

A vocabulary of meaning of designed commercial artefacts based on naturally occurring language use

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Abstract

This study is a survey of the English language words which are used when speaking about meaning with specific focus on the categories of function, ritual and myth. Such words can be used in interviews, questionnaires, measurement metrics and other forms of ethnography and testing.

Understanding why consumers perceive designed artefacts to be personally relevant is a commercial imperative. Previous research has suggested that three categories of meaning are commonly encountered, i.e. function, ritual and myth. They cover a spectrum from the purely instrumental to the purely symbolic. However, despite the logical and philosophical groundwork there has been little analysis of the actual words and phrases which are in everyday use by people when describing the meanings of designed artefacts.

The objectives of the study described here were (1) to identify the words and phrases which are most frequently encountered in everyday language when discussing meaning, (2) to determine for each word or phrase its degree of belonging to the formal categories of function, ritual and myth, and (3) to thematically group the words and phrases into macro-components of meaning. Three different analysis were performed. The first was based on the contents of major online dictionaries and thesauri, the second was based on the results from queries of the online lexical database WordNet and the third was based on a corpus analysis approach involving neural network word embedding algorithms.

Thematic grouping of the database of extracted words and phrases suggested that in all three cases the macro-components of the concept of ‘function’, ‘ritual’ and ‘myth’ cover a spectrum which can be considered to be from an essential property (‘intention’, ‘ceremonial’ and ‘belief’) to an emergent property (‘action’, ‘spiritual’ and ‘symbolism’). The list of words, phrases and macro-components provides a first empirically established vocabulary of meaning for use in design activity.

Keywords: words, function, ritual, myth, meaning, human centred design

1 Introduction

In 1959 Sidney J. Levy (1959, p.119) wrote that ‘the things people buy are seen to have personal and social meanings in addition to their functions.’ And Csikszentmihalyi and Rochberg-Halton (1981) added that beyond function, artefacts are also relational mediators which shape the long term aims, objectives and behaviours of an individual or of a group. Baudrillard (1968) suggested that people value objects not for what they do, or what they are made of, but for what they signify. And Douglas and Baron (2021) extended the logic by suggesting that rather than personal preferences, it is best to think of consumption as an information system which is used by humans to relate to each other.

While it is generally assumed that the consumption of designed commercial artefacts plays an important role in the way people communicate, create identity, and establish relationships (Douglas and Isherwood 2021, Baudrillard 1968), relatively little empirical work has focused specifically on why the designed commercial artefacts are seen as salient choice criteria (Reynolds and Olson 2000). The reasons why consumers perceive artefacts to be personally meaningful (Black 1973) are not always understood. At the moment, the meaning or meanings of many designed commercial artefacts are more the result of unconnected design decisions than the result of carefully executed ethnography and detailed consumer interactions.

In most cases an artefact's principle significance is in fact its ability to provide and communicate meaning. Research studies in disciplines as diverse as business history (Williams, 1982), sociology (Bourdieu 1984, du Gay 1997), anthropology (Belk 1985, McCracken 1986), consumer behaviour (Holbrook and Hirschman 1982, Batey 2008, Holt and Cameron, 2010, Douglas and Baron 2021), design-driven innovation (Verganti, 2009) and human-centred design (Diller et al., 2005, Krippendorff and Butter, 2007, Giacomini, 2014, Giacomini 2017) have all provided evidence that consumers select artefacts not only for their practical benefits, but also, perhaps mainly, for their meaning.

Standard English language dictionaries suggest that the word '*meaning*' can express at least three concepts: (1) the thing or idea that a sound, word or sign represents; (2) the things or ideas that somebody wishes to communicate by what they say or do; and (3) the significance or sense of purpose that makes you feel that your life is valuable. The same standard dictionaries suggest that the word '*value*' can instead express: (1) the amount of money that can be received for something; (2) how useful something is; and (3) the importance or worth of something for someone.

The words '*meaning*' and '*value*' are often used interchangeably in design settings but actually express different concepts. For example, Diller et al. (2005, p.36) have claimed that "values involve preferences; they represent our choices between opposing modes of behaviour, and they are shaped not only by ourselves, but also by those around us", whereas "meaning provides a framework for assessing what we value, believe, condone, and desire" (Diller et al. 2005, p.23). And Richins (1994) has suggested that an artefact's value derives from its meaning within the cultural system. Diller et al. 2005 (p.24) further states that "meaning is the sense we make of reality. Assigning meaning to experience is how each of us creates the story of our life and its ultimate value and purpose". Meaning is thus a main source of value, but value is not usually a main source of meaning.

The sense of the word '*meaning*' used in the current study is close to English language words such as '*purpose*', '*significance*', '*motivation*' and '*importance*'. It involves the reasons why a person engages with something, what value that engagement might have for the person, and the place that engagement might occupy in that person's subjective realm of life. It refers to the '*reason why*' a designed artefact has value for the person in the operational and social context of its use. And it does not refer to single experiences, since meaning is rarely solely about one specific moment in time (Mekler and Hornbæk, 2019).

Most previous research has approached the topic of artefact meaning from a product attribute perspective. A product's meaning has usually been considered to be a function of its observable physical characteristics (Gutman, 1982, Reynolds & Gutman, 1988, Kleine and Kernan 1988, Reynolds and Olson 2000). And most of the research has assumed that meaning falls within self-evident taxonomic categories (Park et al. 1986, Fournier 1991, Smith and Colgate 2007, Almquist et al. 2016) despite the diverging perceptual modes (Dewey 1934) of individual consumers and despite many artefacts possessing polysemic (i.e. multi-meaning) characteristics (Justeson and Katz 1995, Csikszentmihalyi and Rochberg-Halton 1981).

Despite the gaps in the current understanding of why consumers perceive designed artefacts to be personally meaningful, it is nevertheless the case that the increasing complexity and cost of new products, systems and services have recently led to a greater focus on artefact meaning and to targets

being set in many design processes. The challenge is thus to find ways to discuss meaning, to specify it and to measure its achievement.

One approach for discussing meaning was suggested by Giacomini (2017). The core of the framework is a set of three categories of meaning which cover the spectrum from the purely instrumental to the purely symbolic. The three categories of function, ritual and myth were identified from literature review and validated via empirical studies (see for example Ajovalasit and Giacomini 2019). The premise is to consider the three forms of meaning, to prioritise one or more of them, and to evaluate their achievement at every point in the design process with at least the major stakeholders.

