Happy men and machines: an applied approach to affective computing driven by linguistic data

Щасливі люди і машини: прикладний підхід до емоційного штучного інтелекту, керованого мовними даними

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"In the beginning was the Word"
John 1:1

Abstract

This paper suggests that affective computing can achieve linguistic and cultural grounding of human knowledge about emotions, in combination of emotion concepts' diachronic depths and modern contents in a national worldview, matching the evolution that the human mind has gone through. The diachronic depth is an image that had formed in man's archaic consciousness and was prerequisite for a concept to emerge already in man's modern consciousness, in that the archaic image converted to a concept and motivated the word that was created as this concept's name. The paper shows that words for emotions contain original information making emotion concepts' contents in the archaic worldview, and eventual information making these concepts' contents in the modern worldview. This information is culture-specific; it is structured using frames and represented in the form of an ontology, which is machine-interpretable when formalized. Since emotion concepts' diachronic depths are archetypal, their ontological representation is regarded as non-trivial, in view of the fact that artificial minds are not supported by psychological archetypes. This paper's commitments find application in the case of HAPPINESS in the English worldview. Relevance of this paper's commitments is substantiated within the field of artificial intelligence, considering the viable link it establishes between ontology of human existence, natural language ontology in particular, and ontology as a computational artifact, and also within the humanistic context, given the global-scale crisis humanity is now facing.

Keywords: affective computing, emotion concept, emotion name, mental image, ontology.

Анотація

У статті запропоновано прикладний підхід до емоційного штучного інтелекту, керованого мовними даними, з метою обчислити знання про емоції, що його мають люди, у складі діахронічної глибини й сучасного змісту концептів емоцій у національно-мовній картині світу, відповідно до напрямку еволюції людського розуму. Діахронічною глибиною концепту є образ, який сформувався в архаїчній свідомості людини й був передумовою виникнення цього концепту вже у сучасній свідомості людини, коли архаїчний образ обернувся концептом і мотивував виникнення у мові слова-імені цього концепту. Показано, що слово-ім'я концепту емоції активує вихідну інформацію, яка складала зміст цього концепту в архаїчній картині світу, й кінцеву інформацію, яка складає зміст цього концепту в сучасній картині світу. Ця інформація визначається як культурно-специфічна; вона структурується за використання фреймів і постає у вигляді онтології, формалізація якої робить її зрозумілою для систем штучного інтелекту. Оскільки образи в діахронічній глибині концептів емоцій архетипні, їхнє онтологічне представлення є нетривіальним, враховуючи те, що штучний розум не спирається на психологічні архетипи. Підхід застосовано до концепту ЩАСТЯ в англійськомовній картині світу. Розкрито гуманістичний потенціал підходу в умовах техногенної кризи сьогодення.

Ключові слова: емоційний штучний інтелект, концепт емоції, ментальний образ, онтологія, слово-ім'я концепту емоції.

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Introduction

This paper holds that affective computing requires machine-interpretable representation of human knowledge about emotions, which is linguistically and culturally grounded, and proposes a way of how this grounding could be achieved.

In **affective computing**, artificial agents learn to detect, recognize, interpret, process, and simulate human emotions (Picard, 2000). Emotion is a cognitive phenomenon (Barrett, 2023), so machines' emotionality apparently enriches their rationality, with fair importance given to questions if and how machines think, and feel (Minsky, 2006). Artificial intelligence depends on data (Ovchinnikova, 2012), which navigates building artificial emotional intelligence, too (Kumar & Martin, 2023): human knowledge about emotions, human qualia of emotions included, must optimally be translated into a database, integrating this knowledge for natural language understanding. **Verbal report**, *ie* using words to describe emotions, is, as Feldman Barrett (1996, p. 47) puts it, "the most reliable and possibly only window that researchers have on conscious, subjective, emotional experience," with emotions detected in emoters' speech in natural contexts; indeed, it is language that human knowledge is expressed in (Steedman, 2008).

We accentuate sign-symbolic nature of words in human languages, as emotion names as signs **describe emotions**, whereas emotion names as symbols **depict emotions**; this rests on universal mechanism of linguistic meaning-making, in which non-propositional thought as a set of modal mental representations is converted into propositional thought as a set of amodal mental representations, and back (Vakhovska, 2023, p. 195-197). Artifact we use to fix sign-symbolic properties of a word is the semiotic passport of this word (term by Vasko, 2019).

Emotions are phenomena of the objective world that are subjectively experienced by humans as qualia. **Emotion concepts** are pieces of structured information about emotions that the human mind operates on for purposes of cognition; emotion concepts make a fragment in the conceptual worldview, and are a conceptual category. **Emotion names** are words of natural language that serve purposes of communication; emotion names make a fragment in linguistic worldview, and are a lexical-semantic field; this field maps onto the conceptual category of emotion, each word in the field naming a distinct concept in the category (Vakhovska, 2017, p. 9-27). Emotion names as words take this paper's centerstage.

