*[29]

is_a: Implicit Memory

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[28] Schacter, "Implicit Memory: History and Current Status."

[29] Definition source derived in part from https://en.wikipedia.org/wiki/Implicit-association_test

- **Repressed Memory**

    =def *An implicit memory that the agent is unable to self-ascribe from a first-person perspective. An implicit memory is said to be repressed when its cause is due to dissociation events, such as intense trauma.*[30]

    is_a: Implicit Memory

    This is the clearest a case where I have attempted to capture the common ground between depth psychology and social psychology, by making dissociation the starting point rather than trauma. This formulation should be a conducive to both, but partly due to such limited theoretical commitment.

§4.2. Unconscious attitude and affect

- **Attitude**

    =def *A mental disposition to attribute positive or negative evaluation in an appraisal.*

    is_a: Mental Disposition

    The term 'attitude' has trade-offs. On the one hand, 'attitude' can have a technical meaning which is broader in philosophy, implying only a cognition and intension (e.g., a belief is a kind of propositional attitude). However, in psychology this term has connotations with appraisal. In cognitive dissonance theory, for example, attitudes involve evaluations of self, peers, groups, behaviors, etc.[31] This term is subject to revision or replacement by a more domain-neutral one.

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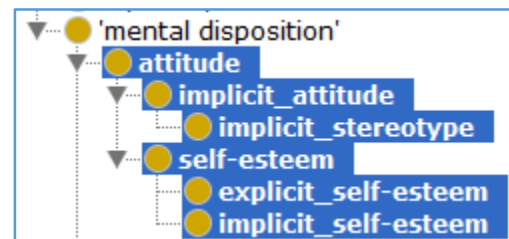
[30] David H. Finkelstein, "On the Distinction Between Conscious and Unconscious States of Mind," *American Philosophical Quarterly* 36, no. 2 (1999): 95. Especially endnote 18.

[31] For example, see Norman H. Anderson, "Integration Theory and Attitude Change.," *Psychological Review* 78, no. 3 (1971): 171–206, https://doi.org/10.1037/h0030834.

As I am here introducing the notion of an attitude, this connects with the emotion ontology (MF-EMO) in the following way: an attitude is realized by an appraisal process. According to MF-EMO, an appraisal process has a mental process which has an output appraisal (a type of cognitive representation) and is part of an emotional process (another type of mental process). So construed, expressions of attitudes involve evaluations of objects, whether of the subject or the world the subject experiences. Clearly, attitudes are commonly expressed in a conscious way, but this need not be the case. When these attitudes are expressed unconsciously, they are implicit.

- **Implicit Attitude**

    =$_{def}$ *An attitude which influences the bearer's appraisal process without the agent's awareness.*

    is_a: Attitude

- **Implicit Stereotype**

    =$_{def}$ *An implicit attitude which attributes particular qualities to a member of a certain social group. Also known as "implicit bias."[32]*

    is_a: Implicit Attitude

One may be tempted to regard implicit association as synonymous with (or inclusive of) implicit stereotype, as the literature sometimes replaces this with the term "implicit bias." But synonymy would be category mistake. Implicit attitudes involve appraisals, but implicit associations need not,[33] even if the content associated involves social relations such as racial dynamics.

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[32] Definition derived in part from https://en.wikipedia.org/wiki/Implicit_stereotype
[33] One might suggest that all implicit stereotypes have implicit associations as parts; I have not yet worked this out.

- **Self-esteem**

    =$_{def}$ *An attitude, a type of mental disposition, to evaluate oneself.*

    is_a: Attitude

- **Explicit self-esteem**

    =$_{def}$ *A mental disposition to evaluate oneself in a conscious, reflective, and deliberate manner.*[34]

    is_a: Self-esteem

- **Implicit self-esteem**

    =$_{def}$ *A disposition to evaluate oneself in a spontaneous, automatic, or unconscious manner.*[35]

    is_a: Self-esteem

One difficulty involved in the hierarchy of this universal is that 'implicit self-esteem' might seem better understood as a type of implicit attitude. That is, implicit self-esteem may be an implicit attitude which is about the bearer of the disposition. My decision to include it under self-esteem is for symmetry with explicit self-esteem; this seems better, but I admit the relationship between the two classes would benefit further explanation and refinement.

