# An Evolutionary View of the Life Span of Obsolete English Words

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## ABSTRACT

Language change in a living language is inevitable, and in this paper it is assumed that changes in a language are not purely random and are sometimes subject to selective pressure. Therefore this paper follows an evolutionary approach to studying language change. This paper does not challenge or offer ideas on how language first evolved, but explores some of the ways in which language is evolving, by using a representative sample of obsolete words taken from the Oxford English Dictionary (2nd edition), and analysing the life span of those words using an evolutionary theory framework. Ideas from Darwin of evolution by natural selection are borrowed and interpreted liberally throughout, particularly that of fitness. The manner of evolution between biological organisms and languages is notably different, but the fact that adaptation exists in both worlds makes the two worthy of analogous comparison. This paper is a study of the life span of obsolete words, and it is hoped that this will reveal a structured, or at least logical, evolution over time. By extension the patterns revealed may go some way towards creating a predictive theory of lexical life span.

**Keywords**: Cultural transmission; Evolution; Linguistic obsolescence

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## บทคัดย่อ

การเปลี่ยนแปลงของภาษาที่ยังมีชีวิตอยู่นั้นเป็นสิ่งที่หลีกเลี่ยงไม่ได้ ไม่ใช่สิ่งบังเอิญ และขึ้นอยู่กับแรงกดดันจากกระบวนการคัดสรรในลักษณะต่างๆ ด้วยเหตุนี้บทความนี้จึงใช้แนวทางวิเคราะห์ตามมุมมองทางวิวัฒนาการเพื่อศึกษาการเปลี่ยนแปลงของภาษา โดยได้สำรวจลักษณะการวิวัฒนาการของภาษาในด้านต่างๆ โดยใช้คำศัพท์ล้าสมัยในภาษาอังกฤษเป็นกลุ่มตัวอย่างและวิเคราะห์อายุขัยคำศัพท์เหล่านั้น ทั้งนี้ได้นำทฤษฎีวิวัฒนาการของดาร์วินมาประยุกต์ใช้เพื่อการวิเคราะห์อย่างเต็มที่ โดยเฉพาะแนวคิดเรื่องความเหมาะสมในการอยู่รอด

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## 1. Introduction

Language change in a living language is an inevitability (Aitchison, 2001, p. 3; Crystal, 2005, p. 357; Kirby, 2002, p. 187). In this paper it is assumed that changes in a language are not purely random (Aitchison, 2003, pp. 163-164) and are sometimes subject to selective pressure. Therefore this paper follows an evolutionary approach to studying language change with ideas from Darwin's theory of evolution by natural selection borrowed and interpreted liberally throughout. It does not seek to challenge or offer ideas on the origins of how language first evolved, but to explore some of the ways in which language is evolving. This is done by examining the life spans of obsolete words, recorded in the Oxford English Dictionary, to see if any pattern exists which could be viewed through an evolutionary theory framework, especially that of fitness. The manner of evolution between biological organisms and language is notably different: animals adapt physically or behaviourally, while words adapt morphologically, syntactically, semantically or phonologically. But it is the fact that adaptation exists in both worlds that makes the two worthy of analogous comparison. Darwin noted that the creatures which survive best are those most able to adapt to changes within their physical environment; the linguistic comparison would be that words which survive best are those which adapt to suit their changing, intangible world. Species which are unable to adapt become extinct, words which are unable to adapt become obsolete.

The linguistic fossil record used for the purposes of this paper is the Oxford English Dictionary. The paper is a study of the life span of archaic and obsolete words, and it is hoped that this will reveal a

structured, or at least logical, evolution over time. By extension the patterns revealed may go some way towards creating a predictive theory of lexical life span.

Explanation of non- or quasi-biological transmission of information already exists in memetics (sometimes called meme theory), and therefore this paper uses Richard Dawkins' meme hypothesis (1989) to assume that languages are living entities, that words and phrases are memes, and survive through memetic transmission. This is non-biological reproduction and propagation of an entity with no physical properties (excluding the neurons of the human brain in which a meme resides). But memes are living structures insofar as they are "*... actual patterns of neuronal hard-wiring that reconstitute themselves in one brain after another"* (Dawkins, 1989, p. 323). With this in mind, analogies of living and dead languages seem apt.