The context that this paper works in is that of emotions that get computed for the purposes of human-centered artificial intelligence, tackling *the problem* of culture-specific information that the linguistic concepts of human emotions bear in different national worldviews. *This paper's objective* is to show, first, that words for emotions in different languages contain original, *ie* archaic, information about respective emotions (this information is represented in the form of images, and relates to words for emotions as symbols), and eventual, *ie* modern, information about respective emotions (this information is represented in the form of propositions, and relates to words for emotions as signs), and, second, that this information, both original and eventual, lends itself to structuring with the help of frames and to modeling with the help of ontologies, which makes this information machine-interpretable when formalized. This paper's objective frames *the theoretical concepts* that are presented in the progression of this paper's sections that follow.

Theoretical framework

Sign-symbolic nature of the word

Sign-symbolic nature of words in human languages has arisen through evolution, when archaic consciousness in humans transitioned to their modern one, with format of mental representations converting from modal to amodal (Vakhovska, 2024, p. 52-53).

On evolutionary view, **archaic consciousness**, mythical consciousness in particular, had featured **mental images**, before it gave way to **modern consciousness** that consists in **concepts** (Gebser, 1986), where we understand that archaic images, rather than simply vanish, have left their trace, making the diachronic depths of modern concepts (Vakhovska, 2023, p. 196-197). Diachronic depth of a concept is "the archaic image whose formation in the human mind was prerequisite for this concept to emerge" (Vakhovska, 2024, p. 51); this image is a symbol, as mythical thinking is "representing the world with the help of images as symbols for the phenomena of this world" (Vakhovska, 2023, p. 197).

Images are phylogenetically older than words, where we find that first words in **human evolution** were symbols whose forms and meanings were in a sacred way syncretic, owing to those images of the world that appeared in the emerging consciousness of early men (Makovsky, 2012). With time, this syncretism fell apart, with the result that human words became signs whose forms and meanings were now connected but arbitrarily.

Word as sign relates to propositional thinking, making "one's understanding of the world" (Vakhovska, 2023, p. 195); **word as symbol** relates to non-propositional thinking, making "one's view of the world" (ibid.), or **worldview** as symbolic space (Grace, 1987) and semiosphere (Lotman, 2010) inside which speakers of this language live. Semiosphere enables linguistic semiosis, making human communication possible, as languages are functions derived from their semiospheres, with cultural specificity of each.

Semiotic passport of a word: form and content of a word

> *"Stat rosa pristina nomine, nomina nuda tenemus"*
> Eco (1994, p. 531)

Semiotic passport of a word is languacultural artifact that fixes sign-symbolic nature of this word, which requires that the word be reconstructed as sign-symbol whose semantic properties are propositional, as those of sign, and non-propositional, as those of symbol.

Principle of making the semiotic passport of a word is semasiological, as one proceeds from linguistic form to linguistic meaning, exposing the mental entities that **this word's form** as a linguistic entity contains. These mental entities are **this word's meaning** as propositional thought humans think about the referent presenting itself to them, and **the mental image** that once motivated, and converted into, this word's meaning as non-propositional thought humans thought about that same referent at the moment it presented itself, and the word was created (Vakhovska, 2022b, p. 180-181). Referents present themselves to humans in the world, and humans represent these in the mind either non-propositionally or propositionally, with the result that mental images depict those referents that words can only describe.

Words are nominative constructs, as both form and meaning of a word are made up of elements of different order arranged into more or less complex structures. **Form of a word** is the body of formal features that individuate this word in terms of certain grammatical categories, *eg* arrangement of **morphemes** in Russian *преподавательница* "a female lecturer" suggests that this is a feminine singular noun in the nominative case. As words are made up of morphemes, words' morphological structure consists of formative base and of pre- and postformants attached to this base (Karaulov, 1997, p. 603-604).

Morphemes are meaningful constituents of words, with peculiar sound composition, and with sequencing of theirs that proves combinatorial, in the sense that the meaning of such a sequence is compositional: it is the function of meanings of its constituents, and of the way constituents combine, and is analyzed in their terms, enacting the complex interface between word's formal and semantic structures (Booij, 2005, p. 207-213).

Meaning of a word is this word's content emerging due to representation in human consciousness of the extralinguisitic reality, or the world (Karaulov, 1997, p. 140). Meaning of a word is the concept that this word captures (Kubryakova, 1997, p. 89-93); words name and linguistically manifest concepts that find themselves in the human mind, but not in the world or language.

Word meanings are complex structures of central and peripheral semantic components. Components in **intension of meaning** are central, and underpin processes of categorization (Zhabotynska, 2013a, p. 48-62). Intensions are given in language dictionaries as signified meanings of words. Less central and more peripheral components, depending on their gravitation toward the intension, make implication of meaning.

