

A Human Experience Realist Ontology in Basic Formal Ontology

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Abstract: A realist ontology of the modern human experience is built using the Basic Formal Ontology. Four measurable and observable entities are identified as upper-level and universal in the domain of human experience. All other entities and abstractions are shown to emerge from these. The universals are: material things, individual humans, money and energy. A four by four matrix of the universals creates ten phenomena-based categories that systematically map the domains codified in the *Dewey Decimal Classification*. The matrix is an example of the property of low-emergence in human development. A human research study using interview methodology linked the sufficiency of seven common instances of each universal to fully cover the subjective and present life experiences of twenty-five physically, educationally, economically and culturally diverse participants. To address the significant diversity of human experience, the universals and instances used in the human research are realistically mapped onto a Rubik's Cube. Applying the known properties of cube, mathematics implies the sufficiency of the upper-level universals to account for human diversity. Implications for rationally based ethical categorical imperatives in education are discussed.

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1.0 Introduction and hypotheses

Existing ontologies and organizations of knowledge relative to the experience of being a modern human are generally too abstract to provide scientific value or too reductionist to satisfactorily address or codify our human experience. Jonathan Turner (2006) critiques sociology, the discipline perhaps most closely aligned with human experience, as in a chaotic state. John Searle (2004) claims social science does not rise to the level of science. These assessments beg many questions but few more important than how knowledge directly related to the human experience might be organized. Therefore, an integrated object-based ontology suitable for use in a hybrid classification and integrated knowledge organization system is presented.

The human experience realist ontology in the Basic Formal Ontology (HERO-BFO) framework is a phenomena-based upper-level ontology that organizes and codifies human experience, including its emergent prop-

erty of learning. A successful ontology will serve to objectively unify human knowledge and encompass conceptual, contextual and subjective differences. HERO-BFO identifies four objects or phenomena using strict criteria. It supports a mapped relational-structure, is further confirmed with interviews with individuals and mathematically extends to demonstrate capacity to deal with diversity. Thus, the four universals are the essence of human experience. Essence (Zhang and Olson 2015) is a quality of a genre of experience, in this case a human experience, that is innate, immutable and independent of context. Section two defines an upper-level universal and identifies the four objects which qualify. Section three presents the universals in relationship and systematically maps the existing disciplines or sub-domains of knowledge within those relationships. Section four links subjective lived experiences of research participants through interviews to structured sets of instances of the universals. Section five labels an artifact that has known mathemati-

cal properties with the universals and their instances to quantify their capacity to address human diversity. Values-based ethical implications form the conclusion.

The academic seedbed of the universals is French and Raven's (1959) bases of social power taxonomy and conflict sociology. These original bases were applied in a meta-analysis of social conflict (Smith 2013) that identified their presence across conflict models used in individual, managerial, bureaucratic, political and game theory approaches to social tensions and outcomes. Searle (2010) suggests that all social ontology is power structure. HERO-BFO is a formal presentation of such a structure. French and Raven's bases are coercive, reward, socially legitimate, expert and referent powers. These are parallel to HERO-BFO's physical matter, money, other individuals and energy, respectively. Referent power implies a relationship of respect between individuals or groups who may perceive innate value, competence or leadership in others relative to these powers. In this sense, referent power is an emergent quality.

Ontologies from several disciplines attempt to structure human experience. In general, these use more abstract forms of these same four universals or apply to only one discipline. These ontologies are presented, perhaps too briefly, in this section. These are presented to map the academic landscape. HERO-BFO's universals serve as an object-based legend in the column headings for comparative purposes.

Including money as a universal is a differentiator of this ontology. Yet, this may be what makes it workable in the lives of modern humans. I challenge some of the perspective of John R. Searle (2006), who views money only as an

institutional derivative rather than a necessary foundation for modern institutions. Money as a universal of human experience is supported by the institutional history provided by Jonathan Turner (2003) and others. No ideological claim is made that money ought or ought not to be a universal. The status of money as a universal simply is as defined in basic formal ontology. Logically, the power of money to communicate an objective message of value that moves with social and individual goals, aspirations and developments is money's critical value function.

1.1 An academic landscape: existing ontologies for human experience

The relatively well-known ontologies in Table 1 are from the disciplines of psychology, sociology, biology and economics. These same disciplines manifest as sub-ontologies in the knowledge map of section three of this article. The universals in these other ontologies can be organized co-gently using HERO-BFO universals as column headings. While each discipline is critical to understanding human experience, none is sufficient alone to account for it. Alone, each tends toward either a reductionist, partial or unfortunately incomplete account. One challenge for interdisciplinary communications is how to balance the claims made by proponents of each discipline that tend to claim dominance in explaining human experience.

These ontologies are organized under the same category labels yet exhibit differing levels of abstraction. The labels suggest similarities parallel to the universals of HERO-BFO. While there may be other ways to categorize these ontologies, each similarly tends to lend itself to

<u>Categories</u>	<u>Physical in Nature</u>	<u>Energy in Nature</u>	<u>Social in Nature</u>	<u>Other Existents</u>	<u>Emergent Property</u>	<u>Discipline</u>
<u>Ontologies</u>						
HERO-BFO Human Experience	Physical Things	Energy	Individuals	Money	Knowledge Map	Human Systems
R. Axelrod Game Theory	Payoff good	Decision Code	Players	Value-Matrix	Evolutionary Community	Multi-Disciplinary
L. Vitt Life Values	Things	Feelings	Relationships	Money	Learning & Values	Economics
K. Wilber Integral Theory	It (singular)	I (Singular)	We (Plural)	Its (Plural)	Lines of Development	Psychology
J. R. Searle Social Construction	Brute Facts	Mind	Institutions	SFD's (Money)		Philosophy Sociology
E. O. Wilson Consilience	All Biological	Environmental Policy	Social Science	Ethics	Unstable	Biology
R. Bhaskar Critical Realism	Empirical Domain	Experience Domain	Event Domain		Yes	Philosophy

Table 1. HERO-BFO and other ontologies. Universals used in each ontology are aligned using the universals posited by HERO-BFO. SFD is Searle's status function declaration concept.

a categorical description through physical, energy-related, social, money and emergent universals.