A current weakness in the approach proposed by Giacomini (2017) and in the other studies of designed artefact meaning is uncertainty regarding the most relevant and most efficient words to use when performing the ethnographic and design activities. It is not obvious which words and phrases should be used, and which ideas should be raised when talking about the meaning of a designed commercial artefact. Discussing a concept as complex as meaning requires precise language, and the words and phrases become even more critical if used as components of a system of measurement. The issue is compounded by the fact that words are not only denotative and literal in nature, they are also connotative and metaphorical. Words establish webs of connectivities and temporal sequences which, when assembled, form thoughts.

Natural language is both an abstract system of phonetics, grammar, lexicon, etc. and a context-based system of communication (Baker, 2013). Wittgenstein emphasised the context of usage when he argued that language is a human activity and that its meaning is found in the activity which it accomplishes (Krippendorff, 2006). Word meanings are highly dependent on their context and their purpose of use. And both actions and experiences have in fact been found to be prevalent in everyday language usage, providing the background contexts which are needed to determine the exact word meanings (Dourish, 2004).

Identifying semantically relevant words (Stubbs 2001b) which co-occur with the words function, ritual and myth is therefore a useful exercise which provides a vocabulary for discussing the meaning of designed artefacts. Such words may even constitute an empirically derived taxonomy of meaning for use when designing artefacts.

The objectives of the study described here were (1) to identify the words and phrases which are most frequently encountered in everyday English language when discussing meaning, (2) to determine for each word or word group its degree of belonging to the formal categories of function, ritual and myth, and (3) to thematically group the words and phrases into macro-components of meaning. Three different analysis were performed. The first was based on the contents of major online dictionaries and thesauri, the second was based on the results from queries of the online lexical database WordNet and the third was based on a corpus analysis approach involving neural network word embedding algorithms.

2 Method

Figure 1 presents the main activities which constituted the study. Three approaches were used to identify the words and phrases which are most frequently encountered in discussions of meaning and to establish their degree of belonging to the formal categories of function, ritual and myth.

The first approach involved standard online dictionaries and standard online thesauri of the English language. Dictionaries and thesauri were considered to provide a formally agreed, and professionally approved, set of words and phrases which describe a given word. Five online resources were selected for use in the current study based on their ubiquity and on their frequency of encounter in academic writing: the Macmillan Thesaurus (Macmillan Education Limited, 2022), the Merriam-Webster The-

saurus (Merriam-Webster Incorporated, 2022), the Cambridge English Dictionary (Cambridge University Press, 2022), the Collins Thesaurus (Collins, 2022) and Thesaurus.com (Dictionary.com LLC, 2022).

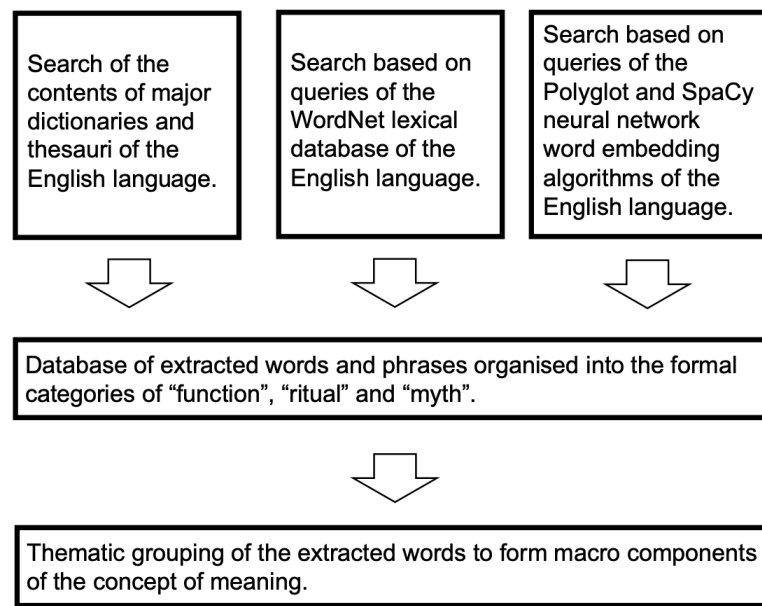


Figure 1: Extraction of semantically related words and phrases, their grouping and their use in defining macro-components of meaning.

A search was performed by manually interrogating each online resource using the target words of function, ritual and myth. Semantically related words were extracted based on their frequency of occurrence (i.e. based on the number of times that they appeared) and based on their applicability (extraction was guaranteed for words or phrases which were applicable to general contexts but not necessarily for those which appeared applicable only within highly specialised contexts).

The extracted words and phrases were placed in a table under the headings of function, ritual and myth. The degree of belonging to the formal category (function, ritual or myth) was estimated by counting the number of times that each word or phrase occurred within that category. The words and phrases extracted from the online resources provided a baseline of semantically related words.

The second approach involved the use of WordNet (Fellbaum, 1998), a large online lexical database of the English language. WordNet currently contains approximately 95,600 different word forms gathered from a variety of English language resources including the COMLEX common lexicon (Macleod et al. 1994). In WordNet, the word forms are organised into approximately 70,100 synonym sets (synsets) which consist of nouns, verbs, adjectives and adverbs which were manually grouped together by the developers to express a distinct concept. WordNet can be considered to be a combination and extension of a dictionary and a thesaurus.

The most frequently encoded relation in WordNet is the super-subordinate relation (also called hyperonymy, hyponymy or ISA relation). It links general terms such as {furniture} to increasingly specific ones such as {bed} and {bunkbed}. The location (Justeson and Katz, 1995) of a word in WordNet helps to semantically disambiguate it. Those words which are in close proximity can be considered to be close in their sense and meaning. Those words which are instead distant in WordNet are usually considered to be more distant in terms of their sense and meaning. And, unlike a thesaurus which uses frequency of occurrence as the index of familial similarity, WordNet adopts instead

polysemy. Each word or phrase has an associated count of the number meanings which can be found for it within the WordNet database.

Searches were performed by querying WordNet using the target words of function, ritual and myth. To limit the analysis to a manageable number of the words and phrases, similar to the number extracted from the online dictionaries and thesauri, the ten most frequently occurring lexical entries were extracted. The words and phrases which were extracted from WordNet provided a widened set of semantically related words with respect to those extracted from the online dictionaries and thesauri, involving additional contexts and additional forms of familial similarity.

The third approach involved the use of linguistic corpora. A linguistic corpus is a collection of thousands or even millions of words (Stubbs 2001, Baker 2006, McEnery and Hardie 2011). Stored on computers, linguistic corpora are examples of naturally occurring language which contain the words and word meanings which the people of the specific era, geographic location or group normally used within their cultural system. Computer encoding allows the algorithmic querying of a selected corpus, revealing frequency information and linguistic patterns which would otherwise require a significant amount of time to be uncovered by hand (Baker, 2013).