Regions in **implication of meaning** are strict implication (intension's most probable companions whose absence, yet, does not expel the concept from its category), highly probable implication (intension's more probable companions), and weak implication (free components whose link with intension is as much probable as improbable, which is contingent on the ground that one takes for categorization in each particular case); these are fuzzy sets making a center-to-periphery continuum. Implication can be improbable, too, as in negative implication (Nikitin, 2007, p. 102-135). Knowledge of language is knowing

both what is probable and improbable for referents in the world, *eg* emotions provide affordance to think about themselves in some rather than other ways, distinguishing metaphors from non-metaphors in how humans conceptualize emotions.

Mental image is pictorial representation in the human mind of the referent presenting itself in the world, in the visual modality in the first place (Kosslyn, 1980), with the result that humans see images in their mind's eye.

Words contain mental images in words' inner forms (Vakhovska, 2022b, p. 180-181). Word's outer form is phonic and graphic container for this word's meaning. **Word's inner form** is "a fragment of this word's meaning that in its own time motivated this word to emerge in its peculiar outer form into language" (Vakhovska, 2024, p. 52, citing Potebnya, 1892, p. 102). This is **archaic image** that "has pictorial resemblance to the referent of the word, in view of how this referent presented itself, emerging into consciousness of man who gave this referent its name" (Vakhovska, 2024, p. 52, citing Potebnya, 1892, p. 102). This image makes the diachronic depth of the respective concept (Vakhovska, 2023, p. 196-197), and "acts as a seed generating in a culture those multiple mental representations that the concept eventually comes to subsume" (Vakhovska, & Isaienko, 2021, p. 244). All words in human languages are modal because of their inner forms, as long as words retain in their content a relationship to that modality which was the source of their origin (Vakhovska, 2024); see Figure 1, with a solid line for motivated relationship between form and referent, based on Zhabotynska (2013b).
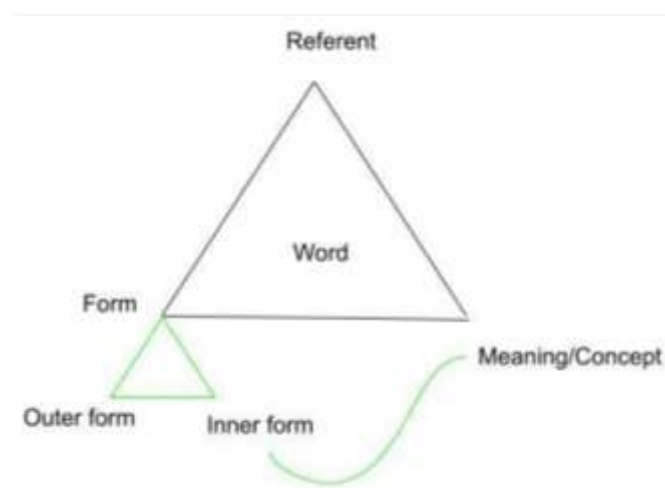
Figure 1. Word as sign-symbol, per Zhabotynska (2013b)

Absence of motivated relationship characterizes words as signs; in this sense, words are amodal; see Figure 2, with a dotted line for arbitrary relationship between form and referent, based on Ogden, & Richards (1923).
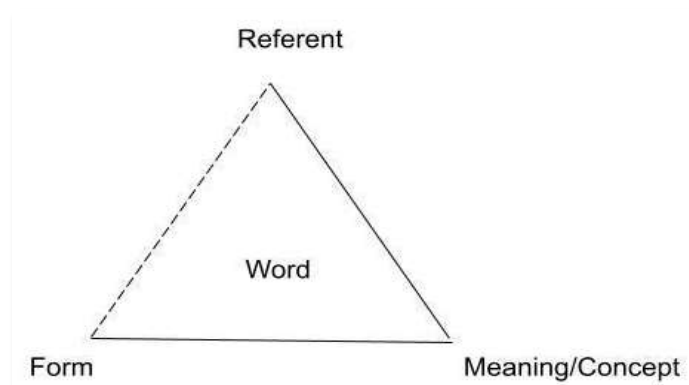
Figure 2. Word as sign, per Ogden, & Richards (1923)

Word inner forms are multimodal, as "visual and auditory perception becomes syncretic in them: visual and auditory modalities interact in acts of word interpretation, with humans switching between visual and auditory codes" (Vakhovska & Jusuk, 2021, p. 63), which is recorded in activity of the brain: brain's auditory regions get activated to process word forms (word outer forms, in our terminology), while brain's visual regions yield processing of word meanings (Hasson, 2016; Zada et al., 2023; Kumar et al., 2024).

Word inner forms "make a subset in the set of mental images," with difference that word inner forms are **archetypal images** (Vakhovska, 2022b, p. 181-184; *qv* Jung, 1947). Archetypal image "can be something as simple as a static dream image or it can be an entire narrative in complexity, as stories can be metaphors just as static images can" (Goodwyn, 2011, p. 56). Word inner forms appear both as singular images and as sequences of images, with certain regularities of arrangement within their particular cultures. Combination of images, similarly to that of morphemes, has a compositional meaning of its own. This is "denotation by depiction" (Eisenstein, 1929, p. 30-35), with combination of two or three more or less simple images producing "an imagist effect" (ibid., 31) to represent a complex abstract concept. Effect is not in the content as such, but rather in the way in which this content is (re-)presented (Shershnova, 2020).