§4.3. Unconscious task completion

This is perhaps the least controversial entity to consider, in that automaticity is so common. For example, when an experienced driver manages not only the complex task of driving, but also obeying nuanced traffic laws, all without constantly monitoring performance and attending to the most salient external stimuli. To varying degrees walking, typing lyrics, scrubbing dishes, etc. involve automatic mental processes. Whether the agent intentionally or

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[34] Definition adapted from https://en.wikipedia.org/wiki/Implicit_self-esteem
[35] Definition adapted from https://en.wikipedia.org/wiki/Implicit_self-esteem

unintentionally started the mental process, it nevertheless continues *as if the agent were*

attending to the process, even though the agent need not devote attention or have an awareness

of the process. Thus, an automatic driver can succeed in stopping at traffic signs with potentially

identical performance as an attentive driver.

The literature on automaticity is fairly well-established; the characterization, however, is

somewhat diverse. For example, many of the prior categories (implicit attitudes, for example)

are often described in terms of their being automatic. Rather than treat automaticity as a catch-

all category, I limit its application to that cognition needed to complete intentional actions, such

that the performance of those tasks can be graded as higher or lower quality. I will adopt the

following strategy: there are automatic processes (a type of mental processes), and

'automaticity' (a quality, a specifically dependent continuant).

In the literature the term 'automatic' is attributed to either "performances or effects,

which are observable, or … the processes underline the performance which are not observable

and hence need to be inferred."[36] However, rather than defining automaticity in terms of a bodily

disposition, it is more accurate to say that automaticity is *properly* predicated of the process, and

only indirectly (or improperly) predicated of the disposition.

- **Automatic process**

    =$_{def}$ *A mental process which "can run to completion without conscious monitoring,*
        irrespective of whether it was started intentionally or unintentionally."[37]

    is_a: Mental process

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[36] Agnes Moores and Jan De Houwer, "What Is Automaticity? An Analysis of Its Component Features and Their
Interrelations," in *Social Psychology and the Unconscious: The Automaticity of Higher Order Processes*, ed. John A.
Bargh (New York, NY: Psychology Press, 2007), 11.
[37] Ibid, 19.

In distinction to other autonomic processes involving the brain, 'automatic processes' (or more precisely, automatic *mental* processes) realize implicit memories of various types. Procedural memory[38] is learned through regular repetitions or routines of performing certain behavior processes; thus, insofar as a behavior process involves mentality and the implicit memory enables the agent to act with high performance, despite little to no attention necessary, that mental process which guides the behavior is said to be an automatic mental process.

There are other such kinds of automatic processes that need not be so robust, such as priming. A mental process is 'primed' if some stimulus in the implicit memory influences how the
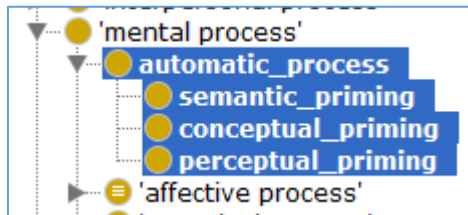
agent reacts to another, different stimulus, apart from the agent's intention or awareness that this influence is taking place. Some authors treat priming and automatic processing as conceptually the same, but priming is a narrower concept; hence, I will enumerate kinds of priming as child-classes of automatic processes: perceptual priming, semantic priming, and conceptual priming.

