

December 2016


Recent Semantic Changes for the Term "Digital"

Tore Brattli

University of Tromsø, tore.brattli@uit.no

Please take a moment to share how this work helps you [through this survey](#). Your feedback will be important as we plan further development of our repository.

Follow this and additional works at: <http://ideaexchange.uakron.edu/docam>

 Part of the [Communication Technology and New Media Commons](#), [Comparative and Historical Linguistics Commons](#), [Digital Circuits Commons](#), and the [Language Description and Documentation Commons](#)

Recommended Citation

Brattli, Tore (2016) "Recent Semantic Changes for the Term "Digital"," *Proceedings from the Document Academy*: Vol. 3 : Iss. 2 , Article 16.

Available at: <http://ideaexchange.uakron.edu/docam/vol3/iss2/16>

This Conference Proceeding is brought to you for free and open access by University of Akron Press Managed at IdeaExchange@UAKron, the institutional repository of The University of Akron in Akron, Ohio, USA. It has been accepted for inclusion in Proceedings from the Document Academy by an authorized administrator of IdeaExchange@UAKron. For more information, please contact mjon@uakron.edu, uapress@uakron.edu.

Introduction

The use of the term *digital* has within a few years increased significantly in Norwegian written language, and is now at the same level as everyday words such as mobile phone and hospital (National Library of Norway, 2016).

Historically, digital has evolved from the Latin term for finger, counting and digits (0-9), to denote a specific type of electrical pulse in the first “computer supported” air defense systems during World War II. Much of the same principle is retained in computer technology with digital electronic circuits, digital signals and digital storage media. The use of discrete quantities (as opposed to continuous) to represent information is the core of the technical concept digital. This implies that digital, also in “pre-digital” times, has been a recognized principle of representation, independent of computers. Both human genes and printed text are essentially digital representations. In recent years, the technical term seems to have expanded its meaning to also include the technology that uses discrete representation. We now also have well established terms¹ like *digital literacy* and *digital humanities*. In addition, the term seems to be quite arbitrarily defined in some areas, e.g. the distinction between electronic and digital literature. In medicine, digital is still the term for finger. We also have variants of digital in botany with *Digitalis purpurea* (foxglove) and the digitalis medicine that is extracted from the plant. The use of the term is thus very diverse.

Words that change meaning are not unusual, but what we are now witnessing in technology are uncommonly significant changes. This makes it interesting to investigate the change and the reasons for it more closely. It is reasonable to assume that the ongoing “digital revolution” is an important factor. The aim of this study is to determine if semantic change can be detected compared to the prevailing discrete digital concept. I will also assess the motivations for and types of semantic change. Finally, I will consider whether we are witnessing the emergence of one or more “new,” unique, and lasting concepts of digital, or whether the change is more temporary.

The focus is mainly on Norwegian conditions and especially daily usage in Norwegian media. Illustrative examples from English are also used, where relevant. For technological terms in such related languages, there is reason to believe the results largely can be generalized between the languages.

Theory and related works

Modern semantics and the term semantic originates from Michel Bréal, who in 1897 published *Essai de Sémantique*. In most languages there is no significant

¹ i.e. multi-word expressions

correlation between the phonetic shape of a term and the concept it is representing (Saussure & Harris, 2013). The relationship is based on an arbitrary convention between the speakers of a language. Conventional relationships may change over time and cause semantic change (Luján, 2010), i.e. evolution in word usage. According to Blank (1999) the main motivations for semantic change are expressivity and efficiency, which can be further divided into linguistic, psychological, sociocultural, and cultural/encyclopedic forces. Grzega (2004) has devised a longer and more specified list where forces like onomasiological² fuzziness, prestige, fashion, dominance of the prototype, and excessive length of words are most relevant.

For the classification of types of changes, the scheme from Bloomfield (1933) has long been one of the most accepted. Blank (1999) uses a slightly different and more updated scheme. Of the more recent works on semantic change, Luján (2010) has an excellent summary of both motivations and types of changes.