Such narratives give different quale, and different knowledge, of happiness in English and Ukrainian worldviews (Vakhovska, 2024, p. 54-55). Pictorially, this is different happiness, as image at diachronic depth of HAPPINESS in each worldview comes in different sequence, contrasting movement of Deity in the vertical world to that of man in the horizontal world.

Semiotic passport of a word: data-relevance problem, and a solution

> *"One does not put what cannot be boiled into the pot"*
> East Slavic proverb

Relevance we primarily need presume here is that to the purpose of building **human-centered artificial emotional intelligence**, using this paper's framework to that end.

This paper primes larger-scale research, aiming not to create another lexicographic source, but to let artificial agents understand what we humans know about our emotions, and what we humans mean when we use particular words for emotions we experience and for emotion concepts we have in mind. On that, aspects in data-relevance problem, and practical solution we tentatively offer, are as follows:

In hand-crafting words' semiotic passports, question *What is the word?* must first be answered, as **word** is the subject with centuries-old history in various disciplines of human knowledge, each discipline holding various points of view, and yet with transcendence into the unknowable, as the Word was in the beginning, *ie* prior to humans and any human knowledge, as we understand it. Views we deem relevant are that word is a minimal free form in language that can occur by itself and be meaningful (Bloomfield, 1933), and that word is cardinal element of language faculty in humans, as it relates conceptual and linguistic worldviews, ensuring relation for human cognition and communication (Kubryakova, 2004). Our theoretical perspective is that word is a sign-symbol, which determines **structure of the word's semiotic passport** in the composition of two items: **archaic image** at the diachronic depth, and **modern content** of the concept that this word is the name to. Passport is semiotic because it documents the word as a "citizen" of a particular semiosphere. Notably, passport opens with citizen's picture and includes relevant data on citizen's life; citizens need passports to go abroad, *ie* to other semiospheres, which occurs in word borrowing.

Practically, though, passport-maker needs to know not what the word of language is, but rather what the words of particular language(s) are. On that practical understanding, authoritative dictionaries, perhaps of various types, must be consulted, as dictionaries do not normally contain non-words; one makes sure that *happiness* is **a word of English**, and *щастя* "happiness" is **a word of Ukrainian**, and that these are translation equivalents. With this respect, passports can be considered only as resource, compared to dictionaries as source. Semiotic passports are source of a different kind of knowledge, *ie* knowledge of what makes these words into elements of their semiosphere, which is unique. It is their sign-symbolic nature that characterizes words as such elements.

Another practical question is *Which morphemes in a word's makeup must this word's semiotic passport hold?* We mean that passport can and should withhold some morphemes in word's makeup. Rationale behind this solution is that linguistic worldview holds knowledge of language as system of forms, and

knowledge in language as system of meanings (Kubryakova, 2004). It is **knowledge in language** that we find relevant to represent at the ontological level, for machines.

Grammatical meaning depends on lexical meaning, not vice versa, with combinations of morphemes enriching words' semantic structures in the first place. We suggest that morphemes in word's makeup be given different weights, depending on the contribution each morpheme makes into this word's compositional meaning. Weight belongs to morphemes that contribute to the compositional lexical rather than grammatical meaning of a word, and in doing so enrich etymological interpretation of this word (see Methodology), showing the image that once motivated this word.

Example is English *happiness* and Ukrainian *щастя*, where the postformant *-ness* in *happiness* (Old English **hæp*) serves to form a common non-count abstract noun, while the postformant *-я* in *щастя* (**-je* in Old East Slavic **sъčęstьje*) not only serves to form such a noun but also contributes "collection of parts" in word's compositional meaning (Vakhovska & Borozenets, 2023, p. 31-32). So, *-я* is given **semantic weight**, with result that featuring *-ness* in semiotic passport of *happiness* is irrelevant, while semiotic passport of *щастя* must feature *-я*, together with *-част-* (**čęstь*) "a part" and *c-* (**sъ-*) "good," which confirms that Ukrainian is (highly) synthetic, whereas English is (growingly) analytic. Cf. Levitsky's (2012, p. 228-229) judgment on correlation between a word's length in morphemes and this word's semantic volume, regarding linguistic typology. Morphologies of languages naturally vary, each with rules for building and understanding words of its language; passport-maker's responsibility is to weigh morphemes in each particular word for the nature and amount of meaning they carry.

Calibrating word's morphemes for their semantic weight postpones the part-of-speech theorizing that would otherwise be the case, as we make passports for emotion names as nouns but not adjectives. Practically, we work with morphemes that constitute emotion names, and we find that these same morphemes constitute both nouns and adjectives, as **happ-* in *happiness* and *happy*. We make semiotic passport of *happiness*, considering that category of object is primary among **ontological categories known by humans**, objects coming first when one experiences and cognizes the world (Rudenko, 1990). Nouns denote thingness, substituting in the mind things as such (physical object :: mental object). On that, *happiness* substitutes emotion *per se*, whereas *happy* does not, as adjectives denote properties of things; intuitively, *happy* is property of an emoter, while *happiness* is that very emotion itself.