A meme behaves like a gene to the degree that it is able to self-replicate, but it is a "*...unit of cultural transmission*" (Dawkins, 1989, p. 192) rather than a unit of physical or behavioural characteristics transmission. The Darwinian (or perhaps Dawkinsian) evolutionary view is that a meme is to cultural change what a gene is to biological change. It is a unit which inherits and accumulates adaptations and which replicates through social transmission of information (Aunger, 2006, p. 176). As living memes, are words and languages subject to similar evolutionary selection pressures as other living entities are? If so, can the linguistic fitness of a word be determined, and do other factors exist which influence lexical life and death? Successful replicators are those which possess the qualities of longevity, fecundity, and copying-fidelity, and that it is the fecundity of any copy of a meme which is the most important

factor of these qualities (Dawkins, 1989, p. 194). But can this hypothesis automatically be applied to words? If the fecundity of a word is constrained by the number of people who use it, a word used by many people will be most fecund. Does this necessarily mean that the word will survive longer than a word used by a much smaller number of people? Will a word with high copying-fidelity survive? Will a word which produces identical copies with no variation in sound or meaning from generation to generation survive, or will this be precisely the reason why a word dies?

The aim of this study is to attempt to answer these questions, and use these answers to identify patterns which can be used to predict the life span of words. This will be done by first examining the evolution of language change by tracing the life span of selected words now deemed obsolete, and then by looking for consistent, non-random patterns amongst the data collected.

### 1.1 Purposes of the study

The purposes of this study are:

1. to investigate whether the life span of a word is affected by
   a) semantic meaning
   b) word class and function
   c) standardisation
   d) ease of transmission
2. to attempt to apply biological evolutionary models to language change
3. to attempt to define a theory for prediction of expected life span of a word

## 1.2 Significance of the study

If testable patterns of word life span become evident, then these patterns could influence future language learning and teaching strategies related to vocabulary acquisition. Knowing the properties which are likely to influence the life span of a word would allow better hypotheses for future studies of language and vocabulary change. Then, further study could be carried out to determine if the patterns are a linguistically universal phenomenon or applicable only to English.

Predictive patterns of word life span would be useful to anyone who wanted to coin a new word, for example for consciousness raising of health or social issues. Less altruistically, the predictive patterns would also be of use to advertisers and marketers.

## 1.3 Basic Assumptions

1) In this study it is assumed that both archaic and obsolete words used for analysis were once commonly understood.
2) In this study British English is treated as if it were a living species, and susceptible to selection pressures as the main forces which may cause it to evolve.
3) The judgement of the Oxford English dictionary is used to determine the recorded number of words and obsolete words in the English language. The number of obsolete words used in this study is 54,444. This total is based on the OED print edition plus additions and on-line updates up to and including April 2011.
4) All words are considered to be units of cultural transmission called memes.

5) The breakdown of population of obsolete words by word class will not significantly differ from the living population. More than half will be nouns, approximately one-quarter will be adjectives, one-seventh will be verbs, and the remainder will be other word classes[2].
6) Infrequently used words will be more susceptible to change than frequently used words. Words which are used extremely frequently may survive indefinitely, even if non-standard.

**1.4 Hypotheses**

1) Words which are closely linked to rapidly changing phenomena or concepts will have a short life span. Conversely, words linked to phenomena or concepts which change slowly or not at all will have a long life span.
2) Standardisation is an important catalyst in the evolution of languages. Words which do not conform to the dominant morphological or phonetic standards will be changed to fit the standard, or be abandoned and replaced with other synonyms. When non-standard words persist in sufficient quantity, or are used with high frequency, the accepted standard will change.
3) The ease of transmission of a word will influence its life span, with words which can be transmitted easily having a longer life span than those which cannot. Ease of transmission will be judged by number of syllables; variation of spelling; and non-standard consonant clusters.

[2]from: http://www.oxforddictionaries.com/page/howmanywords Accessed: 27/04/11

### 1.5 Limitations

For the purpose of defining sample size, it is the number of headwords in the OED which are counted. However for the purpose of analysis after the data has been collected each distinct meaning is counted as a separate word, but derivatives of the canonical form which serve only as grammatical function markers (plurals, tense markers, person markers) are not counted as separate words.

The use of OED provides a source from which anyone can check data included in this study. In this sense, the data are objective, but the fact that data entry into the OED was at times subjective and not necessarily verifiable means that to provide a more accurate data set several different corpora should be used.

## 2. Review of Literature

Human language is the unique result of "...three distinct but interacting adaptive systems: individual learning, cultural transmission, and biological evolution" (Christiansen & Kirby, 2003, p. 302). In some senses, language evolution and biological evolution cannot be separated because each is or has been influenced by the other. But when studying the evolution of human language, which has had a life of probably no more than 200,000 years so far, comparison is possible with biological evolution, which has been happening for thousands of millions of years. The ability to learn specific varieties of language is culturally transmitted, and this exists in very few species other than humans. There is evidence of regional dialectical variation amongst songbirds, chimpanzees, and killer whales (Milhalicek & Wilson, 2011, p. 571), and evidence of language change in the songs of humpback whales, which change during the course of a breeding season when the language is used, though not