The release of the Google Books N-gram dataset (English books) in 2010 opened up immense opportunities for statistical analysis of semantic change. Wijaya, Yeniterzi (2011) provide one of the significant studies where they conducted cluster analysis on several words (e.g. *gay*) to discover change based on the co-occurrence of related words over time.

There is surprisingly little research in semantic change targeting information technology terms in particular. Colburn, Shute (2008) focus on metaphors in computer science while Covington (1981) classifies a number of computer terms using a scheme similar to Bloomfield's. Caso (1980) has examined changes for 4300 scientific terms and found semantic changes for 37.7%.

On semantic change and the term *digital* I have found nothing of relevance.

Method

I will first examine the meaning of the more technical (post–World War II) concept of digital, using etymological dictionaries and encyclopedias, research on the analog/digital distinction and textbooks from the field of digital electronics.

Full-text archives and tools like ATEKST³ (newspaper articles), Bokhylla.no (Norwegian books), JSTOR, The Norwegian National Library, Google books N-gram viewers, Google, and Google Trends are used to find diachronic changes in both meaning and popularity of *digital*⁴ in recent years.

² Onomasiology is a branch of lexicology

³ Norwegian newspaper articles: <https://web.retriever-info.com/services/archive.html>

⁴ i.e. phrases that begins with the term

The classification scheme described by Blank (1999) and Luján (2010) is then used as a model for analyzing semantic change.

The original technical concept

Since recent use of the term digital seems to denote several different concepts, it is relevant to review the “original” technical meaning.

Historically, it seems relatively clear that digital comes from the Latin word for finger. Furthermore, it is associated with integer counting on the 10 fingers, and hence the digits 0-9. This is confirmed by a number of sources, including *A Natural History of Latin* (Janson, 2004, p. 165). Interestingly enough, the term is still used in medicine for fingers where we have digital nerves, digital arteries, etc. A search of databases with excellent retrospective coverage (like Science Citation Index or JSTOR) shows only medical (i.e. finger related) articles before ≈1945. Today both meanings are found, even within the same article, e.g. *digital ulcer*⁵ and *digital retinal images* (Aissopou et al., 2015).

First use of more technical nature

The more contemporary use of digital can be traced to a 1942 meeting of the U.S. National Defense Research Committee regarding the development of anti-aircraft fire during World War II:

The committee examined a number of designs, which they noticed fell into two broad categories. One directed antiaircraft fire by constructing a mechanical or electrical analog of the mathematical equations of fire control, ... The other solved the equations numerically—as with an ordinary calculating machine, only with fast electrical pulses instead of mechanical counters. One member of the committee, Bell Telephone Laboratories mathematician George Stibitz, felt that the term pulse was not quite right. He suggested another term that he felt was more descriptive: digital. (Ceruzzi, 2012, p. 1)

Signals in the form of electrical (or light) pulses are still fundamental of computers. The first articles that used digital related to computers were published around 1947:

Students of computing aids have been accustomed to putting computers into one of two classes. One class includes "continuous" devices... The second class consists of digital computers that represent mathematical quantities first in a digital or radix notation, such as the decimal or the binary notation; they then represent each digit of this notation by setting up certain discrete physical situations, like 10 stable positions of a

⁵ Open sores on the fingers and toes that do not heal

counter wheel or the off-or-on conditions of an electric switch. ("A New Class of Computing Aids," 1948)

From the first use of digital in a technical context, we can see that the term is connected to whole (countable) quantities or numbers, and as something opposed to analog.

Analog/digital theory

For research on digital representation, Goodman is still recognized as one of the first to analyze the analog/digital distinction:

A symbol *scheme* is analog if syntactically dense. ... for every character there are infinitely many others such that for some mark, we cannot possibly determine that the mark does not belong to all, and such that for some object we cannot possibly determine that the object does not comply with all. ... A digital scheme, in contrast, is discontinuous throughout; and in a digital system the characters of such a scheme are one-one correlated with compliance-classes of a similarly discontinuous set ... (Goodman, 1976, p. 160)

He also writes that: "... a digital system has nothing special to do with digits, The characters of a digital system may have objects or events of any kind as their inscriptions; ...".