Two corpora served as the basis for the current study. The first corpus was the English language Wikipedia website dataset for the year 2013 which consists of more than 100,000 words (Meta-Wiki, 2022). The Wikipedia website dataset contains mostly written examples of professional and disciplinary writing such as reports and the works produced by committees. The second corpus was the popular Reddit Hivemind website dataset (Baumgartner, 2022) for the year 2015 which consists of 2.86 billion English language words. The Reddit Hivemind website dataset contains mostly written examples of subjective, informal, everyday language usage such as the comments posted by people on websites.

Word embedding algorithms (see Bengio et al. 2003, Collobert et al. 2011 for details) were used to query the two corpora with the target words of function, ritual and myth. Embedding methods (also known as encoding methods or vectorising methods) convert symbolic representations such as words into numbers. Word embedding algorithms map each given word to a feature vector in a high dimensional space. The multiple dimensions of the vector space permit the representation of multiple concepts, thus permitting multiple ways in which any two words might prove similar. Word embedding algorithms thus represent words as vectors which can be analysed statistically to estimate the degree of similarity between any two words.

Neural network based embedding algorithms were used in the current study due to their superior performance in preserving linear regularities among words (Bengio et al., 2003) with respect to other well-known approaches such as Latent Semantic Analysis (LSA) and Latent Dirichlet Allocation (LDA) (see Altszyler et al., 2017). Two open-source neural network based embedding algorithms were selected for use from among those which are publicly and freely available.

The first tool was the Polyglot neural network embedding algorithm (Al-Rfou, 2015) which had been trained by its developers using the Wikipedia 2013 corpus. In Polyglot, each word or phrase is embedded as a 64-dimensional vector which captures the sense of the word or phrase. The 64-dimensional embedding used in Polyglot is proprietary, but has however been made publicly available for general use (Al-Rfou, 2015b). The embedding format was itself the result of neural network training and optimisation, using a large dataset of linguistic corpora from 117 different languages (Al-Rfou et al., 2013).

The second tool was the spaCy neural network embedding algorithm (Babieno et al., 2022) which had been trained by its developers using the Reddit Hivemind website 2015 corpus. In spaCy the data is structured as a 300-dimensional sense2vec embedding (Trask et al., 2015). With a sense2vec embedding the sense is provided by a label which represents the context in which the word was used.

The labels must be provided by the developers, either manually or automatically, prior to the training of the neural network. The 300-dimensional embedding used in spaCy has been made publicly available for general use by its developer Explosion (2020).

A popular measure of word similarity is that of cosine similarity (Mihalcea and Corley 2006, Gromann and Declerck 2018) which provides a score between 0 and 1 in value. A score of 0 suggests no similarity and no overlap in meaning between the two words, while a score of 1 suggests instead identical denotation and connotation by the two words. A minimum value of 0.5 is usually considered necessary for claiming similarity of meaning for any two words (Mihalcea and Corley, 2006). Cosine similarity was adopted as the main control parameter when extracting words and phrases from Polyglot and from spaCy. To limit the analysis to a manageable number of the words and phrases, similar to the number extracted from the dictionaries, thesauri and WordNet, a minimum cosine similarity value of 0.65 was set for use with Polyglot and with spaCy.

The words and phrases which were extracted via the neural network based word embedding algorithms provided a differently widened set of semantically related words with respect to those extracted from the dictionaries, thesauri and WordNet, involving additional contexts, writing styles and statistical measure of similarity.

3 Results

3.1 Semantically related words extracted from online dictionaries and thesauri

Tables 1, 2 and 3 present the semantically related words which were extracted from the online dictionaries and thesauri when queried using the words function, ritual and myth. From the Tables it is possible to note the similarity of the entries across the different online resources. The necessity of agreement between the scholars responsible for each resource presumably produced substantial convergence of concepts and wordings.

Each Table contains the three most frequently encountered definitions for the target word (function, ritual or myth). Within each Table the individual words and phrases are listed under the definition which gives rise to their use, i.e. the individual words and phrases are listed under the logical domain within which they operate. The ordering of both the definitions and the words is according to the frequency of occurrence within the set of online resources, from the most frequently encountered to the least frequently encountered.

Table 1 summarises the findings for the word ‘function’. It can be noted that the first definition in Table 1 and its associated words appear to involve strongly the concepts of ‘intention’ and ‘purpose’. The second definition and its associated words appear to involve strongly the concepts of ‘operation’ and ‘outcome’. And the third definition and its associated words appear to involve strongly the concepts of ‘control’ and ‘supervision’.

Table 2 summarises the findings for the word ‘ritual’. It can be noted that the first definition in Table 2 and its associated words appear to involve strongly the concepts of ‘habitual’ and ‘ceremonial’. The second definition and its associated words appear to involve strongly the concepts of ‘routine’ and ‘tradition’. And the third definition and its associated words appear to involve strongly the concepts of ‘spiritual’ and ‘religious’.

Table 3 summarises the findings for the word ‘myth’. It can be noted that the first definition in the table and its associated words appear to involve strongly the concepts of ‘story’ and ‘belief’. The second definition and its associated words appear to involve strongly the concepts of ‘fiction’ and ‘false belief’. And the third definition and its associated words appear to involve strongly the concepts of ‘legend’ and ‘symbolism’.

Table 1: Words which were found to be semantically related to the word 'function' in the online dictionaries and thesauri.

Dictionary / Thesaurus

Target word: FUNCTION	MacMillan Thesaurus	Merriam-Webster Thesaurus	Cambridge English Dictionary	Collins Thesaurus	Thesaurus.com
definition #1	"the job that something is designed to do"	"the action for which a person or thing is specially fitted or used or for which a thing exists"	"the natural purpose of something or the duty of a person"	"the intended role or purpose of a person or thing"	"the kind of action or activity proper to a person, thing, or institution; the purpose for which something is designed or exists; role"
	purpose role goal aim intention objective intent the object of the exercise object target	business capacity job part place position purpose role task work affair concern hand involvement participation niche office post situation calling occupation pursuit vocation activity assignment charge commission duty employ mission responsibility service use	affordance ambition avail cause dedicated deflect dream eye goal intention moonshot point purpose target target setting thought towards unfocused use utility	purpose business job concern use part office charge role post operation situation activity exercise responsibility task duty mission employment capacity province occupation raison d'être (French)	action activity affair behavior business duty exercise objective operation part power purpose responsibility role service situation task work
definition #2	"to work or operate in a particular way"		"the way in which something works or operates; to work or operate"	"a factor, the precise nature of which depends upon another thing in some way"	"to perform a specified action or activity; work; operate"
	operate come on work run go on play cut in into operation cope		act as something function as something functionalist high-performance janitorial make multifunctional operate operation performing a function purpose serve taken work	result effect consequence outcome end result	behave operate react serve
definition #3	"to operate in the same way as something else"	"to have a certain purpose"		"to perform the action or role of (something or someone else)"	
	act as be oriented to/towards be designed to do something be intended for be aimed at doing something be meant to do something	act perform serve work operate run administer carry on control direct guide handle manage oversee regulate supervise		act serve operate perform behave officiate act the part of do duty have the role of be in commission be in operatio or action serve your turn	

Table 2: Words which were found to be semantically related to the word 'ritual' in the online dictionaries and thesauri.