Solution resonates with convention to label etymological archetypes in historical linguistics, *eg* Proto-Germanic **happ-* "to bend" is hypothetical original form of *happiness* (Levitsky, 2010, p. 248). Words' archetypes are panchronic; they are free from theoretical speculation and linguistic fashion, and have special relevance in view of transdisciplinarity. Solution adds practical value, agreeing in principle with stemming in data retrieval. More so, it promotes **psychological realism**, creating opportunities for non-superficial match between human and artificial minds, where we find it relevant to associate word meanings with naïve worldviews that are language-dependent and culture-specific, while scientific worldview is language- and culture-generic (Apresyan, 1974, p. 57-59). Scherer (2005) analyzes links between scientific and naïve concepts of emotion, accentuating "primary role of natural language categories for emotions as reflected by emotion words" (ibid., 717). These categories come as roots and stems of English nouns and adjectives; HAPPINESS is "*cheer**, *bliss**, *delect**, *delight**, *enchant**, *enjoy**, *felicit**, *happ**, *merr**" (ibid., p. 714-715), making one understand that HAPPINESS has *happ** as its name.

Basic-level knowledge ordinary people have of their emotions can help ensure the match. We take these emotions as basic, too. Whereas we now work with HAPPINESS in English worldview, and with *happiness* in English, we locate prospect in working with other **basic emotions** (Ekman, 1980) humans conceptualize in the mind and manifest in various languages. "Inquiry into a single language can suggest that linguistic meanings activate universal concepts, whereas comparative analysis shows that conceptualizations are linguistically (and culturally) grounded" (Głaz, 2022). Further work can include non-basic, and very non-basic (Smith, 2016), emotions, depending on scale of research. By and large, semiotic passports of emotion names from various languacultures need be collected into a database, for artificial minds to operate on the data.

Semiotic passport of a word: ontological dimension

> *"The word is given to us in order that we learn to think"*
> Kryshtal (2022, p. 250)

Semiotic passport of a word, given its cognitive, cultural, and discursive bearing, respects this word's evolutionary dynamics (Vakhovska, 2024) via the distinction between diachronic depth and diachronic variation of the concept that this word is the name to.

Semiotic passport contains **information**. Whereas "diachronic depth is original information making a concept's content in the archaic worldview, intension and implication are eventual information making this concept's content in the modern worldview, at different stages of concept's development. Information in a concept's content - either original or eventual - is structured using **frames** (Minsky, 1974) as tools for representing ontological knowledge" (Vakhovska, 2024, p. 57).

Ontology is knowledge model that specifies entities, their properties and links inside a domain (Peters & Shrobe, 2003). As we hold that human knowledge has archetypal basis, emotion concepts' diachronic depths appear rather non-trivial to specify, since images located there link indirectly to archetypes in the collective unconscious (Vakhovska, 2022b, p. 179). It is archetypes that wire human psyche to evolution and nature (Jung, 1947), making foreknowledge of all things humans know. Diachronic depth is a complex system of memory uniquely characterizing each distinct semiosphere (Lotman, 2010); even if humans are unaware of it, their archaic memories maintain strong influence, integrating as etymologies into mother tongues in the first place (Abaev, 1948).

We owe intuition to Dr. Jusuk, in personal communication, that archetypes "speak" to us humans in "language" of kazati; kazati illuminates and sparkles in the mundane stream of conscious thought, sending its ineffable short messages from the unconscious; kazati shows itself in dreams, too (Vakhovska & Jusuk, 2021). Slavic **kaz-/*čez-* is morpheme of productive derivation that inherits its meaning "to shine, speak, show" from Indo-European **keĝ-/*kek̂-* "luster, light; an appearance" (Levitsky, 2010, p. 456). This must be the light we humans can see in "windows" (Kryshtal, 2022, p. 52, 250) that occasionally open between the conscious and unconscious in the mind.

Artificial minds, unlike human minds, are not supported by psychological archetypes. So, **artificial minds must be given diachronic depths**, if match with humans is to be at least somewhat non-superficial. As evolution of human intelligence started with images, evolution from image to concept in a word must be taken by artificial intelligence, too, in order that it learns to think similarly to how humans think. We mean that *думать* "to think; to think a thought" differs from *мыслить* "to think," in that *думать* is to think thoughts that are prompted (*подсказаны*) by kazati from the depth of the mind, whereas *мыслить* is to operate on propositions of thought from the mind's surface. We humans can do both; machines think but never think thoughts.