Haugeland (1981) was inspired by Goodman but tied the analog/digital distinction to a more informal definition, i.e. to the reliability of writing and reading the representations. A *digital device* is one that writes-reads tokens with absolute certainty (practically error-free), while write-read procedures for analog devices are approximations. A few instances of Goodman's definition of digital are not Haugeland's digital and the opposite, however the latter appears more foresighted and practical.

Schonbein supported the 'received view' of the distinction between analog and digital, where analog representations are continuous while digital representations are discrete.

The terms continuous and discrete are here understood mathematically: Discrete representational schemes are bijective with (a finite subset of) the natural numbers, and continuous representational schemes are bijective with the reals. Less formally, the received view holds that slide rules are analog devices precisely because they utilize representations that vary by 'arbitrarily small degrees', while standard electronic computers are digital because they use representations that do not. (Schonbein, 2014, p. 416)

He also argued that recent alternative explanations, especially from cognitive psychology, do not imply that the received view is incorrect, but rather that some fields have established their own variants.

In the field of digital electronics, there seems to be widespread agreement about the meaning of the term digital. Agarwal & Lang (2005) is a central work:

Digital systems use the digital abstraction, which is based on discretizing signal values. Clocked digital systems are based on discretizing both signals and time, ... Signals in the physical world are most commonly analog, that is, spanning a continuum of values. Sound pressure is such a signal. ... Value discretization forms the basis of the digital abstraction, which yields a number of advantages such as better noise immunity compared to an analog signal representation. ... but they do so at the expense of precision.

Dictionaries and etymology

Various contemporary Norwegian dictionaries⁶ define the term relatively similarly, with only minor deviations. Here are some of the most relevant.

The Bokmålsordboka (Norwegian dictionary) has the following basic and appropriate definition:

Digital: from English *digit* (decimal) digits. Origin from Latin *digitus* finger, in terms of numbers, opposite: analog

Digital data: data that represents physical quantities with discrete characters, usually digits, as opposed to analog data (Wangensteen, UiO, & Språkrådet, 2005)

Store norske leksikon (Norwegian Encyclopedia):

Digital data: data that can only assume a finite set of values. Digital data is usually represented with numbers or characters. The text of a book, or ordinary decimal numbers are examples of digital data. Opposite: analog data which can assume an infinite set of values. A pointer deflection is an example of analog data. (Andersen, 2009)

Since analog is included in most definitions as the antonymous term of digital, it is relevant to examine this term as well. In Store norske leksikon *analog technique* is defined as:

... continuously variable quantities are represented by (infinitely) variable pointer deflections on a scale. This differs from digital technology, which shows quantities directly in numeric values or

⁶ The definitions are translated from Norwegian by the author

symbols. A clock with hands is analog, one with numbers is digital. (Tranøy, 2015)

Some dictionaries relate digital to numbers, especially binary numbers. Tanums store rettskrivningsordbok (Norwegian dictionary):

Digital: that applies to digits, in the form of numbers (Wangensteen & Språkrådet, 2015)

Norsk Riksmålsordbok (Norwegian dictionary):

Digital: from Latin *digitalis* → *digitus* “finger or relating to the fingers”

Technique/subject that makes use of, is based on a binary digit system
Digital calculating machine: machine that processes data in form of digits (Noreng, Knudsen, Sommerfelt, & Bødtker, 1995)

Summary

Even if there is no widespread agreement from history, theory, and dictionaries, we can see the outline of a digital concept. To summarize, it might be appropriate to begin with the antonymous term analog, which often is linked to the more original or traditional. Although analog and digital basically are complementary antonyms, they may both at the same time be associated with an information carrier through different properties. For example, a movie on traditional photographic film has analog images on a digital (discrete) time axis.