between (Aitchison, 2001, p. 240). Dawkins (2006) attributes random memetic drift[3] as the main cause of linguistic evolution, and doubts whether linguistic evolution by natural selection is as important (Dawkins, 2006, p. 230). But this view is at odds with the views of many linguists. Aitchison, for example, disputes the idea that language change can be accidental or entirely random, as similar changes happen in different, unconnected languages, and because random change would lead to a disorganized language which could not be used for communication (Aitchison, 2003, pp. 163-164). The studies outlined here suggest successful communication is an example of a selection pressure, and memes which allow ease of transmission are favoured. One experimental study by Kirby, Cornish, and Smith (2008) showed that an 'alien' (invented) language taught to participants over several generations evolved to become easier to learn and more structured. This follows a model of iterated learning, which is a form of cultural transmission where "*an individual acquires a behavior by observing a similar behavior in another individual who acquired it in the same way.*" (Kirby *et al*., 2008, p. 10681) The language used randomly generated words as names for alien symbols. Participants were shown symbols with the alien name, and later tested on these symbols supplemented with symbols they had never seen before. The participant's output was used as the input for another participant, whose output was used to teach the next participant, and this was repeated for 10 cycles, representing generations. The sets of seen and unseen symbols were divided randomly every generation. Participants were not told

[3] "*Biologists acknowledge that a gene may be spread through a population not because it is a good gene but simply because it's a lucky one. We call this genetic drift* ...[Memetic drift is]*the cultural equivalent of genetic drift"* (Dawkins. 2006. 219)

that their output would be used as the input for the next generation, and therefore the experimenters assumed that intentional manipulation of the language by participants did not occur (Kirby *et al*., 2008). The language was passed via vertical transmission from one generation to the next only, never horizontally amongst members of the same generation.

Nowak (2000) states linguistic fitness, defined in the paper as successful communication, can be reduced when too many objects or concepts need to be defined using a limited repertoire, as this may lead to errors in communication. The following quote is made with reference to animal communication in bees, birds, and vervet monkeys: "*…if* [sound] *signals can be mistaken for each other, it can be better to have fewer signals that can be clearly identified"* (Nowak, 2000, p. 1618). Nowak writes here about single sound signals, but it is later stated that combinations of phonemes allow for novel creations and new words. In turn, this can reduce lack of successful information transfer caused by errors of reproduction, allowing for expansion of the language without a detrimental effect on fitness. This does not happen in non-creative languages. In the conclusion to the article Nowak summarizes how words survive:

> "*Words are maintained in the lexicon of a language if their basic reproductive ratio exceeds unity: a person who knows a word must transmit knowledge of this word to more than one new person on average. Since there is a limit on how much people can say to each other and how much they can memorize, this implies a maximum size for the lexicon of a language (in the absence of written records).*"
> (Nowak, 2000, p. 1621)

The lexicon of the language referred to by Nowak should be assumed to be the 'mental lexicon', which has been defined as "*the repository of a language user's words with their meanings and forms*" (Levelt, 2003, p. 410) and "*... the stored mental representation of what we know about the words in our language. This mental store stands at the heart of the language processing system.*" (Marslen-Wilson, 2003, p. 420)

The standardisation of language, prescribed or otherwise, has added more stability to certain words, in the sense that stable words are less vulnerable to change. Standardisation of language can be seen as a selection pressure acting upon these memes. Dawkins argues that stability of a meme leads to longevity; with longevity the likelihood of successful replication increases. "*Darwin's 'survival of the fittest' is really a special case of a more general law of* ***survival of the stable***" (Dawkins, 1989, p. 12 [emphasis in original]). Replicators with high longevity have a longer time to make copies of themselves, and this would suggest that longevity is an important factor in successful replication, but it is in fact less important than fecundity, the speed of replication (Dawkins, 1989, p. 17). Longevity of a copy of a meme is relatively unimportant (Dawkins, 1989, p. 194) as the speed of replication is likely to have the secondary result of increasing the longevity of the word, therefore it is not important that any one copy of a meme survives, as long as other copies are extant. It is theoretically possible to separate words which are replicated (for example, printed or recorded) from those which are reproduced (spoken or written by hand), but in practice as no word belongs solely to one group no real distinction between replication and reproduction is made in this paper, but it is

acknowledged that there is a necessary and important difference in biological terms[4].

Irregular and non-standard forms may persist when memetic fecundity, in this case frequency of use, is high, or when frequency of use is low but the meaning or use is highly specific or specialized. If the formality of language increases so too does the specificity and the less likely it is to be used by a large number of people. This is true of the two 'highest' forms of Thai, used by and to address Buddhist monks and members of the royal family. Words which belong to these forms of language are non-standard and have a low ease of transmission rating. (Low Thai words generally have a higher ease of transmission rating due to fewer syllables, and also more sonority when spoken.) If following hypotheses 2 and 3, it would be reasonable to assume that the life spans of these words would be short, but it is not necessarily so because the words are linked to concepts which change slowly, if at all. Furthermore tradition and ritual ensure that the words are enshrined in a protected lexical reliquary, giving stability to words which would otherwise die. These words can survive because the purpose is niche and the concepts which are described are not rapidly changing. The life span of these words is of the type predicted in hypothesis 1.