Dictionary / Thesaurus					
Target word: RITUAL	MacMillan Thesaurus	Merriam-Webster Thesaurus	Cambridge English Dictionary	Collins Thesaurus	Thesaurus.com
definition #1	"a formal ceremony that is always done in the same way"	"a usual manner of behaving or doing"	"a way of doing something in which the same actions are done in the same way every time";	"action done in exactly the same way whenever a particular situation occurs"	
	ceremonial ceremony commemoration commencement communicator conferment convocation dedication flummery graduation induction initiation installation investiture march-past observance parade pomp pow-wow presentation review rite of passage salute solemnities swearing-in testimonial unveiling	custom fashion habit habitude pattern practice second nature trick way wont	cavalcade ceremonial ceremonially ceremony dub induction initiate installation investiture knight master of ceremonies memorial service pageant ribbon cutting rite of passage ritualistic ritualistically salute troop	ceremonial formal conventional routine prescribed stereotyped customary procedural habitual ceremonious	
definition #2	"something done regularly and in same way"	"an often repeated action or series of actions performed in accordance with tradition or a set of rules"		"a way of behaving or a series of actions which people regularly carry out in a particular situation, because it is their custom to do so"	
	habit routine daily life custom tendency way of life common practice as is someone's wont proclivity	ceremonial ceremony form formality observance rite solemnity amenities civility decorum		custom tradition routine convention form practice procedure habit usage protocol formality ordinance	
definition #3		"as in religious, spiritual"		"regular repeated action or behaviour"	"an established or prescribed procedure for a religious or other rite"
		ceremonial liturgical priestly religious sacramental spiritual adored enshrined glorified revered		ceremony rite ceremonial sacrament service mystery communion observance liturgy solemnity	act custom formality habit liturgy observance practice procedure rite routine stereotype

Table 3: Words which were found to be semantically related to the word 'myth' in the online dictionaries and thesauri.

Dictionary / Thesaurus					
Target word: MYTH	MacMillan Thesaurus	Merriam-Webster Thesaurus	Cambridge English Dictionary	Collins Thesaurus	Thesaurus.com
definition #1	"ancient traditional stories"	"a traditional but unfounded story that gives the reason for a current custom, belief, or fact of nature"	"an ancient story or set of stories, especially explaining the early history of a group of people or about natural events and facts"	"a story about superhuman beings of an earlier age, usually of how natural phenomena or social customs came into existence"	
	adaptation allegory anecdote black comedy cautionary tale epic fable fairy tale fantasy fiction folk tale ghost story legend mystery mythology narrative oral history pantomime parable parody saga story tale tall story urban myth yarn	fable legend mythos allegory parable fabrication fantasy fiction figment invention narrative saga story tale yarn	anecdote brushstroke case study commentary legendary lore misdescription mythical mythological plot short story sob story sob stuff story storyline strand	legend story tradition fiction saga fable parable allegory fairy story folk tale urban myth urban legend	
definition #2	"something that people wrongly believe to be true"	"a false idea or belief"	"a commonly believed but false idea"	"a person or thing whose existence is fictional or unproven"	"a fictitious story, often ancient"
	falsehood fantasy illusion imaginings fraud hallucination mirage a figment of imagination optical illusion apparition cardboard cut-out counterfactual deepfake	delusion error fallacy falsehood falsity hallucination illusion misbelief misconception untruth	artifice bad faith cakeism canard falsification fib fiction flimflam lie mythologize perjure perjury polygraph porky white lie whopper	illusion story fancy fantasy imagination invention delusion superstition fabrication falsehood figment tall story	fable fantasy fiction illusion imagination legend lore parable superstition tale tradition allegory
definition #3		"the body of customs, beliefs, stories, and sayings associated with a people, thing, or place"		"a story, poem, or picture with an underlying meaning as well as the literal one"	
		folklore legend legendry lore mythology mythos tradition folklife information knowledge wisdom		symbol story symbolism emblem fable parable apologue	

3.2 Semantically related words extracted from the WordNet online lexical database

Table 4 presents the semantically related words which were extracted from WordNet. The table contains the ten words which were most frequently encountered when WordNet was queried using the words function, ritual and myth. To assist interpretation, a short dictionary definition of each word is provided alongside it in the table.

The semantically related words of Table 4 are not distant from those obtained from the online dictionaries and thesauri. For example, the first three entries for 'function' include 'purpose' and allude to 'intention'. The fourth through to the seventh entries include 'operation' and allude to 'outcome'. And the eighth through to the tenth entries allude to 'supervision' and 'control'.

Similarly, the first five entries for 'ritual' allude to 'habitual' and 'ceremonial', the sixth and seventh entries include 'traditional' and 'religious', and the eight through to the tenth entries include 'habitual' and 'routine'.

And the first six entries for 'myth' include 'story' and allude to 'belief', while the seventh through to the tenth include 'legend' and allude to a degree of 'symbolism'. For all three forms of meaning (function, ritual and myth) there was substantial overlap among the semantically related words extracted from the online dictionaries and thesauri on the one hand, and WordNet on the other.

With respect to the online dictionaries and thesauri the use of WordNet led to the interesting new entry of the word 'entity' for 'myth', suggesting the possible benefits of WordNet's super-subordinate relations. Whereas the online dictionaries and thesauri provided mostly names and properties associated directly with the word, WordNet appears to have possibly identified also organising properties which underpin the word.

Table 4: The ten most frequently occurring semantically related words extracted for the words function, ritual and myth by means of the WordNet lexical database.