Analog is usually related to continuous signals that can transmit information by varying the amplitude and/or frequency as a function of time. An analog signal⁷ has, in theory, infinite resolution and can be used to transfer any kind of information. Both nature and mathematics are, in many areas, analog. Signals can also be stored analogously (e.g. in vinyl records) and processed analogously (e.g. in a synthesizer). Even the audible music from digital streaming services is analog. Carriers of both analog and digital information are normally analog. The essential is how the information is represented on the carrier and interpreted by the receiver. Digital terrestrial television networks use an analogue carrier to transmit digital TV signals. Similar for barcodes.

Digital on the other hand is related to entities of more discrete nature. Where analog is comparable to an inclined plane or a smooth ramp, digital is stepwise like a staircase, or in most cases points with “integer” coordinates as close as possible to the inclined plane. This is also in accordance with the standard interpretation described by Schonbein (2014).

⁷ https://en.wikipedia.org/wiki/Analog_signal

Some natural phenomena are basically digital, but it is especially representations of reality in the form of symbols, audio recordings, images, movies, and measured values that increasingly become digital. E.g. the loudness of an audio CD sample is specified on an integer scale ranging from 0 to 65,535. The scope of the scale (the number of different values) says something about the accuracy, and usually depends on the demand for quality. With digital representations, it is still possible to achieve a precision and resolution that far exceeds what our eyes and ears can perceive (not to mention the precision of analog options).

A challenge with analog signals is that they are vulnerable to noise. Since “all” values are possible, we have no way of knowing exactly what the original signal was and thereby be able to correct unwanted changes. A vinyl record will never be able to reproduce the original sound perfectly and wear will also change it slightly each time it is played. However, since computers use digital signals, data can be copied back and forth a multitude of times, with no loss of information. Digitization or digital representation involves sacrificing some accuracy (and entropy) in favor of robustness and increased redundancy. Digital (discrete) values are more resistant to errors and adverse changes than continuous values, and can be seen as a form of error correcting codes.

Some implications of the definition

A definition of digital related to discrete countable entities means that it is more than just modern information technology, which uses digital representation.

Digital data is stored on various media as dashed lines, electric charges or magnetic polarizations and is processed/transmitted in computers as electrical pulses. There are no zeros and ones in a PC; they are merely the commonly used designations for the states of a binary storage cell. Within information technology it is certainly the usual principle, however there are alternatives. Modern multi-level cell flash storage uses cells⁸ with up to 16 different charges, while Compact Discs (CDs) represent information using dashes and spaces with 8 different lengths. It follows that these states (or conditions) may be used to represent anything, including numbers. This is in accordance with theory, e.g. Goodman (1976, p. 160): “A digital system has nothing special to do with digits.” Any characters or symbols from a finite alphabet can be used.

Digital representation is nothing new⁹, nor is it restricted to modern information technology. There are many examples of pre-computer technology that are digital, for example:

⁸ Up to 4 bits per cell. https://en.wikipedia.org/wiki/Multi-level_cell (accessed May 12, 2016)

⁹ Inspired by https://en.wikipedia.org/wiki/Digital_data (accessed May 12, 2016)

- All text is in principle digital, also text in printed books. Text is basically a discrete representation of speech, thoughts and entities, divided into whole characters, words, sentences, etc. Support for this view of text is found in e.g. Lavagnino (2007), Goodman (1976), Cramer (2015). However, handwriting and printed text are not necessarily 100% digital if the glyphs represent something more (of a continuous nature) than the characters themselves. The author's handwriting could express both personality and plot if the glyphs themselves are individual works of art conveying a message.
- Genes contain the physical recipe of living organisms and transmit genetic information from one generation to the next. Human genes consists of approximately 3,000,000,000 base pairs; each of which is in one of four states A, T, C or G (Robison, 2014). Genetic information must be durable and evolution did “discover” early the advantages of digital representation.

New digital concepts?

In recent years, there is much to suggest that the term digital has expanded its scope as presented above and perhaps even denote new concepts. At the same time, it continues to denote the original meaning—discrete—in the same subject areas as before, e.g. in digital electronics and signal processing. We will now take an empirical look at the development of some of the original (i.e. technical) and some of the more recent terms that include digital. Since Norwegian is influenced by English technical terminology, full-text archives like JSTOR and Google Books are also used where relevant.