Culture is "collective programming of the mind" (Hofstede, 1991, p. 5), with words as "gene-like codes transmitting culture-specific information through human generations" (Vakhovska & Isaienko, 2021, p. 244); cf. *сказки* "fairytales" in Propp (2001). In the eye of current planetary crisis, we humans need raise awareness of our **cultural knowledge**, perhaps even more than machines, so that words of our languages do not become empty of their original meanings, which threatens to alter or, worse yet, bring archetypal programs of our human life to a halt. Evolutionary survival of human species apparently depends on meaning. Words' database helps regain, unify, and promote this meaning, allowing for a common denominator for people within one culture, while fostering dialogue of various cultures, in appreciation of language and culture of each other's ancestors.

Methodology

Diachronic depth of HAPPINESS in English worldview was reconstructed in two steps. First, etymon of Modern English *happiness* was identified in Old English as *hæp*. This etymon inherently is a word, and also is a sign reconstructed via **etymological analysis** from Proto-Germanic **happą* < Proto-Indo European **kap-*.

Second, **archaic image** that motivated *happiness* at the moment of creation was shown via **etymological interpretation**, in form of "a mythical story narrated relative to rituals of pagans, as in their mind the world was represented with images as symbols for phenomena of this world, so that coherence is given to the archaic consciousness of men whose mind's eyes were looking at happiness" (Vakhovska, 2023, p. 197-198). Interpretation requires that we look at happiness with our mind's eye, taking a mythical view of the world.

Whereas in evolution images converted into words, we as interpreter need go in reverse in order to re-convert words into images.

Details and decisions as to data selection and analysis, as well as reconstruction, bibliographic references, and lexicographic sources are documented in Vakhovska (2024).

Content of HAPPINESS in early 21st century English worldview was reconstructed in four steps, based on data of modern English discourse, using semantics of lingual networks. This is theory of linguistic meaning, and methodology of conceptual analysis, in which concepts are analyzed as lexical meanings of their names, with concepts' content structured by propositions of basic frames (Zhabotynska, 2013a). **Proposition** is logical subject and logical predicate of this subject; each proposition belongs to a particular **frame**, depending on the semantic role of its predicate. Propositions have "the highest level of abstraction, or schematicity; they single out primary conceptual entities and basic attributes and relations of these, and are universal finite tools of human propositional thought in its infinite configurations. Each configuration of propositions is configuration of propositional thought, forming a conceptual network" (Vakhovska, 2022a, p. 121).

First, 1000 discourse fragments manifesting HAPPINESS as *happiness* were retrieved from British National Corpus; this was direct simple random sample. Second, predicate calculus was used to contextually detect in fragments the logical predicates of HAPPINESS. Third, propositions in the content of HAPPINESS were sorted based on frames they belong to, in virtue of their predicates. Fourth, conceptual network of HAPPINESS structured by propositions of basic frames was built.

Each proposition in the network has a prominence indicator. This is prominence of a proposition, "depending on how many linguistic expressions in the data are licensed to occur by this proposition; the bigger the number, the more prominent the proposition" (Vakhovska, 2021, p. 38). Based on their prominence, propositions were distributed into **intension** and **implication** of HAPPINESS. Levels to which these were generalized are as follows:

"***intension of meaning***,
strict implication - more than 50 expressions licensed by a proposition,
highly probable implication - 20-50 expressions,
weak implication - less than 20 expressions" (Vakhovska, 2021, p. 38).

Propositional knowledge about happiness was given the form of narrative. By analogy to mythical stories in Gebser (1986), this narrative is mental story about happiness. Narrative captures original information if one considers the diachronic depth of HAPPINESS; this is mythical story about happiness. Narrative captures eventual information if one considers the intension and implication of HAPPINESS; this is mental story about happiness. Both pieces of information were represented as **ontologies** structured by propositions of basic frames.

Details and decisions as to data selection and analysis, as well as reconstruction, and bibliographic references are documented in Vakhovska (2021).

Results and discussion

Semiotic passport of *happiness*

Two items in semiotic passport of *happiness* are archaic image at the diachronic depth, and propositions in the modern content of HAPPINESS in English worldview.

Archaic image that brought *happiness* into English is shown as narrative in Vakhovska (2024, p. 54-55). Whereas this image shows movement of man, image at the diachronic depth of HAPPINESS in Ukrainian worldview shows movement of Deity Who cuts off and bestows a good fate upon man. Man is creation of Deity. Man's fate is the part that is given to him by Deity. Man's happiness is the piece of common good that he is allowed by Deity to bite off (Vakhovska, 2024, p. 55). The images are apparently distinct, and in a unique way transcend their cultures, with the result that *happiness* and *щастя* are translatable but not interpretable in each other's terms (Vakhovska, 2022b).