Standardisation and regularization can be complementary selection pressures, though there is no good reason to assume they always

[4] Replication and reproduction both refer to the process of creating a copy of something. In a scientific sense, replication is the production of an exact copy, while reproduction is the production of a similar copy. Words can only be truly replicated by mechanical or technological means. Words spoken, then repeated by another, would be considered reproduction because the phonetic quality would differ slightly. However, for the purposes of this study, no distinction is made.

are. Many irregular verbs occur in SBE, and remain irregular because they are frequently used and therefore self-normalizing. Lieberman *et al.* state that "...less than 3% of modern verbs are irregular, the ten most common verbs are all irregular (*be, have, do, go, say, can, will, see, take, get*)". (Lieberman *et al.*, 2007, p. 714). The forms of these words do not fit existing patterns. The examples '*Go, Went, Gone*' and '*Good, Better, Best*' are SBE, but irregular. '*Go, *Goed, *Goed'* and '*Good, *Gooder, *Goodest'* are non-standard and break one or both of Aitchison's guiding principles of pattern neatening (see Aitchison, 2001, p. 177). However, it is the latter non-standard form which would usually be produced during child language acquisition and by learners of English as a second language through a process of regularization. The time-frame in which these productions occur is limited, and thus the high frequency irregular forms remain dominant.

By using comparative analysis of four corpora (English, Spanish, Russian, and Greek) and a comparative database of 200 word meanings in 87 Indo-European languages, Pagel, Atkinson, and Meade (2007) found that the rate of lexical replacement in a language was directly related to frequency of use. Word class was controlled to represent higher frequency of use of different word classes in normal language use. The results showed that the speed of evolution differed between word classes, with prepositions and conjunctions evolving fastest, followed by adjectives, verbs, nouns, special adverbs (what, when, where, here, there, how, not) pronouns, and numbers. (Pagel *et al*, 2007, pp. 717-720). English irregular verbs are examples of words which are frequently used and have not evolved to include a standard -ed suffix. A "*...purifying force of spoken word frequency*" (Pagel *et al*., 2007, p. 719) is

credited with being the reason for such high-fidelity replication, and this is consistent with the idea of self-normalizing memes, while the errors of reproduction and reproductive ratio described by Nowak[5] complement Dawkins' ideas of memetic copying fidelity and fecundity.

Accuracy of replication, or copying-fidelity, is the final quality necessary for genetic or memetic survival. But it is in this sense that genes and memes differ, and the analogy of memes as cultural genes becomes more abstract. The accuracy of replication may deteriorate due to any number of factors, but words are 'self-normalizing memes' (Dawkins, 2006, p. 226). This means that they can be reproduced correctly even if they have been transmitted incorrectly, but this is based on the assumption that the word is familiar to the receiver and the context is not ambiguous. This self-normalizing process accounts for the high fidelity rate of certain memes (Dawkins, 2006, p. 228). Neologisms and non-standard words in general are less likely to be self-normalizing, and therefore have a much lower rate of fidelity. The creation of neologisms is unpredictable, and the rate of attrition amongst those that are created is high. For a word to achieve stability in a language, the rate of learning (the spread from an existing speaker to a new speaker) must not be less than the rate of death of existing speakers, but for successful propagation the rate of learning should

[5] Nowak's paper is not limited to word formation and population limitations, but for the sake of brevity and relevance, evolution of syntax and mathematical formulas included in the original paper have not been included in this paper. Likewise, if lexicon in Nowak's paper refers to something other than the mental lexicon, then the mistake for misinterpretation is entirely mine.

exceed the rate of death of existing speakers (Solé *et al*, 2010, p. 1649).

## 3. Research Methodology

A sample of 381 obsolete words was taken at random from the OED New Edition, and certain tests applied to see if any patterns exist which might suggest evolutionary pressures have contributed to or caused obsolescence. The population of obsolete words is 54,544 words and was determined using a search engine of the main OED database by Dr. James McCracken, publication editor of OED, and includes only entries which are labelled as obsolete, not entries which contain something obsolete within them (McCracken, *pers. comm.*, 05th November 2010). Data includes everything from the OED Second Edition (1989), the Additions Series vol. 1 and 2 (1993), the Additions Series vol. 3 (1997), and online quarterly updates from March 2000, up to and including April 2011. In cases where a revision has been made to an existing entry (i.e. a Second Edition or Additions entry) and all entries are available for comparison, it is the newest entry which has been used. To ensure an even sample distribution across the population, every 143rd word is included. The starting position was determined by the roll of a die.