ATEKST has registered an increase in use of the term **digital** from 1970 to the present day with a leveling off in 2010 (Figure 1). The bibliographic services of the National Library of Norway¹⁰ confirm this development, but indicate a leveling off from approximately 2006. Normally digital is used as an adjective, e.g. digital representation, but increasingly the term is also used alone acting as a noun (nominalized adjective)¹¹ in, e.g. “the digital has become part of everything” (Dewdney & Ride, 2013, p. 20).

¹⁰ <http://www.nb.no/>

¹¹ <http://www.brighthubeducation.com/english-homework-help/40011-the-use-of-adjectives-as-nouns/>

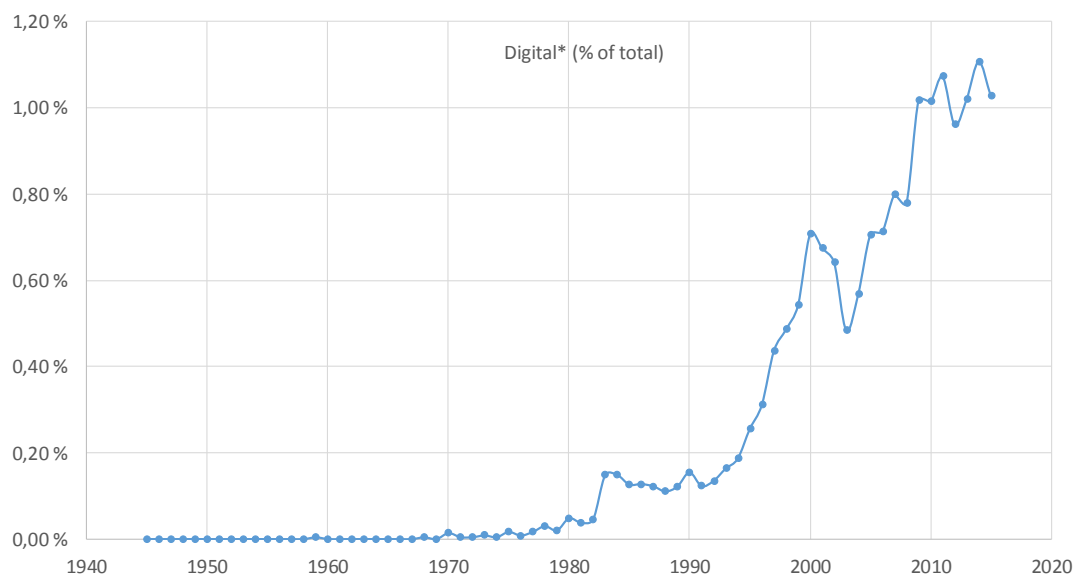


Figure 1: articles in ATEKST containing digital (% of total)

A **digital camera** represents image information using digital electronics and discrete numbers. The term was originally used to denote a new type of camera, which was unlike traditional analog cameras with photographic film. Its usage reached a peak in ATEKST in 2005, in Google trends in 2005 and in NBs N-gram service in 2006. The term is now experiencing a steep decline and has been almost completely replaced by phone camera, compact camera, etc. Digital is now almost nonexistent in product descriptions and categories, and only remains in some manufacturers names, e.g. Western Digital.

Digital music does not seem to have any clear definition and is probably derived from e.g. digital music synthesis and digital music systems around 1980. Many people associate the term with streaming and then as opposed to CDs. E.g. “Digital music now equals CD and vinyl revenue”¹². The opposite use can also be found, for example: “... Apple to acquire streaming service Beats Music ... This is seen as a strategic move, since the market for digital music keeps falling. At the same time streaming services like Spotify grows,...”¹³. In other contexts, it is probably used more as a filler/buzzword. For example: “The church must keep up with the times. Of course, our main wish is live music during a funeral. Nevertheless, a growing number of people want playback of digital music from

¹² <http://www.nrk.no/kultur/digital-musikk-like-stort-som-cd-og-vinyl-1.12310592>

¹³ Dagsavisen 05.10.2014, page 47

CD, MP3 and such”¹⁴. Digital music/audio is mentioned in ATEKST from 1984 with a maximum in 2000, and is now sharply declining.