Ontology with original information that *happiness* activates is in Figure 3.
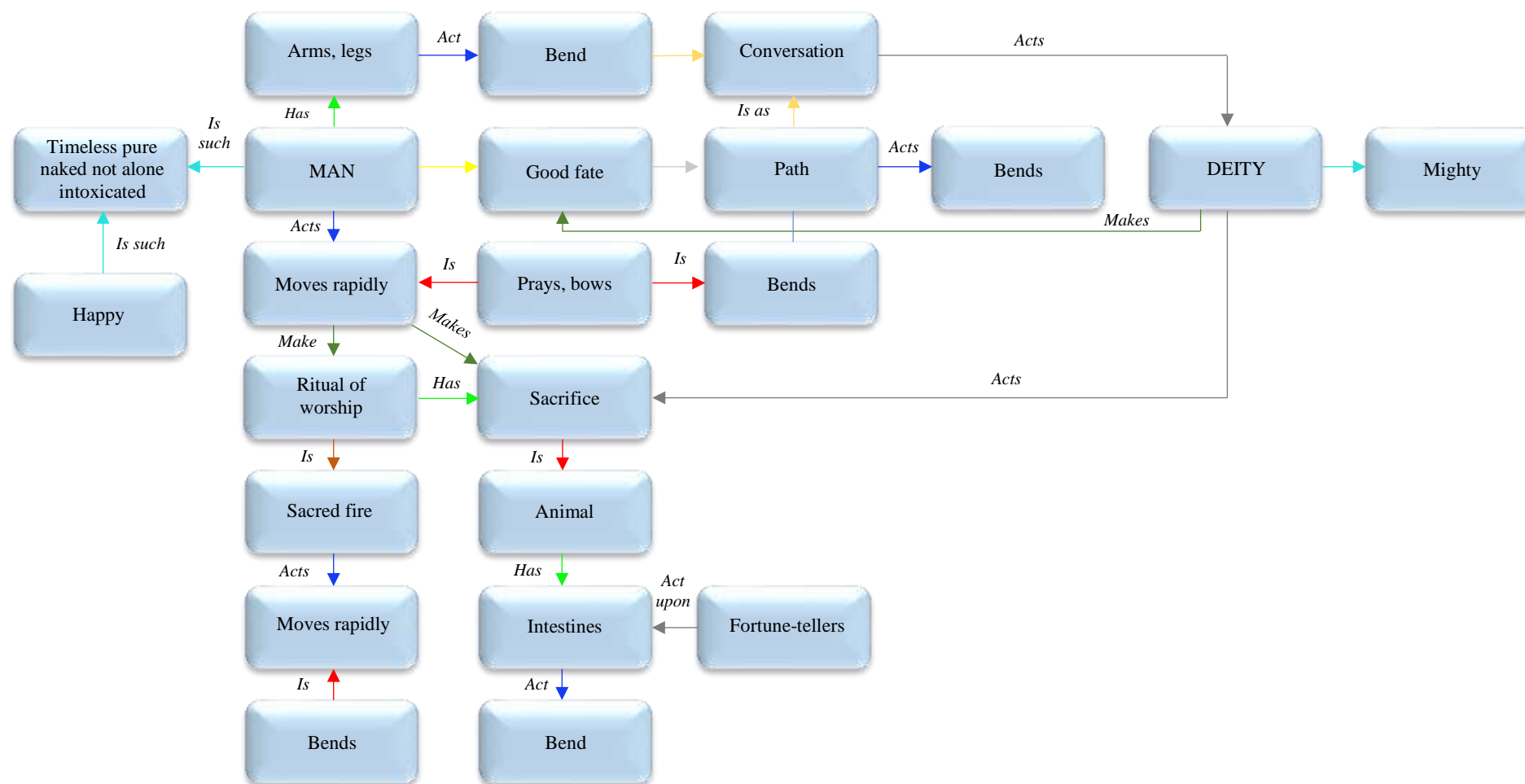
Figure 3. Ontology specifying the diachronic depth of HAPPINESS.

Content of HAPPINESS in early 21st century English worldview is given as narrative in Vakhovska (2021, p. 40). Represented as [numerical value] are numbers of linguistic expressions licensed to occur by respective propositions. (Note: diachronic depths are pre-written, and so impossible to give numerical values to.) Ontology with eventual information that *happiness* activates is in Figure 3, as per Vakhovska (2021, p. 44) where differently colored arrows show frames and their propositions, while colored boxes show intension (red) and strict (orange), highly probable (purple), and weak (gray) implication in the meaning of *happiness*. Knowledge of happiness that this ontology represents is culture-specific. On the whole, ontologies of this kind can be built in respect to earlier written periods in historical time, suggesting the diachronic variation of HAPPINESS in English worldview, *ie* fragments of English discourse must be sampled that were generated during intended periods of time, so that one can fill with meaningful data the semantic continuum that stretches, as an evolution, in between the concept's origin and modern state. Alternatively, HAPPINESS in some very special worldview, *eg* "underlying worldview of the next Aristotle" (Jobs, 1985), could be captured in computer this way.

This paper's prospect is in **formalizing ontologies** for HAPPINESS in Web Ontology Language, using Protégé ontology editor, in view of the archaic image at this concept's diachronic depth, and of this concept's propositional content in the early 21st century.