For example, while HERO-BFO entities are less abstract than Wilber's, they are not categorically different. The "I" used by Wilber is an abstract term. No one can measure or point to an "I" but identifying an individual, as HERO-BFO does, is less problematic. Thus "we" as used by Wilber is also abstract in that "we" includes "I." Using "I" to explain the experience of "I" is not upper-level and cannot answer the question of what "I" is. The Wilberian "I" is the human experience. Wilber's "It" represents physical reality while "Its," referring to all things, has a connection with money to communicate the value of things that are not "I." Bernard Lietaer (2000) is explicit that money and the money system, including communal and transactional economies, respectively, are represented by Wilber's "It" and "Its." Vitt's economically focused universals are exactly parallel to HERO-BFO, not abstract, and yet narrowly applied to economics. Vitt's and Wilber's ontologies serve as examples of an academic pattern that other ontologies tend to follow and through which the nature of HERO-BFO can be grasped and placed. Searle's brute facts relate to things but are at a higher level of abstraction. Searle's claim of the status function declaration as a primary of human life may be, but it is not a higher level universal. This is argued in section two. Axelrod's iterated prisoner's dilemma (IPD) applies in many disciplines to explain how payoff or reward factors operate overtly or subtly to focus life decisions and, thus, life itself. While not a formal ontology, game theory's payoff matrix could operate to describe how the four universals of HERO-BFO tend to interact. Yet, IPD is highly abstract and does not internally account for creative emergence or learning.

The emergent properties of a human ontology are necessary to explain human experience. The emergent property of the ontologies is provided for comparative purposes with no specific elaboration save to show how HERO-BFO relates to others. Emergence is addressed in section three and the base of it, autonomy, is dealt with in section two. HERO-BFO builds on these listed ontologies in a small inductive step toward phenomena-based universals. The goal is a realist, essential and object-based ontology. Those reviewed above were either abstract and concept-based, tended toward reductionism, or were in a sub-domain.

1.2 Hypotheses

Hypothesis one states that modern human experience is comprised only of relationships between and among the universals. Ten pairings created by a four by four matrix consisting only of the four universals are systematically compared with the ten main categories of the *Dewey De-*

cimal Classification (DDC) and its 90 sub categories 000-990. The ten pairing must logically and comprehensively cover all the areas of the *DDC* to reject a null hypothesis.

Hypothesis two states that a limited number of instances of each universal generally, yet fully, describes modern human experience. Twenty-five participants systematically examined their life experience through a list of seven instances of each universal. Individuals must substantially agree these fully describe their present experience to reject the null hypothesis.

2.0 BFO, human experience and universals identification

BFO is an upper-level ontology (Arp et al. 2015) used in knowledge management, bio-medical research, informatics and military operations, among others. BFO's philosophy of science embraces skeptical realism as do 81.6% of philosophers who held academic positions in philosophy. Skeptical realism is the approach to the nature of reality which accepts that there is a real world, objective in nature and that world can be known. In this sense, BFO is not atheoretical (Hjørland 2016) yet appears sufficiently neutral to support the plethora of theory that emerges in section three's knowledge-map.

BFO terms requiring description for this presentation are: real, upper-level universal, type and instance. Ontology seeks to represent reality by designating some combination of universals. Universals are a defined class of entities (Arp et al. 2015). An entity is anything that exists, given the best scientific evidence. Existing as real, in this sense, does not mean that an entity is invariable from any perspective imaginable. Amanda Geftner (2014) found that nothing is real using this definition while using wildly improbable imaginations such as a human experience that included individuals standing on the edge of a black hole. The term real, as used here, means simply observable and measurable. Other than upper-level universals, entities can include objects, processes or qualities.

Upper-level universals are the most general category of entities possible to identify in any domain. Upper-level universals must be real, uniquely relevant, and necessary to the domain. All experiences in that domain must emanate from the universals or the set is incomplete.

Universals are often combined in relationship to form a universal type. For example, in the human genome, the four amino acids of DNA are the universals. Genes are various relations or configurations of the amino acids. Upper-level entities in atomic structures are neutrons, protons, electrons and atomic bonds. Universal types in atomic structure are elements listed on the periodic table.

Types have many specific instances such as isotopes and molecules. Instances are specific appearances of the

universals in forms that are not universal. Instances are real entities as well. For example, the upper-level of individual human has instances of male, female, androgynous, infant, adolescent and adult. The instance male is an individual, but all individuals are not males. Males are instances of the individual as universal even though males are universally present in the species.

Abstractions, such as sets, domain, words, language, numbers, experience, categories, ideas and other representations of reality, are not considered real in BFO. These abstractions are representative of perceived real relationships and easily codified in the knowledge map.

2.1 Human experience domain parameters

The domain of human experience is delineated by conscious experience and an intuitive openness that there is more to experience than simply that of which one is conscious. Conscious experience is presented herein as awareness, focus and higher order thought. Subconscious brain activity influences behavior, however these may be experienced, revealed or manipulated, they are not a part of human experience until brought to awareness. It is easy to be aware that there are things, processes and influences of which we are only vaguely aware and still not experience those influences directly. A bias in this study is the bias or emphasis of conscious awareness.

The awareness of the realm of unawareness is bridged by intuition and less structured feelings. Art, experimentation and creative pursuits in most disciplines are fueled by a desire to expand our awareness and emerge with new and interesting insights. Thus, the concepts from the artificial intelligence community defining consciousness as a function of awareness and focus (Triffet and Green 1999) provide a helpful framework. The simpler concepts of awareness and focus are complimented by the higher order thought theory as proposed by Lau and Rosenthal (2011). Higher order thought frames human experience as a lower-level perceptual state, similar to awareness, and the higher order experiential state, similar to focus. In the higher order state all of the perceptual experiences become one seamless life experience through the integration of all of the perceptual faculties and the processing ability of the brain. Brain processing results in energy that feeds information back to the body or stores it in the form of new neural pathways.

2.2 Human experience

The conscious human experience can be classified along four ranges or dichotomies that describe filters individuals engage for processing their focus through their higher order thought process. Andrew Feenberg's (1999) model

of human experience presents this framework. Feenberg's dichotomies help explain subjective differences in the processing objective data.