It is difficult to pinpoint the first use of the term digital where the primary meaning is obviously more than just discrete representation. As one of the first, Paul Gilster writes in 1997 about “Digital literacy – the ability to access networked computer resources and use them” (Gilster, 1997).

The term **digital literature** seems to be used largely synonymously with electronic literature (and digital/electronic books/journals), sometimes even in the same texts. The following quote illustrates some of this: “The library buys a lot of digital literature, both journals and e-books, which hence are freely available to all the University's students.”¹⁵. In *Electronic literature: new horizons for the literary* Hayles (2008) also uses digital and electronic apparently interchangeably:

Hypertext fiction, network fiction, interactive fiction, locative narratives, installation pieces, “codework,” generative art, and the Flash poem are by no means an exhaustive inventory of the forms of electronic literature, but they are sufficient to illustrate the diversity of the field, the complex relations that emerge between print and electronic literature, and the wide spectrum of aesthetic strategies that digital literature employs. (p. 30)

It is also emphasized that: “Electronic literature, generally considered to exclude print literature that has been digitized, is by contrast “digital born,” a first-generation digital object created on a computer and (usually) meant to be read on a computer” (Hayles, 2008, p. 160).

Others ascribe them various concepts. In Norwegian, several textbooks have been published in recent years about digital literature, which defines the terms (i.e. the digital/electronic distinction) relatively equal, e.g. *Literature in a Digital Time*:

... it may be useful to distinguish between two different types of digital publications in the literary field. On the one hand we find digital publications that also can be read on paper, and which in many cases are written especially for print media ... The ordinary e-book is the typical example of this type of texts. ... On the other hand, we find literary texts that are written directly to a digital medium, and which require a screen and specific software to be realized and displayed. ... for in many ways electronic literature can be described as a digital avant-garde. It serves as an important backdrop both for the

¹⁴ Tidens krav, 03.07.2016, page 12

¹⁵ <http://www.uib.no/ub/71660/digitalt-pensum>

understanding of and for further experimentation with the current fully digital screen literature. (Prytz, 2016) (author's translation)

In ATEKST and bokhylla.no the term *digital literature* has almost no prevalence (< 20). Google has $\approx 7000/5500$ hits for digital/electronic literature (in Norwegian). In English, the situation is the opposite (87,400/188,000 hits in Google), with *electronic literature* as the preferred term. The Google N-gram viewer also confirms this ratio retrospectively. It is difficult to find any deeper analysis of the terms digital/analog or electronic related to literature. This is interesting considering that also printed text has obvious digital features.

The term **digital humanities** has quickly become a major research area; but what is meant by *digital* in this context? To cite the network of digital humanities at the University of Oslo: "Digital humanities, what is it? A silly concept, some believe. A separate new field of study, others say. Digital humanities is strictly what happens in the meeting between the traditional humanities and new digital tools, ..."¹⁶.

Kathleen Fitzpatrick describes both the area of research and the origin of the name:

Digital humanities ... is broadly humanities-based, and includes scholars in history, musicology, performance studies, media studies, and other fields that can benefit from bringing computing technologies to bear on traditional humanities materials. ... There is, however, a specific history to the term "digital humanities," In 2001 the field was known as "humanities computing," and had been around for some decades, when ... three of its key practitioners, entered into discussions with Blackwell Publishing about editing a volume prospectively entitled "A Companion to Humanities Computing." Blackwell wanted a title that might appeal to a wider range of readers, and so proposed "A Companion to Digitized Humanities." [John] Unsworth countered with "Digital Humanities," to keep the field from appearing to be about mere digitization. And the name has stuck... (Fitzpatrick, 2011)