Target words	The ten most frequently occurring words grouped in conceptual relations by WordNet	Brief definition of the words
FUNCTION	1. Purpose, role, use	what something is used for
	2. Raison d'etre	the purpose that justifies a thing's existence
	3. Utility, usefulness	the quality of being of practical use
	4. Office, part, role	the actions and activities assigned to or required or expected of a person or group
	5. Operative	performing or capable of performing
	6. Capacity	capability to perform or produce
	7. Work, operate, go, run	perform as expected when applied
	8. Serve	serve a purpose, role, or function
	9. act as	function as or act like
	10. Officiate	perform duties attached to a particular office or place or function
RITUAL	1. rite	any customary observance or practice
	2. custom, usage, usance	accepted or habitual practice
	3. practice, pattern	a customary way of operation or behavior
	4. activity	any specific behaviour
	5. human activity	something that people do or cause to happen
	6. celebration, solemnisation	the public performance of a sacrament or solemn ceremony with all appropriate ritual
	7. communion, sacramental manducation	the act of participating in the celebration of the Eucharist
	8. habit, use	an automatic pattern of behavior in reaction to a specific situation; may be inherited or acquired through frequent repetition
	9. event	something that happens at a given place and time
	10. continuance	the act of continuing an activity without interruption
MYTH	1. mythology	the body of stories associated with a culture or institution or person
	2. story	a piece of fiction that narrates a chain of related events
	3. fiction	a literary work based on the imagination and not necessarily on fact
	4. communication	something that is communicated by or to or between people or groups
	5. abstract entity	a general concept formed by extracting common features from specific examples
	6. entity	that which is perceived or known or inferred to have its own distinct existence (living or nonliving)
	7. mythic, mythical	based on or told of in traditional stories; lacking factual basis or historical validity
	8. legend	a story about mythical or supernatural beings or events
	9. fable, parable, allegory	a short moral story, often with animal characters
	10. plot	the story that is told in a novel or play or movie etc.

3.3 Semantically related words extracted from Polyglot and spaCy

Table 5 presents the semantically related words which were extracted using the Polyglot and spaCy word embedding algorithms. The table contains the ten words which were most frequently encountered when the algorithm was queried using the words function, ritual and myth.

Inspection of Table 5 suggests that the spaCy algorithm seems to have provided a greater variety of words and word contexts than the Polyglot algorithm. For example, for the target word ‘myth’, it can be noted that Polyglot produced a smaller number of unique words since the term ‘myth’ itself appears in more than a single Polyglot output. Possible explanations for the greater variety may include the larger size of the corpus (2.86 billion words for spaCy versus 100,000 words for Polyglot), the greater generality of the linguistic corpus (subjective, informal, everyday language for spaCy versus professional and disciplinary writing for Polyglot) and the larger dimensionality of the numerical embedding (300-dimensional vector for spaCy versus 64-dimensional vector for Polyglot).

Due to the apparently greater generality, the spaCy results were deemed worthy of further inspection. Table 6 presents the full set of the semantically related words which were extracted from spaCy when the cosine similarity threshold was set to 65%. At that threshold setting the algorithm provided 88 semantically related words consisting of 23 words for ‘function’, 18 words for ‘ritual’ and 47 words for ‘myth’. Given the greater variability and usefulness of the spaCy results, the Polyglot outputs results were not considered further.

Table 5: Semantically related words extracted for the words *function*, *ritual* and *myth* by the Polyglot and spaCy neural network based word embedding algorithms.

NLP library	Polyglot	spaCy
FUNCTION	structure	robust
	measure	usable
	change	modifiable
	domain	customizable
	rule	practical
	index	operable
	load	functioning
	sample	extensible
	input	workable
	object	responsive
RITUAL	<i>narrative</i>	<i>rituals</i>
	<i>myth</i>	<i>spiritual</i>
	<i>prophecy</i>	<i>ritualized</i>
	<i>cult</i>	<i>religious ritual</i>
	<i>brotherhood</i>	<i>meditative</i>
	<i>spirit</i>	<i>symbolic</i>
	<i>garden</i>	<i>liturgical</i>
	<i>discourse</i>	<i>magic</i>
	<i>worldview</i>	<i>occult</i>
	<i>taboo</i>	<i>reverent</i>
MYTH	<i>prophecy</i>	<i>common belief</i>
	<i>symbolism</i>	<i>misconception</i>
	<i>ritual</i>	<i>proven fact</i>
	<i>fable</i>	<i>perpetuated</i>
	<i>superstition</i>	<i>urban myth</i>
	<i>mythology</i>	<i>popular notion</i>
	<i>mysticism</i>	<i>well known fact</i>
	<i>revelation</i>	<i>widespread belief</i>
	<i>myths</i>	<i>common knowledge</i>
	<i>civilization</i>	<i>popular misconception</i>

Table 6: Semantically related words extracted for the words function, ritual and myth by the spaCy neural network based word embedding algorithm when set to a cosine similarity threshold of 65%.

FUNCTION	cosine similarity percentage	RITUAL	cosine similarity percentage	MYTH	cosine similarity percentage
functioning	86%	rituals	75%	common belief	79%
operate	73%	spiritual	74%	misconception	78%
control	70%	ritualized	73%	proven fact	75%
work	70%	religious ritual	71%	perpetuated	75%
functional	68%	meditative	71%	urban myth	75%
limited capacity	67%	symbolic	70%	popular notion	75%
utilise	67%	liturgical	69%	well known fact	74%
manage	67%	magic	69%	widespread belief	74%
functionally	67%	occult	68%	common knowledge	73%
handle	67%	reverent	67%	popular misconception	73%
interact	66%	legalistic	67%	general belief	73%
programmed	66%	spiritual aspects	66%	popular myth	73%
albeit	65%	pious	66%	undeniable fact	73%
behave	65%	mystical	66%	actual fact	72%
limited ability	65%	traditions	66%	hogwash	72%
enables	65%	mysticism	66%	urban legend	72%
cognitively	65%	demonic	66%	popular idea	72%
behaves	65%	worldly	66%	well established fact	72%
constrained	65%	hedonistic	65%	common idea	72%
controlled	65%	asceticism	65%	great irony	72%
same limitations	65%			prevailing theory	72%
quite	65%			common thought	69%
regulate	65%			widely held belief	71%
				pseudo-science	71%
				common assumption	71%
				common misunderstanding	71%
				false idea	71%
				ridiculous notion	71%
				popular conception	70%
				propagated	70%
				just nonsense	70%
				historical fact	70%
				utter nonsense	70%
				big lie	69%
				historical evidence	69%
				superstition	69%
				mainstream view	69%
				bad science	69%
				phenomenon	69%
				conspiracy theory	69%
				modern invention	69%
				exact opposite	69%
				modern times	69%
				disproven	68%
				common claim	68%
				implication	68%
				real fact	68%

3.4 Thematic Grouping

A database consisting of 583 semantically related words and phrases was achieved by combining the outputs of the three methods. 448 were extracted from the dictionaries and thesauri (170 for function, 128 for ritual and 150 for myth), 47 were extracted using WordNet (18 for function, 16 for ritual and 13 for myth) and 88 were extracted using spaCy (23 for function, 18 for ritual and 47 for myth). In order to focus analysis on those words and phrases which provided a significant degree of generality and flexibility for use in ethnography and design, all words which appeared in the database only once were removed. This led to a final list of 355 semantically related words and phrases.