Data provided by the OED yields the following information for individual words: primary word class; date of first recorded use; date of last recorded use; definition; number of standard and variant spellings; number of quotations; number of homonyms.

## 4. Data collection and analysis

4.1) The length of recorded use in years, used as proxy for lexical life span, for every word in the sample is necessary as part of the calculations on which many assumptions are predicated.

The life span for each word was determined by subtracting the date of first recorded use from the date of last recorded use. When only one use entry has been entered into the OED, the year of first and last recorded use are the same, but it is assumed that every recorded word had a life span of at least one year. Distribution of life span data is asymmetrical, so median average is used as the preferred measure of central tendency to compensate for the effect of outlying data.

Table 1 shows the frequency of word occurrences by length of recorded use, grouped into periods of 50 years, and the percentage of the total that these represent. Grouping is in 50 year periods except for the final group which is for words of 500 years or more. The length of recorded use in the sample showed that more than half of words (228, or 59.8%) had a lifespan of between 1 and 50 years. Of the 228 words which make up this set, the highest frequency occurs at one year, this being the life span of 172 words. The next highest is three years, with four occurrences. All other years have a frequency of no more than three occurrences, with the majority having only one.

**Table 1**: Frequency of word occurrences by length of recorded use (grouped years).

| Years of recorded use | Frequency | Percent |
|---|---|---|
| 1 – 50 | 228 | 59.8 |
| 51 – 100 | 39 | 10.2 |
| 101 – 150 | 26 | 6.8 |
| 151 – 200 | 20 | 5.2 |
| 201 – 250 | 22 | 5.8 |
| 251 – 300 | 8 | 2.1 |
| 301 – 350 | 10 | 2.6 |
| 351 – 400 | 4 | 1.0 |
| 401 – 450 | 5 | 1.3 |
| 451 -500 | 5 | 1.3 |
| > 500 | 14 | 3.7 |
| Total | 381 | 100 |

Table 2 shows the mean and median averages for years of recorded use, standard deviation, skewness, and standard error of skewness. The mean and median averages differ considerably (96.18 years compared to 13 years). The effect of outlying data, specifically the high frequency of words with a life span of only one year, has meant the distribution is skewed.

**Table 2**: Mean and median averages for years of recorded use.

| | | |
|---|---|---|
| N | Valid | 381 |
| Mean | | 96.18 |
| Median | | 13.00 |
| Std. Deviation | | 155.836 |
| Skewness | | 2.397 |
| Std. Error of Skewness | | .125 |

4.2) The average length of recorded use by word class tests the assumption that word class will not affect life span. A non-parametric Kruskal-Wallis one-way analysis of variance test was used. The null hypothesis is that there is no difference between groups, meaning that the word class does not influence the life span of any word. The same test and sig. value of $p < 0.05$ necessary to reject the null hypothesis are applied to every subsequent test, with the exception of the number of non-standard consonant clusters in sample, for which Mann-Whitney U test is used.

Table 3 shows the frequency of word occurrences by word class and the percentage of total that this represents, and mean and median average for years of recorded use by word class. Table 4 shows the frequency of word occurrences by word class, the percentage of the total that these represent and length of recorded use when grouped into units of 50 years up to a maximum of 500 years. The final group is for words with a length of recorded use of more than 500 years.

**Table 3**: Frequency of word occurrences, mean and median average for years of recorded use by word class.

| | | | Years of recorded use | |
|---|---|---|---|---|
| | Frequency | Percent | Mean | Median |
| Adjective | 105 | 27.6 | 77.25 | 1.00 |
| Adverb | 14 | 3.7 | 198.86 | 129.00 |
| Interjection | 1 | .3 | 563.00 | 563.00 |
| Noun | 193 | 50.7 | 93.40 | 13.00 |
| Preposition | 1 | .3 | 276.00 | 276.00 |
| Verb | 67 | 17.6 | 102.78 | 43.00 |
| Total | 381 | 100.0 | 96.18 | 13.00 |