The first dichotomy is between scientific epistemology and dogmatic, inflexible belief. Human experience may be filtered through a realist skeptical philosophy or a religiously oriented theological perspective. The religious-spiritual end of this dichotomy appeared in a few of the research participants. A second dichotomy is filtering experience as immediate and sensory compared with experience as deep reflection. A third dichotomy is a developmental line through immersion in an experience or community over a long period of enculturation. Lastly, an experience that transcends the subject-object divide is different from all the others. While the experiences are different, the things experienced are not altered by a human's experience of the things. It is the things experienced, rather than how they are experienced, that are the focus of HERO-BFO.

The time frame of this human experience realist ontology domain is from birth to death. A foundational assertion of this approach to ontology of the human experience is that being human is simply an experience housed in the human body.

2.3 The upper-level universals identified

The definition of upper-level universals was provided at the beginning of this section. At this point, each of the four is shown to meet the criteria. The first two universals are matter and energy. It is hard to argue that both are not real, unique, necessary and relevant to human experience. While both are all encompassing and used as the basis for positivism, they are not sufficient to explain modern human experience. These fail to explain autonomy and the emergence of life or consciousness from inanimate sources. Thirdly, individual humans display autonomy at a level not found in other entities. Individuals are thus real, unique, and necessary for modern human experience. Fourthly, money is the entity used among modern humans to communicate value and facilitate the creation and maintenance of the division of labor and knowledge society. Now, more details follow to establish each of the universals more soundly as real, relevant, necessary and unique:

- 1) Physical things, or matter having rest mass, whether those things are flora, fauna or inanimate. Immediately experienced instances of things include the body, food, homes, chemicals and cars.
- 2) Energy is considered a quality of matter even though matter can claim no primacy over energy. Energy forms include electromagnetic waves, gravitational waves, mo-

lecular bonds and perhaps others. Humans experience energy without experiencing matter in two critical areas. Externally, humans experience sunlight without ever touching the Sun. Sunlight is relevant and necessary to human life providing vitamin D and threatening health with skin cancer. Internally, humans experience thoughts and feelings without experiencing the material organs or chemicals which stimulate them. Thoughts, feelings and emotions are biochemical energy experienced through electrical activity of the neurons that deliver the experience. Thus, humans experience thought, without experiencing the brain.

3) Humans experience one another in ways they do not experience themselves. The unique characteristic of any individual is autonomy at some measurable level. It is not necessary to invoke the philosophy of methodological individualism to affirm individual autonomy. It is neither circular nor redundant to consider individuals within the ontology of human experience. Humans experience other individuals singly and in groups differently and uniquely from other entities. Examples of these are lovers, family, strangers and enemies.

Autonomy, following Killmister's (2013) schema, is a function of the knowledge and ability to make informed choices or create options, reflect upon the options, align them with self-identity, form an intention to act and act upon the intention. Any of these factors may be compromised and thus levels of autonomy vary. Killmister's work aligns with the concept of diminished autonomy, as opposed to fuller autonomy, cited by the Belmont Report (United States 1978) on ethical research guidelines. Autonomy is likely the source of emergent properties in modern social life that includes growth, learning, development, aspirations, identity and culture.

4) Money is a real entity, uniquely relevant and a necessary communication device. Money objects include commodity, specie, currency and crypto-currency. Cryptocurrency like bitcoin functions with natural value as a payment system as well as a measure of accounts. The vast majority of economies today use paper, also known as fiat currency.

Money emerged organically among communities and grew to modern global proportions connecting communities directly in nearly every way. Instances of money can be experienced as cash, earnings, gold, credit, social welfare payments or many other ways. Unlike spoken language or institutional entities, money is fully translatable and directly exchangeable in its forms. Thus, money transcends language and institutions. While spoken words or other acts may or may not represent private thoughts, en-

ties or events accurately, the transfer of money is a communicative action, a speech act, of unambiguous value. In this characteristic, money is real communication because of its innate value and relatively consistent value over time. Consider the words, "the check is in the mail." The check may be or may not be in the mail. Handing over cash is immediately communicative of reality. I could proclaim to be speaking in Chinese while clearly speaking in English. The interpretations of contracts or even religious literature present similar challenges.

Peter Hadreas (1989) states, "Failing to consider money within the conversational context in which it occurs results in ontological and conceptual errors." Money is the human speech act that allows society and modern institutions to be possible per Georg Simmel (2004) and Mathieu Deflem (2003). The use of money in modern society grew organically from individual personal exchanges within and between small communities of exchange and all the way to its modern use to support production, industrialization and global institutions (Turner 2003). Money rose organically among individuals, then to masses and finally to the sophisticated money structures existent today that facilitate trading and support diversity of knowledge and expertise.

How does this history fit with John Searle's claim that money, multi-colored or green pieces of paper, is money by virtue of an institutional edict or status function declaration? Searle is both correct and incorrect. Searle is incorrect about the need for an institutional declaration as money emerged organically between individuals and grew in use without an institutional edict (Smit et al. 2011). Searle is more correct to the point where consolidation and control of social power through institutional control of money became possible and perhaps necessary with growth and use of more complicated financial devices, laws and technology.

Searle (2005) points out correctly that an institution can declare something like green slips of paper will be money in their nation. Thus X, green slips of paper, is Y, money, in C the nation. X is Y in C. Money is easily transferable between nations with little to no problem. If I visit your tribe and you visit mine, all we must do is exchange our money at a specific mathematical rate of exchange. Then each can begin a full life in a foreign land without saying a word, all other things being equal. The initial exchange is a simple rate-based exchange set by a person familiar with the prices of both our tribes. Soon enough, both of us will know each other's language for daily communications.

Status function declarations alone have failed to exert sufficient influence to declare currency as money. The Weimar Republic lost control over the mark which became worthless. The entire world refused to buy U.S. Bonds in 1978 unless those bonds were denominated not in dollars but in German and Swiss currencies. Money was able to

circulate without declaration in the days of free banking. The United States' military intelligence practices include financial warfare games (Rickards 2011) that demonstrate how nations are destroyed by targeting only their money.

It may be that neither language nor institution is necessary for the money to emerge among non-modern barter, exchange and gift economies. Yet, money appears to be a requirement to move from simpler hunter-gatherer communities to a modern global set of communities in spite of the tensions between and within the communal economies and those significantly more trade-based.

Spoken or written language is not upper level. It is at best representative of the four universals. A shared language is a facet of relationship. Language is simply mutually recognized modulated pulses of air (energy) beating upon the nerves of the ear, becoming sparks in the brain, initiating a feeling of awareness in the hearer. That is the objective reality.