Once assembled, the list was used as the basis for a thematic coding (Saldana, 2021) and thematic grouping (Braun and Clarke, 2021) exercise to bring common words and phrases together. The three researchers (the authors) first grouped the words and phrases individually and independently, then met to assemble the results and agree the common themes. The activity attempted to group together those words and phrases which appeared to the researchers to be characterised by common conceptual relationships and similarity of meaning. The individual themes which were agreed can be considered to be macro-components of meaning which are common to the many words and phrases of the group.

For the word ‘function’ the three macro-components of meaning which were agreed by the researchers were: (1) purpose and intention, (2) operation, and (3) action. For the word ‘ritual’ the three macro-components of meaning which were agreed by the researchers were: (1) ceremonial, (2) habitual, and (3) spiritual. And for the word ‘myth’ the three macro-components of meaning which were agreed by the researchers were: (1) belief and story, (2) fiction, and (3) symbolism. Figures 2 to 4 present the semantically related words and phrases along with the macro-components of meaning for the words function, ritual and myth. The numbers provided in each figure indicate the number of times that the given word or phrase was found in the database.

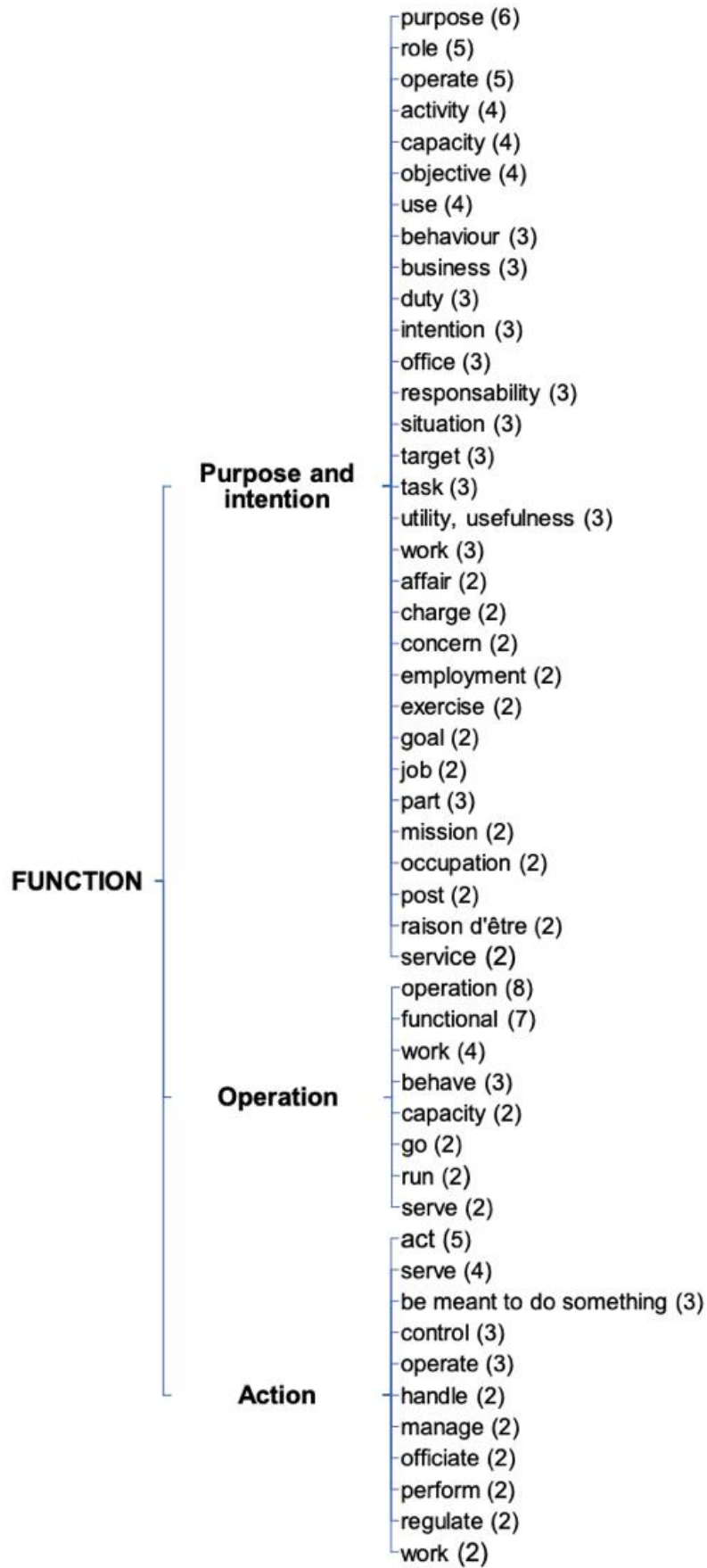


Figure 2: Semantically related words and macro-components of meaning for the word 'function'.