**Table 4**: Frequency of word occurrences by word class and length of recorded use (grouped).

| | Adj. | | Adv. | | Int. | | Nouns | | Prep. | | Verbs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Years of use | No. | % | No. | % | No. | % | No. | % | No. | % | No. | % |
| 01 – 50 | 70 | 66.7 | 6 | 42.9 | 0 | 0 | 115 | 59.3 | 0 | 0 | 37 | 56.1 |
| 51 – 100 | 10 | 9.5 | 1 | 7.1 | 0 | 0 | 17 | 8.8 | 0 | 0 | 11 | 16.7 |
| 101– 150 | 1 | 1 | 0 | 0 | 0 | 0 | 20 | 10.3 | 0 | 0 | 5 | 7.6 |
| 151 – 200 | 10 | 9.5 | 0 | 0 | 0 | 0 | 9 | 4.6 | 0 | 0 | 1 | 1.5 |
| 201 – 250 | 3 | 2.9 | 2 | 14.3 | 0 | 0 | 12 | 6.2 | 0 | 0 | 5 | 7.6 |
| 251 – 300 | 3 | 2.9 | 1 | 7.1 | 0 | 0 | 2 | 1 | 1 | 100 | 1 | 1.5 |
| 301 – 350 | 2 | 1.9 | 2 | 14.3 | 1 | 100 | 6 | 3.1 | 0 | 0 | 0 | 0 |
| 351 – 400 | 1 | 1 | 1 | 7.1 | 0 | 0 | 1 | 0.5 | 0 | 0 | 1 | 1.5 |
| 401 – 450 | 2 | 1.9 | 0 | 0 | 0 | 0 | 2 | 1 | 0 | 0 | 1 | 1.5 |
| 451 -500 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 1.5 | 0 | 0 | 2 | 3 |
| >500 | 3 | 2.9 | 1 | 7.1 | 0 | 0 | 7 | 3.6 | 0 | 0 | 2 | 3 |
| Total | 105 | 100 | 14 | 100 | 1 | 100 | 194 | 100 | 1 | 100 | 66 | 100 |

Table 3 shows that mean and median averages are substantially different, as expected with a skewed distribution of data. Exceptions exist for interjection and preposition classes, for each has only one word in its group. The percentage value for each word class in the sample of obsolete words is not different from the value which is expected in the population of living words as long as the fact that figures for living populations are based on assumptions and estimates is not ignored. This is as expected, and as stated in the assumptions made in 1.4.5. Slightly more than half of the words are nouns (50.7%), more than one quarter (27.6%) are adjectives where one-quarter is predicted, more than one-seventh are verbs (17.6%) where one seventh is predicted (14.3%), and the remainder are other word classes.

Results of Kruskal-Wallis test ($p$ = .017) show that a difference between groups based on word class exists.

4.3) The average length of recorded use by definition of all words in the sample test**s** the first hypothesis, that the meaning of a word will influence its life span. All words were divided into one of four groups; 1) words which refer to both obsolete and extant technologies, concepts, or grammatical functions; 2) words with definitions related to extant technologies, concepts, or grammatical functions; 3) words with definitions referring to archaic, obsolete or superseded technologies, concepts, or grammatical functions; 4) words with ambiguous or unknown definitions. This fourth category was included to reduce subjectivity. Table 5 shows the frequency of word occurrences and average length of recorded use by definition type. Categories for definition types were recoded to single letters

(B, E, O, U, following the order given above), then processed in alphabetical order.

**Table 5**: Frequency of word occurrences by definition type.

| | | | Years of recorded use | |
|---|---|---|---|---|
| Definition type | Frequency | Percent | Mean | Median |
| B | 1 | .3 | 1.00 | 1.00 |
| E | 328 | 86.1 | 103.48 | 23.50 |
| O | 19 | 5.0 | 93.74 | 95.00 |
| U | 33 | 8.7 | 27.94 | 1.00 |
| Total | 381 | 100.0 | 96.18 | 13.00 |

It was expected that words with definitions referring to archaic, obsolete or superseded technologies, concepts, or grammatical functions would have the shortest life spans. Words of this type occur 19 times, making 5% of the total. The median life span is 95 years, which is contrarily the longest life span of any group. The shortest median life spans belong equally to words with definitions that can refer to both extant and obsolete technologies, concepts, or grammatical functions, and words with unknown or ambiguous definitions. Each has a median life span of 1 year. The frequency of occurrence for the former type of definition is 1 (0.3%), and for the latter 33 (8.7%). The remaining definition type, words which refer to extant technologies, concepts, or grammatical functions, has a frequency of occurrence of 328 (86.1%) and a median life span of 23.5 years.

Results of Kruskal-Wallis test ($p$ = .010) show that a difference between groups based on definition type exists.

4.4) The number of non-standard consonant clusters in sample, here defined as clusters which occur in one or two extant words only, is used to test hypothesis 2, that standardisation is an important catalyst for the evolution of languages. Clusters that occur in more than two words are defined as standard, and those which never occur are judged to be impossible. The list of non-standard consonant clusters used is based on Szigetvari (2007). Non-standard consonant clusters may occur in initial, medial, or final positions, but will not necessarily be non-standard in other positions. For example, /ln/ does not occur as an initial cluster in English, occurs medially in words such as *vulnerable* /vʌ́lnərəbəl/ and many nouns ending with *-fulness*, but does not occur finally except in *kiln* /kíln/. Therefore /ln/ is considered a non-standard consonant cluster only when in a final position. The number of non-standard consonant clusters, and the percentage of sample these words form were counted, with a high percentage indicating that non-standard clusters contribute to obsolescence.