3.0 Mapping human experience through knowledge organization

A conceptual map formed by the creation of a four by four matrix with the four universals serving as headings both the column and row (Figure 1) is compared to the

contents in the *Dewey Decimal Classification (DDC)*. The matrix creates sixteen individual cells. Four cells are unique. Six have duplicates. The duplicates are ignored as simple and trivial inversions. The *DDC* library classification serves to approximate extant human knowledge. The *DDC* is not significantly at variance (Zins and Santos 2011) with the Library of Congress *Classification* system or the Universal Decimal Classification system. Therefore, the *DDC* serves as a reasonable proxy.

The comparison consists of three steps. First is describing the ten universal types. Next, the universal types are matched systematically with the *DDC*'s contents. Thirdly, interdisciplinary classification connections are briefly discussed.

The benefit of this phenomena-based knowledge map is that these universals support a knowledge organization founded on objective reality. Interdisciplinary knowledge organization scholars (Szostak et al. 2016) suggest organizing a conceptual map of phenomena linked by relationships to create a web of relations. This style of mapping follows the resource description framework (RDF) used in the semantic web development: object, concept and subject. The universal phenomena of section two are linked to concepts, domains, theories and such in the knowledge map, and eventually connected to specific

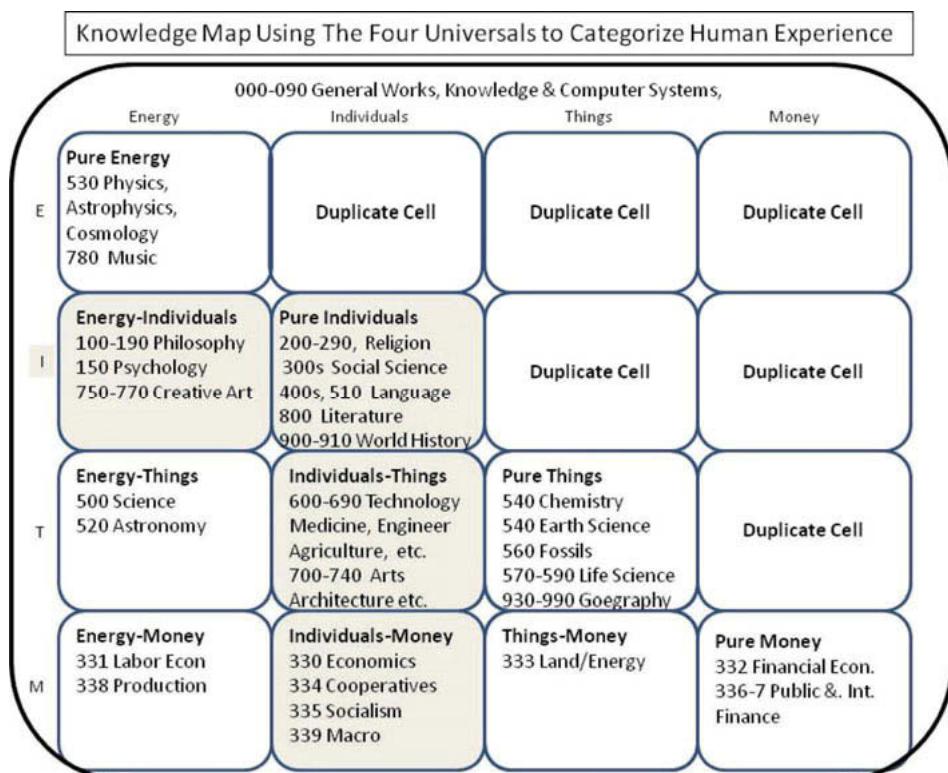


Figure 1. Rows and columns have same labels (E equals Energy and so on). Grey cells are primary to the individual human experience. Numbers and names are from the *Dewey Decimal Classification* top level 000-900 and the second level of the 10s between each top level hundred as needed. Economics, 330-339 is fully presented in the bottom row.

subject attributes. Specific instances in human experience are presented in section four on human research.

3.1 Cell descriptions

For clarity, the ten unique cells are classified as three different types: primary pairs, pure pairs and other pairs. Each pair links closely with one or more related disciplines but remains distinct from other pairs. Primary pairs are the four cells that contain the individual human universal. Primary pairs are slightly greyer in Figure 1 and represent direct human experience and perception. The remaining six cells represent the external entities, context and environment of human experience.

Pure pairs form where the row and column share the same name. Pure pairs represent the universals themselves except for the individual-individual cell. The individual-individual cell is both a pure and primary cell. This cell is primary in human experience. The three other cells are neither pure nor do they contain the autonomous individual. Technically, there are four primary cells, three pure cells and three context cells.

The primary pairs are the core of the human experience.

- 1) An individual human interacting with energy (object level) is the academic domain of neuroscience, psychology, cognitive science, neurology and branches of medicine (concept level) associated with sunlight and radiation as associated with vitamin D synthesis or skin cancer, among many other related factors (subject level).
- 2) An individual interacting with other individuals (object level) is the academic domain of sociology, anthropology, language, history, religion and cultural studies (concept level). Subjects include wars, teamwork, education, family and tribes.
- 3) An individual interacting with physical things is the academic domain of positivism. It includes the human body, medicine focused on the physical, biology, genetics, nutrition and ergonomics (concept level). Subjects include pharmaceuticals, surgery, housing and recreational sports and style.
- 4) An individual interacting with money (object level) is conceptualized with economics, marginal utility and delayed gratification. The subject experiences income, net worth and saving habits among others.

Primary cells represent the core human experience as evidenced in section three where the assessment by individual research participants is reported. The ability of these four to define and identify experience at the upper-level and subjective levels gives HERO-BFO high explanatory value.

The three pure pairs are: 5) money and money; 6) things and things; and, 7) energy and energy. Things and things represents pure nature. It is often divided further to animal, plant and mineral types. Things need only have rest mass. Energy and energy is pure energy. This encompasses the physics of movement, astronomy of heavenly bodies, electro-magnetic waves, gravity waves and quantum sciences. Money and money is the domain of money as a system including banking, central banks and financial processes. Three other cells exist: 8) things and money; 9) money and energy; and, 10) energy and things. Things and money is specifically the things that can be money, types of money, payment systems, stocks, bonds and insurances. Money and energy is human economic motivation, discretionary power and compounding interest. This includes the velocity of money, a measure of how fast money changes hands. Energy and things categorizes most of the natural sciences while considering kinetic energy, potential energy and waves in physics.