Advantages that this paper's approach implies for the field of artificial emotional intelligence bear largely on the fact that affective computing refers not only to certain technological functions in emotion detection, recognition, interpretation, processing, and simulation, as per (Picard, 2000), but also to major and imperative social processes, in which **cultural expectations** and **cultural differences** take on a critical role of the regulator, with the result that the concept of culture has become more and more often applied in the development of artificially intelligent systems (White, & Katsuno, 2022) and also in the evaluation of such systems in terms of (non-)humanistic criteria in particular (Sufyan et al., 2024).

The traditional focus on cultural attitudes and behaviors that prove formative for emotional agents (*qv* Osgood, May, & Miron, 1975; Scherer, Bänziger, & Roesch, 2010) is by this paper's approach extended in a non-trivial way to include the fine-grained aspects of humans' **cultural embodiment**, *cf* Allbeck, & Badler (2004), which promises to align machines with humans better - more naturally, more intuitively, and, above all, civilizationally safer, *cf* Yonck (2017), - and which does align itself with the **evolution** of human intelligence that once started with images of the world, such as cave drawings showing people in worship around the sacred fire, and then continued with abstract concepts, such as the concept of human happiness (*qv* Porshnev, 1974, p. 380-459).

Archaic images that this paper shows at the diachronic depths of emotion concepts testify to the fact that words for emotions universally are linguistic signs that enable human communication and simultaneously are cultural symbols that imbibe, and are motivated by, human subjective experiences (*cf* Łozowski, 2023; Jarosz, 2020, p. 33-51), where we understand that these experiences come through (visual) perception and are phenomenal (*qv* Merleau-Ponty, 1962; Barsalou, 1999), and where we emphasize that these experiences make the unspoken information that words for human emotions carry, *cf* Smith (2016), which promises to equip emotional agents with unprecedented capacities for both **inter- and cross-cultural communication**, *qv* Isbister (2004). This unspoken information comes to be explicated and given a semantic weight to, *cf* Ballout, Krumnack, Heidemann, & Kühnberger (2023), while the multimodal format of how this information is represented is maintained, *cf* Loveys, Sagar, & Broadbent (2020). More than that, the point we make is that artificial minds, unlike human minds, are not supported by psychological archetypes, as long as images at emotion concepts' diachronic depths are archetypal, *cf* Goodwyn (2020).

This paper's approach suggests a viable link between **ontology of human existence** (Hofweber, 2023), **natural language ontology** in particular (Moltmann, 2022), and **ontology as a computational artifact** intended to capture "everything that is there." Ontologies as computational artifacts are gaining an increased importance nowadays, helping sort, organize, and analyse data, and creating an unambiguous semantic basis for human knowledge management (Strassner, 2008), with the result that this knowledge is standardized and can efficiently be shared (Gal, 2009; Staab & Studer, 2009) and utilized by various technologies (Kendall & McGuinness, 2019). In artificial emotional intelligence, standardization of this kind bears on the need of determining the baseline dataset (Wang et al., 2022), where we envisage that a shared vocabulary of emotion words will foster understanding of the related data in different formats (*ie* visual and textual) and in different languages (*eg* English and Ukrainian), enabling the meaningful use and reuse of human knowledge about emotions by both humans and machines.

We subscribe to the opinion expressed in Ojha, Vitale, & Williams (2021) that all the existing approaches to affective computing have *a limitation* in them, the fault of our approach, as we see it, consisting in the fact that the archaic knowledge about emotions we wish humans and machines to connect to via ontologies is largely tacit in nature, as this knowledge was acquired from our personal experience, in particular that of education and continuous linguistic and etymological research, and comes in combination with intuition, though this intuition in researchers is habitually an informed one, *cf* Levitsky (2010, p. 23-40). As **tacit knowledge** does not lend itself to explication easily (*qv* Nickols, 2000), we remain open to discussing the implicit knowledge we have instilled in this paper with subject matter experts in the field.

Conclusions

This paper has proposed a way of how the linguistic and cultural grounding of human knowledge about emotions could be achieved for machines, in visually representing knowledge that human words for emotions contain. *Originality* of this paper is in the fact that it looks at the linguistic concepts of human emotions from within their diachronic depths, and sees the archaic images that at their own time converted into these concepts, thereby plugging emotion concepts into the evolution of human intelligence and then placing these concepts at the junction of ontology of human existence, natural language ontology in particular, on the one hand, and ontology as a computational artifact, on the other, with the understanding that the latter is intended to structure and formalize the former, in letting machines understand what humans know about their emotions. This paper's *future line of research* is to investigate the other basic emotion concepts, using the framework developed for HAPPINESS towards that end.

We leave it at discretion of this paper's readers to disambiguate *happy men and machines* in its title, deciding if machines are also happy. We in the meanwhile share our belief that machines cannot naturally and genuinely be happy. This can only be a matter of the degree of persuasiveness in how convincingly machines simulate human emotions. When so much gets nowadays simulated, we commit naturality to humans.

Quo vadis, homine?, as words of wisdom go.

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