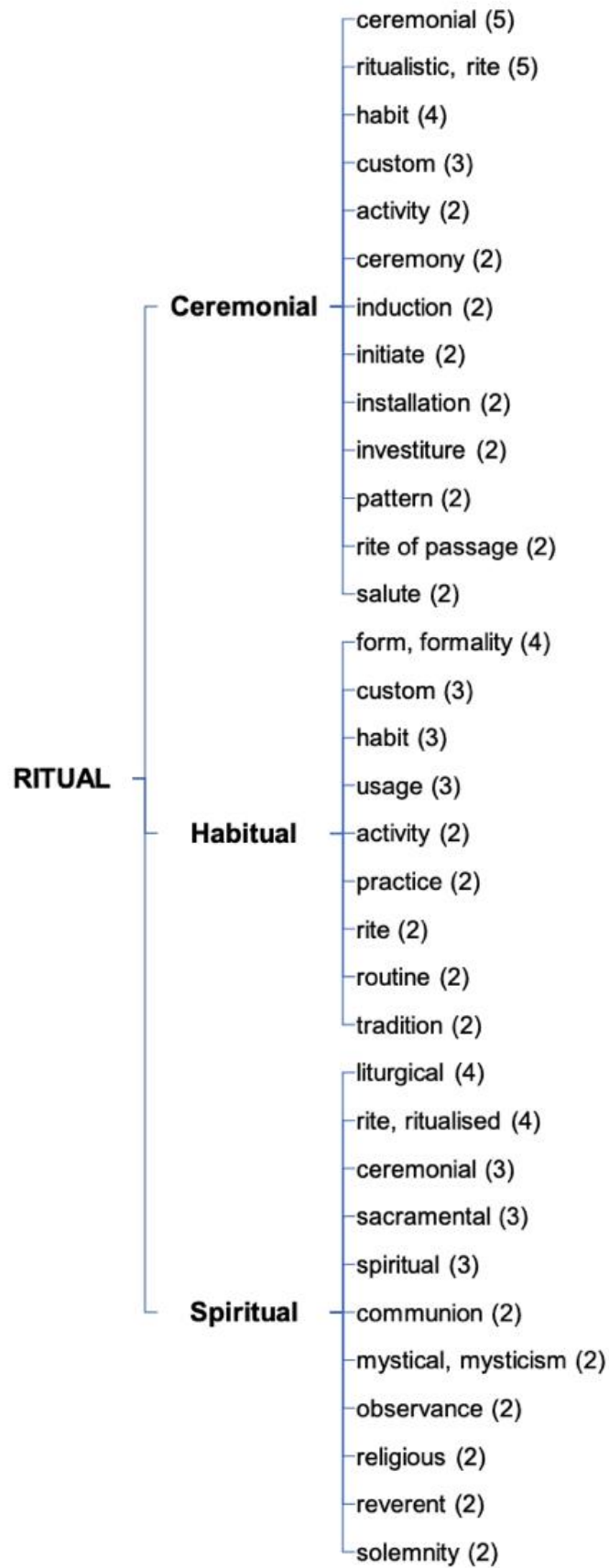


Figure 3: Semantically related words and macro-components of meaning for the word 'ritual'.

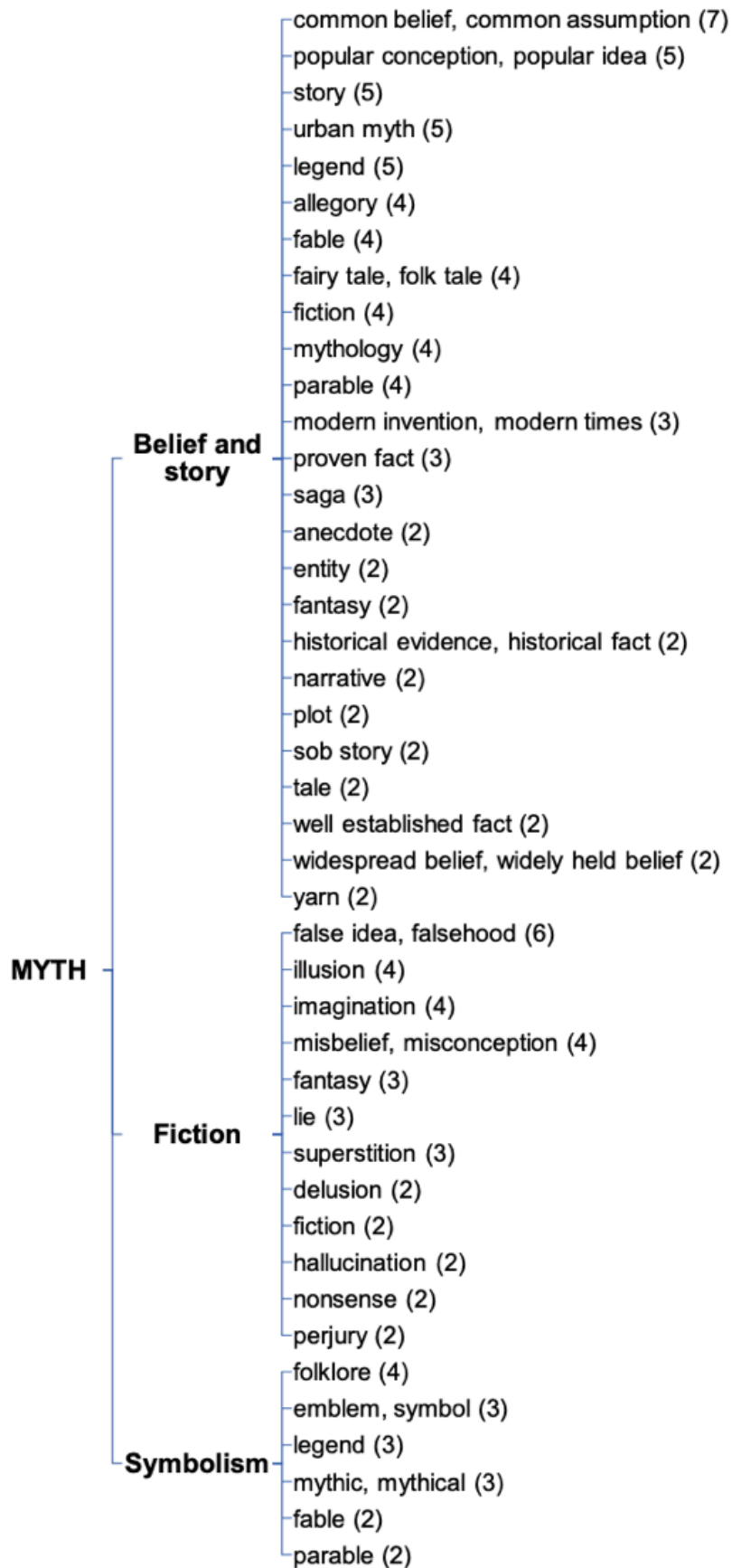


Figure 4: Semantically related words and macro-components of meaning for the word 'myth'.

4 Discussion

Burr (1995, p.48) has suggested that ‘surrounding any one object [...] there may be a variety of different discourses, each with a different story to tell about the world, a different way of representing it to the world’. Likewise, around any one word there is also a variety of different discourses. Using the word ‘*meaning*’, particularly in the context of a designed commercial artefact, is therefore not a simple matter of asking the customer or constituency member to choose between function, ritual and myth.

The current study was part of a wider research effort to consider the everyday usage of the English language word ‘meaning’ and to identify individual components and higher order macro-components of the concept which it conveys. The ultimate objective is to establish a reliable linguistic vocabulary for use in constructing interview questions, questionnaires, menus and other elements of ethnography and co-design. By identifying a fine-grained ensemble of words and phrases, and a higher order structure for their grouping and use, a basis is established for systematic and reliable discussion of the concept.

Any commercially active designer would be expected to clarify, decide upon and communicate the meaning which the artefact is anticipated to provide or facilitate for the consumer in the design process. The consideration of the vocabulary of meaning established in this work provides a basic checklist of the actual words which are in everyday use when describing the meanings of designed artefacts. Knowledge of the most relevant and most frequent words to use when distinguishing between meanings provides the commercially active designer a starting point to consider the three forms of meaning of function, ritual and myth covering a spectrum from the purely instrumental to the purely symbolic, to prioritise one or more of them, and to evaluate their achievement at every point in the design process with at least the major stakeholders. Further, knowledge of possible divergences in word usage might prove useful towards the prioritising of the design processes involved, for example by prioritising ethnographic and validation activities of the concept being analysed.