No crisp demarcation of any of these in human experience is claimed. Logically, experience requires enough overlap of these universal types to facilitate a smoothness of the human experience as discussed in higher order thought.

3.2 Library comparison

Library systems categorize human knowledge by organizing through enumeration each subject and their facets inductively. HERO-BFO builds deductively upon the four upper-level universals. Rather than organizing around disciplines, phenomena are used. Library systems organize knowledge by virtue of the knowledge itself. The map has a starting point separate from books, other knowledge maps or culture. While *DDC* uses abstract categories, such as science in the 500s, the human experience keeps the focus on the things with rest mass and the energy itself. When things or energy are used or applied, they populate technology in the 600s, under the universal type of individuals and things. Though subtle, this distinction is not based upon abstraction but upon real facets and relationships.

Mathematics, 510, is a language of patterns and relationships understood and shared by individuals. Math could fit many places as all things relate in theory.

The map substantially mirrors the *DDC* in all aspects save the primacy of the category of money and the absence of supernatural beings as codified through religions. Economics is classified as a sub group under social science. Religion enjoys the entire major heading of the 200s. HERO-BFO naturally expands money to a full top-level category enjoyed by upper-level universals. Religion is folded into sociology as a cultural experience. The inver-

sion is important. Other than this, only minor regroupings are needed to fit all *DDC* subjects into the map. Fitting all knowledge logically and cogently into the matrix is the test. Duplicating the structure of the *DDC* is not.

The prominence given to money is a logical outcome of the claim that modern society is based on the organic development of money and the assertion that money is foundational to institutions and to modern sociology. Money can be said to supervene on sociology just as the environment supervenes on that which exists in it. In much of the world today, supernatural beliefs supervene on society.

3.3 Emergence

HERO-BFO posits that each modern human is born as a potentially autonomous individual, surrounded by other individuals, various things, feeling or experiencing energy, and soon to learn about money. These do not change categorically. Albert Bergeson (2012) provided well-accepted evidence of the nature of an infant as conscious of collectives, groups and even individuals with goals prior to socialization. Language development is globally similar. The desire to make sense of the world categorically and mathematically is present immediately.

The nurture of the individual's autonomy is a central factor in emergence. According to Neil Postman (1994) it was an expanding knowledge in a traditionally ignorant adult population that created the new social status of childhood. Just as expanding and codified knowledge bases are a natural and emergent property of humanity, the matrix is a naturally emergent property of HERO-BFO.

Bergeson's work identifies some emergent capacities at birth, prior to any socialization. Advances in knowledge are the primary evidence of emergence in our species. The knowledge map presents a macroscopically coherent (Goldstein 2013) structure that contains the major foci of human knowledge. This coherent emergence is tractable along physical, emotional social and economic lines.

While the universals exist as entities with being, changes occur and an emergent becoming is evident. With the universal base as being and the core of knowledge expanding or emerging, the concepts of Heidegger's (1987) being and becoming over time is touched upon.

3.4 Interdisciplinary application

Scholars have suggested (Gnoli, Szostak, et al.) the development of a hybrid classification system based on real objects, subject to classification using integrative levels classification (ILC) or basic concepts classification (BCC). This hybrid must allow for sub-ontologies or disciplines to classify in as specific a place as possible. The map identifies a

specific space for each discipline using real objects. *DDC*'s disciplines have already been classified in BCC. The objects forming the upper-level ontology exhibit minimal ambiguity while the sub-ontologies, the disciplines, can allow for constructivist bias and authorial perspective without losing all touch with real phenomena of human experience.

It appears possible to identify disciplines under HERO-BFO's upper-level categories and further organize the disciplines as has already been done already with BCC. Disciplines are categorized by the objects upon which they focus. Next, general overview works specific to concepts and authorial are organized in BCC.

Linked with systems such as ILC and BCC, items are classified for their physical, energy, individuals and money claims and characteristics as well as others. Bread can serve as one example. In HERO-BFO, bread is classified under individuals and things. How does bread impact the body (thing)? What are the physical characteristics defining or encompassed by bread? Who uses which types of bread and how? Calories in bread is in the subdomain of nutrition. The common phrase "shall not live by bread alone" connotes a psychological impact (energy internal). A new added question to these established questions is, "how much is bread in compared with other food?" Bread also is slang for money. Perhaps this multidisciplinary process brings us a step closer to interdisciplinary interactions through providing clear linkages via the knowledge map.

Multidisciplinary views are a change in focus from one cell to another with the same object or process in view. Consider how the matrix may also serve as a multidisciplinary map for a researcher or entrepreneur creating and delivering a new process or program. Consider a creative idea emerging in the mind of an entrepreneur. Ideas are an experience categorized in the individual and energy cell. This cell is where the vision, passion and desire fit. Following the development of the idea, like the Heimlich choking assistance maneuver, a multidisciplinary pattern can be traced on Table 1. After the initial idea, Dr. Heimlich had to perfect the technique for use on the body. Technique is technology and thus fits in the individuals and things cell. The technique was the thing or manifest idea. Dr. Heimlich then had to show the benefits of this thing to influential individuals. The other individuals fit in the individuals and individuals cell. In his presentation, Dr. Heimlich had to appeal to the others' passions for health, thus entering again the individuals and energy cell but this time it is their energy, emotion or desire rather than his alone.

Once the value of his technology is successfully communicated, he may price it and make it available in the market. This is the individuals and money cell. Even if he is not paid directly, the fame of his name, a relationship, is a payoff in the individuals and individuals cell that may

lead to other payoffs. The order of steps on the multidisciplinary path may change, but they are mapped.

4.0 Individual experience research

Rather than experiencing upper-level categories, humans experience specific instances of those objects in some common-sense everyday schema. If human experience is a matter of a common or cultural sense, cognitive recognition and formal science of the objects themselves (Smith 1995), then it can be tested on a common sense level. The results of this will test any assumptions remaining in underlying ontology.