- **Perceptual priming**

    =def *An automatic mental process in which the agent unconsciously perceives a stimulus, such that the agent more quickly recognizes another similar (perceptually relevant) stimulus.*

    is_a: Automatic process

- **Semantic priming**

    =def *An automatic mental process in which the agent unconsciously acknowledges a word whose semantic content enables the agent to recognize more quickly another similar (semantically relevant) stimulus. AKA word recognition.*

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[38] See also 'procedural memory' in Neuro-behavioral Ontology (NBO)

is_a: Automatic process

- **Conceptual priming**

  =_{def} *An automatic mental process in which the agent unconsciously acknowledges a concept whose conceptual content enables the agent to recognize more quickly another similar (conceptually relevant) stimulus. AKA concept recognition.*

  is_a: Automatic process

- **Automaticity**

  =_{def} A quality of an entity whereby the bearer is characterized by having high performance despite the fact that the core mental processes involved are unconscious. I.e., the behavior no longer requires an 'attending', 'awareness', or 'consciousness' process. Quality is acquired by frequent successful repetitions of a behavior process or mental process.
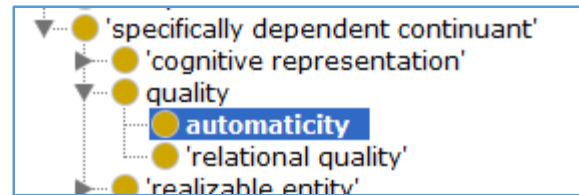
  is_a: Quality

§5. Proposed use for expanded ontology

Since automaticity and implicit associations continue to be useful in psychological research outside the medical application, my revision effectively opens the door wider for other psychological disciplines. This ontology takes a step in the right direction toward standardizing the discipline's redundant vocabulary for psychological phenomena. Moreover, this revised ontology expands the clinical use acknowledged by Hastings and Schultz, 2012:

> As modern clinical contexts become increasingly computerized, management of clinical data and ease of use by medical practitioners become increasing priorities. […] Ontological annotation is also essential in maximizing the benefit of clinical data, such as in the [Electronic Health Record] system of a hospital or medical facility, for purposes such as reporting and clinical research.[39]

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[39] Janna Hastings and Stefan Schulz, "Ontologies for Human Behavior Analysis and Their Application to Clinical Data," in *International Review of Neurobiology*, ed. Elissa J. Chesler and Melissa A. Haendel, vol. 103, Bioinformatics of Behavior: Part 1 (Academic Press, 2012), 102, http://www.sciencedirect.com/science/article/pii/B9780123884084000058.

§6. Outstanding questions and potential future developments

First, while I have offered a method for differentiating automatic processes from other autonomic processes of the brain in that the former are learned and intentional, how do other unconscious processes relate to other brain processes that *cannot* be conscious (e.g., medulla oblongata's regulation of digestion and heartbeat, for example)? John Searle raises this exact question how the unconscious is distinct from those processes that are non-mental.[40] I recommend investigating further ontologies which better distinguish between mental and non-mental, as well as how to connect the brain states which realize conscious mental states, e.g., perhaps the occipital with sight, and those which do not realize such, e.g., the medulla's respiration maintenance process.

Second, a Freudian may consider my division too coarsely grained: I need room for 'preconscious' and 'subconscious' as well; I concede the theoretical value to the latter, but intend not to be so fine grained here to admit either. Unless it is well-established empirically, I regard it outside of the scope of my project. See also my footnote above (note 11) regarding Janet's intellectual heir Ernest Hilgard and his developments along this division.

Third, with respect to some processes and dispositions, such as "repressed memory," one might raise the point that is a normative dimension of dysfunction that merits intersection with Mental Disease Ontology. While my experience with Mental Disease Ontology is significantly limited, I recognize that this could benefit from making the connection explicit. Since I believe

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[40] John R. Searle, "The Connection Principle and the Ontology of the Unconscious: A Reply to Fodor and Lepore," *Philosophy and Phenomenological Research* 54, no. 4 (1994): 847–55, https://doi.org/10.2307/2108415.

that it is the only entity I have introduced that could involve dysfunction, I am willing to recommend it as a further development.

Fourth, as a future development, I believe that my project is set up sufficiently well to introduce sometime in the future the various entities related to 'subliminal messages.' This could involve expanding and distinguishing the kinds of priming from automatic processes. It will require a deeper investigation of the empirical basis and whether core terms are synonymous with entities already enumerated above.