Table 6 shows the frequency of word occurrences by type of consonant cluster, and mean and median average life spans. These can be only either standard or non-standard. 377 words (99%) contain standard consonant clusters and the median life span for these is 14 years. 4 words (1%) contain non-standard consonant clusters and the median life span is 1 year.

**Table 6**: Frequency of word occurrences by type of consonant cluster.

| | | | Years of recorded use | |
|---|---|---|---|---|
| | Frequency | Percent | Mean | Median |
| Standard | 377 | 99.0 | 97.19 | 14.00 |
| Non-standard | 4 | 1.00 | 1.00 | 1.00 |
| Total | 381 | 100.0 | | |

Results of Mann-Whitney test ($p$ = .045) show that a difference between groups based on type of consonant cluster exists, though it should be noted that the difference between number of words with standard consonant clusters and number of words with non-standard consonant clusters, shown in the frequency column, is very large which is likely to have influenced the outcome of this test.

4.5) The number of syllables for each word in the sample and the mean average across the sample were counted and compared, then words grouped according to number of syllables. The mean and median average life spans for each group were calculated, as was the number of words in each group as a percentage of the sample. The expectation was that polysyllabic words would far outnumber monosyllabic words for two main reasons. Firstly, monosyllabic words are more likely to be maintained in a person's mental lexicon than polysyllabic words as being shorter they are easier to remember and therefore less likely to become obsolete. Secondly, monosyllabic words must necessarily have only one syllable, whereas polysyllabic words may have any number above one allowing for a much larger range. The purpose was to test hypothesis 3, with the expectation that an increase in syllables

would correlate with a decrease in number of years of recorded use due to additional transmission difficulty.

Table 7 shows the frequency of occurrences by number of syllables, and the average length of recorded use for words by number of syllables. Words of 2 or 3 syllables occur most frequently, each 116 times (30.4%). The next highest occurrence is 4 syllable words, occurring 72 times (18.9%). Words of one syllable occur 50 times (13.1%). Words of 5 syllables occur 22 times (5.8%), 6 syllables 3 times (0.8%) and 7 syllables twice (0.5%). As expected, there are more polysyllabic words than monosyllabic words. Single syllable words have the longest life span (median 100 years), four times as long as the next longest, 3 syllable words (25 years). 4 syllable words have a life span of 10 years, 2 syllable words have a lifespan of 8 years, with 5, 6, and 7 syllable words having a life span of one year each.

**Table 7**: Frequency of occurrences by number of syllables.

| | | | Years of recorded use | |
|---|---|---|---|---|
| Syllables | Frequency | Percent | Mean | Median |
| 1 | 50 | 13.1 | 174.70 | 100.00 |
| 2 | 116 | 30.4 | 90.41 | 8.00 |
| 3 | 116 | 30.4 | 101.03 | 25.00 |
| 4 | 72 | 18.9 | 59.90 | 10.00 |
| 5 | 22 | 5.8 | 56.36 | 1.00 |
| 6 | 3 | .8 | 49.67 | 1.00 |
| 7 | 2 | .5 | 1.00 | 1.00 |
| Total | 381 | 100.0 | 96.18 | 13.00 |

Results of Kruskal-Wallis test ($p$ = .008) show that a difference between groups based on number of syllables exists.

4.6) The number of standard and variant spellings for words in the sample was used to test hypothesis two and hypothesis three. In the first case it was expected that words with non-standard spellings would have died out or become standardised. It was expected that words with the highest number of variants would have a shorter life span than those words with few or no variant spellings because the latter are more memetically stable.

Table 8 shows the frequency of word occurrences, and mean and median average length of recorded use by number of spellings. Generally the frequency of occurrence decreases with each additional variant. The exceptions are words with 4 spellings which occur 6 times, and words with 5 spellings which occur 7 times. The other anomaly is words with 7 spellings, of which there is only 1. There are 261 words (68.5%) with only one spelling. Using median average, it can be seen that no word with 3 or more variant spellings has a life span of less than 100 years. Contrary to expectations, words with a high number of variants have a longer life span than those words with few or no variant spellings. In this case it may be that the adaptability is more important to survival than stability.