This test presents common instances of the objects stated as possible goals. By definition, individuals possess autonomy to move in any direction of their choosing given the constraints outlined by Killmister. An individual's desires, vision, need and feelings interacting with the outer environment is the context of this section. Do the instances of the universal types, stated as goals, hold in this context?

PDF files containing 4 lists of 7 items each were delivered to 25 self-selected participants from Cornell University, Fielding Graduate University and John Jay College's Dispute Resolution Group. Participants included 17 females and 8 males; 19 were born in the United States, 3 in the UK, 1 in Africa, 1 in Iran and 1 in China. Nine had bachelor degrees, eight master degrees, four JD's, and four PhD's. Ages ranged from 18-65 and incomes from less than \$30,000 to over \$175,000. Specifics of how many in each category responded in what way are provided in Table 3 at end of this section.

The goals were recognizable instances of the four primary universal types. The instances could be considered the most common instances of each universal type. Each instance was framed as a possible goal, desired experience or state. Participants were asked to write a near-term goal that came to mind for each instance then prioritize them by selecting two from each category as most important

The two priority goals from each list formed a fifth short list of eight top priority goals. Finally, participants were asked to select a single top-most and second most important goal from their short list.

Some participants selected based on how they felt intuitively. Others used logic to consider which goal seemed to link all the rest. Using a one to ten scale each assessed how difficult reaching the top two goals on the short list seemed. After answering any questions each participant might have, the evaluation and demographic were completed. In most of the cases, the evaluation was completed verbally with no prompting or explanatory discussion until after completion.

The seven instances or goals of individuals-things are: housing, transportation, toys (video games to yachts), clothing, physique, food or medicine and "other." The "other" is a thing only the participant might know.

The seven instances of the individual-individual contained: family, lover, community, colleagues, career, school and "other." The "other" is a relationship only the participant might know.

The seven instances of individuals-money contained: net worth, credit score, income, cash on hand, insurance, stocks or bonds and retirement funds.

The seven instances of individuals-energy, or feeling goals, contained: feelings of security, excitement, significance, connection and love, growth, giving (Madanes 1993 2009) and positive belief (Seligman et al. 2005).

4.1 Results

The four primary assessment statements addressed clarity of the process, power of it to list all present life situations, the ability of the process to help organize or make sense of life and the preparation formal education provided. Table 2, below, shows the mean, median and mode of the 1-5 Likert scale where 1 is fully disagree, 2 somewhat disagree, 3 neither agree nor disagree, 4 somewhat agree and 5 is fully agree.

Assessment Statements	Mean	Median	Mode
Generally, all my life situations were listed	4.28	5	5
The process was clear even though new to me	4.32	5	5
My formal education taught me knowledge in all these areas	2.60	2	1
The process helps me make sense of my life situation	4.24	4	4

Table 2. Responses of research participants that link the 7 goals in each of the 4 categories to life experience.

In Figure 2, the graph is skewed to the positive for all statements but the formal education statement, which is negatively skewed. Two outliers for the most main statement of the hypothesis, generally, this covered all my life situations, appeared. These participants somewhat disagreed. Why?

The disagreement may have included not finding the process clear. The same two neither agreed nor disagreed the process was clear. Yet, both somewhat agreed the process helped them make sense of their life situation. There seems to be a conceptual challenge with both of

these that is critical to this entire process of realism. This conceptual challenge, and teaching opportunity, is clarity between the abstract and the real in this realist ontology.

One said spirituality was missing. She was correct. Yet, if spirituality is not real in the sense of skeptical realism, how can it ever be present? Spirituality can be experienced as a derivative of the four universals. It can fit as a type of positive belief which is an instance of energy and the individual. Spirituality can also be framed as a balance and or harmony of the four ontological areas and growth in them. This implied definition of spirituality has a firm basis in the real and traditional ethics.

The other said the desire to create a business or leadership center was missing. Conceptually, business is an institution that requires all four parts of the ontology to successfully emerge. Leadership itself is a relationship with community, school, career or colleagues. Business answers the question of how to obtain desire, not of what.

Spirituality, business and growth tend to serve an integrative and identity purpose relative to the universal objects. The manner in which an individual autonomously

organizes their life and knowledge is relative to the concept of identity located under individuals and energy. Identity can be reached by this ontology and thus apply within and across social groups. As Szostak (2014) suggests, a web-of-relations organization supports such integration.

Nine of the participants had been through other programs they considered somewhat similar yet not significantly comparable including: cognitive behavioral therapy, personality assessments, personal development groups, college courses, energy audits, reading, inner guides and full circle leadership. Indications of the inability of the present formal educational curriculum to address life experience are found in the firm disagreement that formal education prepared participants in all these areas (Table 2).

The group's responses to the main statement are presented in Table 3 by demographic. The five numbers each group represent the number of people at each level of agreement. Interpret 1,0,3,0,2 to mean of the six people in that group, one fully disagreed, three were neutral and two fully agreed. Categories add to 25.

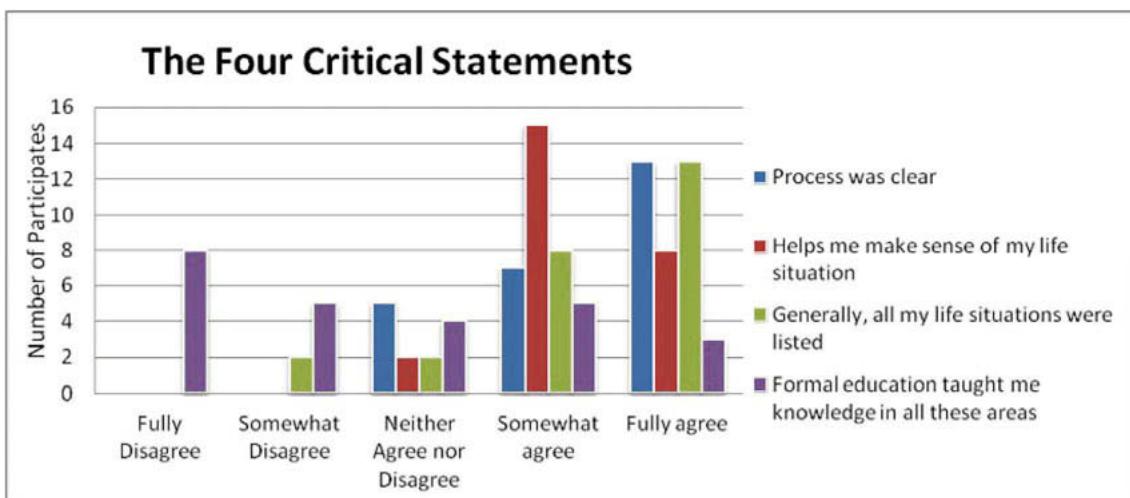


Figure 2. The raw scores graphically.