Fifth, a strategy I considered but did not take is to treat "unconscious" as a defined class (rather than a real universal). On such a view, to be unconscious would pick out certain independent continuants, mental dispositions, and/or mental processes which share in common this attribute. I tentatively formulated it in terms of involving "mental entities, whether mental functions or functioning, characterized by the bearer's lack of introspective access or phenomenal experience but which nevertheless involves representational content." This is an underdeveloped suggestion. Consequently, I did not include it in my OWL file.

Sixth, another strategy, raised by a contributor of MF, Neil Otte, would be to reframe the entire relationship on conscious and unconscious mental processes relate to consciousness. Instead of treating it as a process, Mr. Otte suggested it be a recast as a *specifically dependent continuant*, namely, a *quality* the organism bears. Particularly, a disposition for phenomenal conscious thought realizes a phenomenal conscious thought in which the organism (and the quality of consciousness both) participate. While this suggestion was appealing to reconsider consciousness as a continuant, I opted against making this drastic revision. For future developments, I recommend that this suggestion be taken seriously.

Appendix

Diagram of entities introduced and their relations within existing ontologies.
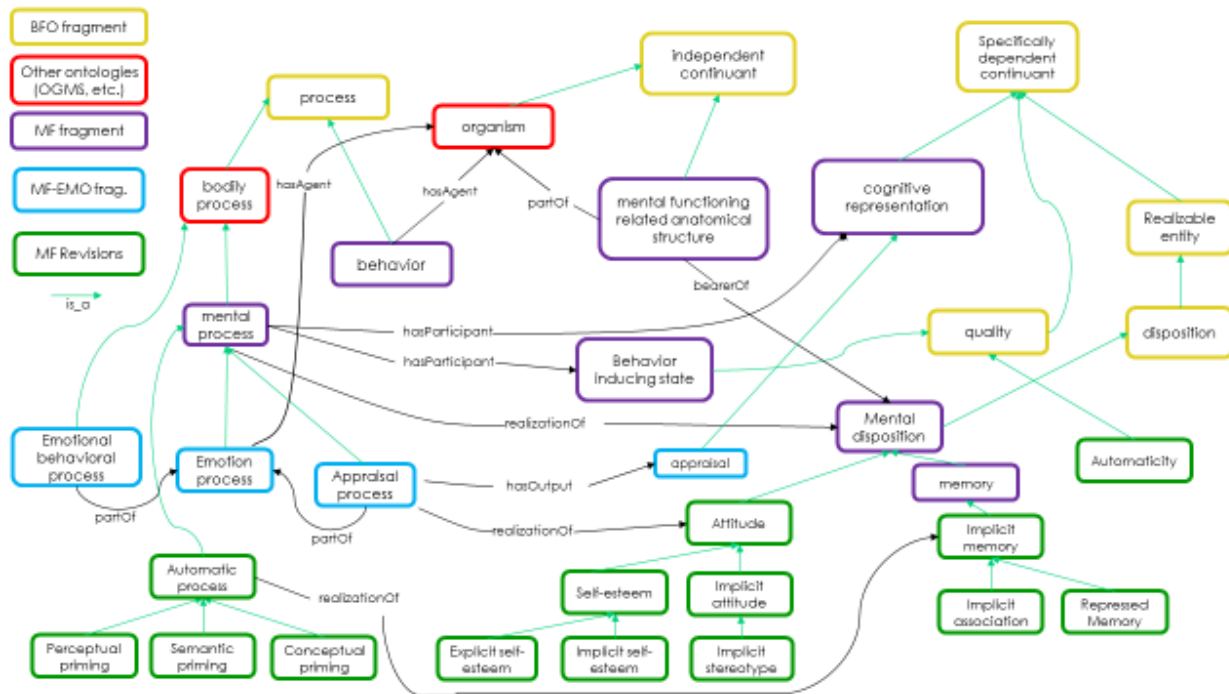
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