**Table 8**: Frequency of word occurrences, and mean and median average length of recorded use by number of spellings.

| | | | Years of recorded use | |
|---|---|---|---|---|
| Spellings | Frequency | Percent | Mean | Median |
| 1 | 261 | 68.5 | 56.60 | 1.00 |
| 2 | 60 | 15.7 | 77.12 | 27.00 |
| 3 | 22 | 5.8 | 180.18 | 176.50 |
| 4 | 6 | 1.6 | 153.33 | 170.00 |
| 5 | 7 | 1.8 | 195.57 | 225.00 |
| 6 | 4 | 1.0 | 148.00 | 136.50 |
| 7 | 1 | .3 | 199.00 | 199.00 |
| 8 | 3 | .8 | 441.33 | 311.00 |
| 9 | 3 | .8 | 498.33 | 489.00 |
| 10 | 3 | .8 | 507.33 | 526.00 |
| 11 | 2 | .5 | 510.50 | 510.50 |
| 12 | 2 | .5 | 470.00 | 470.00 |
| 13 | 2 | .5 | 359.00 | 359.00 |
| 14 | 2 | .5 | 736.00 | 736.00 |
| 16 | 2 | .5 | 405.50 | 405.50 |
| 18 | 1 | .3 | 899.00 | 899.00 |
| Total | 381 | 100.0 | 96.18 | 13.00 |

Results of Kruskal-Wallis test ($p$ = .000) show that a difference between groups based on number of variant spellings exists.

4.7) The overall ease of transmission rating was used to test hypothesis three, that the life span of a word is affected by its ease of transmission. The ease of transmission rating for a word was determined by combining the number of non-standard consonant clusters, number of syllables, and number of variant spellings. This gave a numeric value, with a high number suggesting less ease of transmission. Table 09 shows the frequency of word occurrences and mean and median average length of recorded use by ease of transmission rating.

**Table 9**: Frequency of word occurrences and mean and median average length of recorded use by ease of transmission rating.

| | | | Years of recorded use | |
|---|---|---|---|---|
| Rating | Frequency | Percent | Mean | Median |
| 2 | 25 | 6.6 | 52.64 | 3.00 |
| 3 | 82 | 21.5 | 67.56 | 1.00 |
| 4 | 104 | 27.3 | 67.39 | 1.00 |
| 5 | 87 | 22.8 | 72.16 | 27.00 |
| 6 | 36 | 9.4 | 78.39 | 5.50 |
| 7 | 17 | 4.5 | 125.18 | 97.00 |
| 8 | 9 | 2.4 | 128.00 | 72.00 |
| 9 | 1 | .3 | 311.00 | 311.00 |
| 10 | 3 | .8 | 281.00 | 199.00 |
| 11 | 4 | 1.0 | 574.75 | 616.00 |
| 12 | 2 | .5 | 572.00 | 572.00 |
| 13 | 2 | .5 | 482.00 | 482.00 |
| 14 | 3 | .8 | 403.67 | 377.00 |
| 15 | 1 | .3 | 946.00 | 946.00 |
| 17 | 3 | .8 | 445.67 | 509.00 |
| 18 | 1 | .3 | 447.00 | 447.00 |
| 19 | 1 | .3 | 899.00 | 899.00 |
| Total | 381 | 100.0 | 96.18 | 13.00 |

Results of Kruskal-Wallis test ($p$ = .000) show that a difference between groups based on ease of transmission rating exists.

## 5. Discussion and conclusion

The application of biological evolutionary models to explain language evolution is not a new idea, yet there is no consensus as to which models work best, and there is controversy about the appropriateness of using such models. Using memetics or similar model of cultural transmission adds specificity to the processes which occur, and reduces the use of biological processes metaphorically to describe them. Nevertheless, it is not disputed that living languages do and must change, and an appropriate way to describe the compound changes which occur over time is as evolutionary. Obsolete words have been used as a substitute for living words in this study to allow the life span of words to be examined from birth as neologism, through to moribundity and death. Various factors were tested to see if they affected the life span of a word, and in each case some effect was found. However the extent to which each factor affected the life span of a word is beyond the scope of this study.

## 6. Limitations and remedies

The population of obsolete words was taken from the OED as the only source. As stated earlier, methods of data entry into the OED may not always have been consistent, and would have involved subjectivity on the part of the editors. The effect of this could be mitigated and the validity of the study increased by using several

corpora as sources. With digitisation of dictionaries such as OED this is no longer such a daunting task.

Mann-Whitney and Kruskal-Wallis statistical tests used show differences exist between groups, but cannot be used to identify which groups are different, and if the difference is meaningful or not. Therefore, a multiple comparison test should be used.

## 7. Suggestions for further study

The lifespan of words first used before and extant in 1780s could also be compared using British and American corpora. It was in the 1780s that Noah Webster proposed various language reforms with a view to creating a US English, so the assumption could be made that it is at approximately this point that a lineage split began. However, more precise dating and definitive criteria for assuming divergence would be necessary before starting study. The purpose would be to test hypotheses of language universals. Inclusion of a random sample of living words would allow all hypotheses to be tested more thoroughly by reducing any effect that might be caused by confirmation bias. What is true of obsolete words may not necessarily be true of living words.

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