Birth Nation	Gender I.D.	Age	Income ('000s)	Education
US 0,2,1,6,10	F 0,2,2,3,10	18-24 0,0,0,0,2	<\$30 0,0,0,1,2	BA 0,0,0,3,6
Europe 0,0,1,1,1	M 0,0,0,5,3	25-35 0,1,1,3,1	\$30-60 0,1,2,0,2	MA 0,0,2,3,3
Africa 0,0,0,0,1		36-40 0,0,0,1,4	\$61-99 0,1,0,3,4	JD 0,1,0,1,2
Near East-Asia 0,0,0,1,1		41-50 0,0,1,2,3	\$100-175 0,0,0,2,4	PhD 0,1,0,1,2
	All Participants 0,2,2,8,13	51-65 0,1,0,2,0,3	\$175+ 0,0,0,2,1	

Table 3. Responses to the statement "generally all of my life situations were listed" by demographic.

5.0 Diversity, math and the Rubik's Cube

This section presents the ability of the universal matrix and the instances used in the participant research to account for human diversity. The mathematical characteristics of the Rubik's Cube, its physical structure, and how that structure accommodates the stories and life experiences are applied. This is a demonstration of the HERO-BFO ontology to serve as a categorical foundation globally.

The cube was designed for engineers to experience three dimensional problem solving and is used for similar purposes in other scientific disciplines. Here, the cube is used in understanding variations in human experience in real time. Like an individual, the cube is variable in presentation yet stable as a three dimensional object. It changes position and resultant appearance over time.

5.1 Cube structure and mathematical properties

The Rubik's Cube can be positioned in over 43,000,000,000,000,000,000 (43 quintillion) (Korf 1997) different perfectly cube shaped positions. That large number is just about 6 billion times larger than the population of earth. If each position of a cube can represent a different experience of human life, the number is sufficient to account for human diversity mathematically and realistically.

When in the solved position the cube has six sides each of a different solid color comprised of nine square surfaces, also called facets, of the same size. HERO-BFO's equivalents to the six different colors are six cells applied directly from the knowledge map. The four primary cells that involve the individual and the two cells providing the greatest context of life experience, pure things and things and energy. These are mapped onto the two dimensional graphic of the three dimensional cube in Figure 3.

The six center squares, one on each side, are each labeled with one of the six universal types from the map, related disciplines and the original color of an official Rubik's Cube. Eight instances of each universal type complete the labeling of each side. All the goal instances used in the human research are used as labels.

The squares or facets on each side, though the same size and color, are of three different types.

- 1) The center square on each side, labeled with the universal types, rotates in place but never moves from its center place. These squares are analogous to the universal types. They are immovable, stable and define the color of the other squares that surround them.
- 2) The four corner squares on each side are each connected to the corner squares on two other adjacent sides. These three corner squares always move together. All adjacent squares are labeled with the same

upper-case letters, A-G, and different instances relative to the center square's universal type.

- 3) The four edge squares on each side are located directly above the center squares and between the corner squares. Edge squares are connected to one other edge square on the adjacent side. These edge squares always move together as sets of two. Adjacent squares are numbered with the same number, 1-12.

5.2 Labeling the squares

The center squares are labeled with both the universal type and a color as already described. The corner and edge squares bear the names of instances used in the human research plus one extra to complete additional eight required. Thus, this flattened version of the Rubik's can "really" be linked to any standard three by three cube.

Labeling the squares with the instances of real human experience validated in the human research is an important step to justify extending the cube's mathematical property to HERO-BFO. The corner labeled "E" in Figure 3 serves as an example. The "E" corner has three squares, each labeled "E." The squares are labeled with one instance each. Those instances are school, toys and bricks. On a real cube, this is the corner with the blue, yellow and red squares, respectively. Thus each square is precisely identified. After identifying all the squares, labeled as real things in the human experience, a human story can be constructed from the cube itself with no necessary truth behind it. What could be more human than that? In the *DDC*, after philosophy, science and technology, comes art and literature. The cube is needed for the diversity of literature, or understanding the potentially unlimited number of ways human life presents.

5.3 Interpreting the Rubik's Cube

The research participants described in the previous section identified and prioritized their goals down to a "short list" of their eight top goals. From this short list, the top priority goal was selected. This short list was generally assessed and then reviewed as representing their total life. Note that the short list of eight contains exactly the number as the number of squares surrounding each center square on the cube. Determining which center square these eight surround is logically accomplished by arranging the eight around the center square of the universal type of which the top goal is an instance.

One participant's top goal was physical stamina to care for a new daughter. The other seven goals included unpacking in a new home, finding a new source of income, learning about retirement options, enhancing the feeling of giving support to others, feeling significant as a person, ca-

A	Sense of Contribution	1	Excitement	B	Feeling Secure							
2	Feeling of Significance	Individual & Energy Psychology Neurosciences (White Center)	Belief 3									
C	Sense of Growth	Intuition 4	Feeling Loved	D								
C	Coach	Stranger	Lover	D								
5	Colleague	Individual & Individual Sociology Humanities (Blue Center)	Career 6									
	School	Community 7	Family	F								
C	Iron Weight	5 Trees	E	7 Clothing	F	Physique (DNA)	F	Molecular Bond	6 Fuel	D	Magnet	
2	Mountain	Things & Things Physics (Red Center)	Flora 8	Food	Individual & Things Positivism (Yellow Center)	Assistive Equipment 9	9	Inertia	Things & Energy Thermodynamics Quantum Mech. (Orange Center)	Boson 3		
Sand Beach	Gold	Granite	G	House	Auto	Computer	H	Semi-Conductor	Reflection	Gravity	B	
A	11		G	10		H	H	Credit Score				
			G	Insurance	10 Net Worth							
			11	Cash on Hand	Individual & Money Economics (Green Center)	Retirement 12						
			Estate	Stocks Bonds	1	Income	B					

Figure 3. Rubik's Cube displayed in two dimensions and realistically labeled.

reer networking and accessing colleagues. Since the top goal is physical stamina, related mostly to the body, the center is the yellow center of things and individuals. In Figure 3, these goals are represented by colors as follows: two from the white, blue, yellow and green or individuals and energy, individuals and individuals, individual and things and individuals and money. Not all sides will be this well balanced with two from each area. In the research cases, the research process required that a set of choices be from each category. Not all cases or people will follow this neatly outside of the research laboratory.