In the current study the concept of ‘meaning’ was investigated by extracting semantically related words and phrases from a variety of online linguistic resources. The words and phrases extracted from the dictionaries and thesauri provided a baseline of semantically related words. The words and phrases which were extracted from WordNet provided a semantically widened set, involving additional contexts and additional forms of familial similarity. And the words and phrases which were extracted via the neural network word embedding algorithms provided a differently widened set involving additional contexts, writing styles and statistical measures of similarity.

Hunston (2002) has emphasised that linguistic resources such as dictionaries, thesauri and even WordNet contain decontextualized information due to being based on standardised definitions, terminologies and indices of similarity. While useful, such linguistic tools may not always prove fully representative of the naturally occurring language usage of everyday people. It was therefore considered important in the current study to also identify words and phrases by means of word embedding algorithms which capture the detailed statistical patterns of large linguistic corpora which span a variety of contexts and language uses. The semantically related words and phrases which were extracted by means of Polyglot and spaCy proved instructive, and the spaCy output in particular contributed a large number of new and potentially useful words and phrases to the final database.

Comparison of the words and phrases which were extracted by means of the online dictionaries and thesauri (Tables 1, 2 and 3) to those which were extracted by means of the spaCy word embedding algorithm run on the Reddit Hivemind website dataset (Table 6) suggest obvious differences. The results for the word ‘function’ provide an illustrative example. The entries in Table 6 appear simpler and more colloquial than those in Table 1, which is perhaps not surprising given that the Reddit Hivemind website dataset contains mostly subjective, informal and everyday language usage.

Similar occurrence can be seen for the word 'myth' for which the entries in Table 6 of 'undeniable fact', 'actual fact', 'real fact' and 'well-known fact' appear to be related to the broader and original notion of the word 'myth' in terms of reality as seen by a believer (Barthes, 1973). While the word 'myth' normally refers to ideas that are false: "it is a myth that...", referring to its normal use that is the unbeliever's use of the word, the same word 'myth, in Barthes' use, also refers to "a story by which a culture explains or understands some aspect of reality or nature" (Fiske, 1990, p.88). A myth for Barthes as reported by Fiske (1990, p88), "is a culture's way of thinking about something, a way of conceptualizing or understanding it." Thus, it is not surprising that the semantically related words to 'myth' also addressed 'a real fact to believe in' given that the popular Reddit Hivemind website dataset is not based on standardised definitions and terminologies used by professional and disciplinary writing, but on everyday language usage.

Perhaps more interesting, however, is the observation that the words and phrases of Table 6 also appear to refer more to 'purpose' and 'intention' than to 'features', 'quality' or 'aesthetics'. In routine everyday language it appears that the word 'function' is frequently used to discuss the reasons 'why'. And similar observations can be noted for 'ritual' and 'myth' when the words and phrases which were extracted via spaCy are compared to those which were extracted from the dictionaries and thesauri.

As shown in Figures 2, 3 and 4 the thematic grouping exercise led to the establishment of three groups of words and phrases (macro-components) for each of the forms of meaning which were investigated. For the word 'function' the three macro-components agreed by the researchers were: (1) purpose and intention, (2) operation, and (3) action. For the word 'ritual' the three macro-components which were agreed by the researchers were: (1) ceremonial, (2) habitual, and (3) spiritual. And for the word 'myth' the three macro-components which were agreed by the researchers were: (1) belief and story, (2) fiction, and (3) symbolism. While Figures 2, 3 and 4 list the macro-components in the order that they emerged from the grouping exercise rather than based on other forms of consideration, it can nevertheless be noted that in all three cases the macro-components cover a spectrum which can be considered to be from an essential property (intention, ceremonial and belief) to an emergent property (action, spiritual and symbolism).

5 Conclusion

Understanding why consumers perceive designed artefacts to be personally relevant is a commercial imperative. Previous research has suggested that three categories of meaning are commonly encountered, i.e. function, ritual and myth. They cover a spectrum from the purely instrumental to the purely symbolic. However, despite the logical and philosophical groundwork, there has been little analysis of the actual words which are in everyday use when describing the meanings of designed artefacts.

This study surveyed the English language words and phrases which are used when speaking about meaning. The objectives of the study were (1) to identify the words and phrases which are most frequently encountered in everyday language when discussing meaning, (2) to determine for each word or phrase its degree of belonging to the formal categories of function, ritual and myth, and (3) to thematically group the words and phrases into macro-components of meaning.

Three different analysis were performed. The first was based on the contents of major online dictionaries and thesauri, the second was based on the results from queries of the online lexical database WordNet and the third involved a corpus analysis approach with the queries being made by means of the Polyglot and spaCy neural network based word embedding algorithms.

A database consisting of 583 semantically related words and phrases was achieved by combining the outputs of the three methods. In order to focus analysis on those words and phrases which provided a significant degree of generality and flexibility for use in ethnography and design, all words

which appeared in the database only once were removed. This led to a final list of 355 semantically related words and phrases.

Thematic grouping of the semantically related words and phrases suggested three dominant groups of words and phrases within each of the three categories of meaning, for a total of nine dominant groups. Each group was assigned a name by the researchers and is suggested to be a macro-component of meaning. The groups ‘purpose and intention’, ‘operation’ and ‘action’ were strongly associated with the concept of ‘function’, the groups ‘ceremonial’, ‘habitual’ and ‘spiritual’ were strongly associated with the concept of ‘ritual’ and the groups ‘belief and story’, ‘fiction’ and ‘symbolism’ were strongly associated with the concept of ‘myth’.

The words, phrases and macro-components of meaning provide a first empirically established vocabulary of meaning for use in design activity. By identifying a fine-grained ensemble of words and phrases, and a higher order structure for their grouping and use, a basis is established for systematic discussion of the concept. Such an ensemble provides commercially active designers a starting point and a base for the development of tools which can be used to measure and monitor the meanings of designed artefacts.

The current study was part of a wider research effort to consider the everyday usage of the English language word ‘meaning’ and to identify individual components and higher order macro-components of the concept which it conveys. The objective of the current study was to establish a reliable linguistic vocabulary for use in constructing interview questions, questionnaires, menus and other elements of ethnography and co-design. Pilot studies and validation exercises should permit the further narrowing of the ensemble of individual words and phrases, and their packaging into a standardised measurement tool.

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