To test a more random possibility, I scrambled the cube with 40 varied moves as is done in competitions for speed solving a cube. Then, I chose a side and used the map of Figure 3 to interpret it. From the scrambled cube these eight instances surrounded the center square on the individuals and money, or green side. Toys came on the corner of square "E." "E" is the corner piece of the cube

with yellow, blue and red squares connected. The yellow square is one of the eight squares showing on the green center's side. The other corners are green from the green, orange and white corner "B." This is income. Molecular bond is the orange on the "O," "Y," "B" corner "F." Iron weights or the red square form the "R," "W," "B" corner "C." The four edge squares appearing on the green side include reflection as orange from the orange and green combination of 12, community as blue from 7, food as yellow from 8, and intuition as white from 4.

The top goal of this person is income. This is ascertained by the side of the cube I randomly chose to view: the green center square of economics or money and individuals. Surrounding this center were priorities of income, food, iron weights, community, intuition, reflection, molecular bond and toys. Now, I just need the story.

This could be the story of a scientist, in jail and iron chains as a dangerous person, because of a crime against

the community through some food experiment that did not work out. As the scientist reflects, in a flash intuition, a childhood toy that caused a problem the child scientist did not cause but was blamed for crosses his mind. If only he could get the income from former inventions he could get the evidence needed to exonerate him.

Only one side of the cube has been read here. The deeper connections must include all sides of the cube. Leaving one story or side of the cube to start talking on another side may be a form of digression from a main goal.

There are limits to how much validity the cube mathematics may have to fully apply, but the connections presented here are significant and representative of real life and diversity. The Rubik's Cube extends the use of the ontology to deal with the experience of human diversity.

6.0 Conclusion

HERO-BFO identified a set of four universals that catalogue the essential elements of human experience. The relationship map identified and specifically placed the disciplines and concepts classified in the *DDC* with little ambiguity. Hypothesis one is accepted.

Seven instances of each universal tend to fully describe real humans' life experience. Modes of five, or fully agree, for the instances' ability to cover all life experiences of participants from widely different age groups, educational levels, income levels and birth nations. Hypothesis two can be accepted.

Research participants were in nearly full disagreement that formal education taught them knowledge in all these areas. Any resultant knowledge gap, if not compensated for at home or informally, likely impairs many people's ability to engage the full human experience and achieve or contribute in the most meaningful manner. This represents both opportunity and value of phenomena-based education, focus and classification. The mathematics of the Rubik's Cube extends this pattern globally.

The ethical implications carry weight. At its core, morality and deontology may be a concern for how all people have opportunity and go about enjoying the four universal categories of human experience. The identification, prioritization and alignment of goals can support all individuals in building trusting relations, recognizing the inherent and personal value of knowledge of how money facilitates communication, sharing and giving. Education is missing a key to supporting modern consciousness and autonomy, especially considering step one of Susan Killmister's taxonomy.

Self-interest and empathy can be married philosophically and practically. A value embracing this ontology brings is the ability to understand that each human desires

the four universals in different ways, different amounts and different times. Thus, each person can see the manifestation of these desires in others.

If money was not one of the universals, it is difficult to imagine how people with goals for earning, for things or to help someone they loved, could fully describe their experience. Bringing money out of the *DDC* category of social science or into more prominence supports education for a full life.

Denying money education, implying money education is only for some and not others, finds no basis. If there is a definition of wrong, not teaching money's universal place in institutions, nations and individuals along with how money works, is wrong. This wrong is unethical. This particular wrong is a systemic, well-recognized wrong, ancient as slavery itself, and calls have been made (United States 2015) for teaching money and finance systematically. While not solving all problems, this education can make for better problems such as how to negotiate creatively with a larger enfranchised population.

Belief, as used in positive psychology, was included. Faith is a thought pattern closely aligned with positive belief. When included this way, HERO-BFO is non-antagonistic toward belief in the supernatural. At the same time, HERO-BFO provides a level ground for all belief and thus may serve a purpose of a common ground between rival belief systems.

The lack of a control group is addressed by considering the world itself as the control group. Poverty, ignorance, terrorist attacks, ontological arguments galore and the inability to use real terms to impact the general beliefs that often define perception and cognitive processing are evidence that formal education did not present knowledge necessary for life. From the 9/11 terror attacks to Occupy Wall Street to the refugee crisis of Syrian citizens, the symptoms and need for some reality control is apparent. HERO-BFO suggests a framework that may allow for full diversity of human expression without arbitrary bias through providing this realist set of four universals and their instances as educational benchmarks which can be applied by each individual.

In a presentation to the International Society for Knowledge Organization (ISKO), Jeremy Shapiro (2002) posited that no hierarchical or linear knowledge organization system could suffice to organize information. His reference to a chain mail type of knowledge structure, particularly one based on metaphorical symbols is compatible with HERO-BFO's universals. The universals themselves form a linked chain of knowledge.

Modern life is based on, and now requires a division of labor, expertise and knowledge that allows for no true Renaissance man or woman who knows everything in sufficient detail to emerge. Though the value of this divi-

sion of expertise surrounds humanity, it elicits a physical wound to the desire of the self-aware human to feel at one and connected with the beauty of the life environment. The division of knowledge necessary to create our world of choice and sense of aliveness carries a wounding potential of a divided psyche.

The possibilities of this ontology and its applications may be one step closer to finding that impossible dream of connection and differentiation in a world of expanding knowledge. Like a light particle that jumps suddenly to a new level of energy and insight, it remains still a particle.

The idea that human experience emerges from four real and upper-level categories and four sources of human power holds a promise of sense-making that can support universal inclusion and global oneness. Transforming education through the inclusion of evidence-based or real-based classification may assure inclusion of these four things to all as early in life as possible. It also may begin to heal divisions both perceived and real among us and bring all to higher levels of engagement and respect.

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