The choice of name may seem somewhat arbitrary. In the literature, it is difficult to find any serious analysis of the etymology of the term digital, neither in *A Companion to Digital Humanities* (Schreibman, Siemens, & Unsworth, 2004) nor in subsequent publications such as *Defining Digital Humanities* (Terras, Nyhan, & Vanhoutte, 2013) and *Debate in the Digital Humanities* (Gold, 2012). Meanwhile, there is much debate about what the name really signifies. Digital

¹⁶ <http://www.hf.uio.no/ilos/forskning/aktuelt/aktuelle-saker/2014/humaniora-tar-syvmlilstovler-paa.html>

humanities is hardly mentioned in Norwegian newspapers with only 7 hits in ATEKST, while Google has \approx 9000 hits.

Digital natives (and **digital immigrants**) refers to those who have grown up with digital technology (Prensky, 2001).

They grow up with technology and will not distinguish between offline and online like we seniors do. Millennials are digital natives. Internet, smartphones and social media are a matter of course. Mobile phones will become less used for talking; instead they will be used to accomplish other tasks. (Nygård-Hansen, 2016)

[Researcher Øystein] Gilje says there is a clear distinction between the digital natives (born after 1980), and digital immigrants (born before 1980). The digital natives are using social media in a different way, i.e. mainly to develop their creative interests. (Haugan, 2014)

In Norwegian the term has \approx 5000 hits on Google, but only a few in ATEKST.

Digital addiction and **-detox**: addiction to smartphones¹⁷ and then a limited period of time where you refrain from social media, cell phones, computers, etc.¹⁸

Digital bullying (Cyberbullying in English): bullying via the internet, mobile phones, social media, discussion groups, online games, etc.¹⁹. In ATEKST the term net-bullying is also used to approximately the same extent.

These are just a few examples, but there are many more, e.g. -added value, -age, -consultant, -dating, -dignity, -editor, -everyday, -exams, -investigation, -listening, -manipulation, -meeting place, -newspaper, -quiz, -role model, -school, -skills, -surveillance, and -witch-burning.

At the moment there seem to be no limits to what is possible to combine with the term digital.

As we have seen, digital bullying consists of neither face slaps (with fingers) nor the use of stun guns with square pulses. Certainly, the term is not easy to get a handle on based on current usage. I have examined the more original technical definition of digital which is founded on representation using discrete quantities. Information represented digitally may be copied repeatedly and error-free, it is more robust against unwanted changes and hence better preserved. The concept is fundamental and relatively easy to define (as in dictionaries), at least for most practical purposes. In addition, it works well with computers. A challenge here is the common understanding that digital is limited to “zeros and ones” and/or

¹⁷ <http://www.side2.no/aktuelt/er-du-klar-for-digital-avrusning/3730161.html>

¹⁸ Det Norske Akademis Store Ordbok

¹⁹ <http://forskning.no/mobbing-internett-mobiltelefon-skole-og-utdanning/2010/10/lett-mobbe-digitalt>

“computer technology.” This “concept” is more superficial, meaningless and invites individual interpretation and semantic change, e.g. the idea of analog text.

Classification of semantic change

In the previous section we have seen that several recent examples are not related to discrete representation, at least not directly. Digital addiction, for example, is addiction to computers, smartphones and social media, and digital literature is tailored-made for computer screens. It appears that the term now sometimes denotes digital technology in general and sometimes has more specialized meanings dependent on the context. This means that we have a semantic change. To classify the semantic change of the term digital I will use the scheme from Luján (2010).

Metaphor is change caused by perceived similarity between concepts, often from different domains, e.g. mouse → computer mouse. Even if metaphors are heavily used in computer terminology as described in Colburn, Shute (2008) (e.g. Windows, Desktop, Folders, Cloud and Toolbox) the recent use of digital is not a metaphor. However, multi-word expressions like digital witch-burning or digital books definitely are. The digits 0-9 are likely to be a metaphor for the Latin digital (finger).

Metonymy is caused by proximity between concepts, e.g. The White House → the president and his staff. The analysis has not revealed examples of metonymy in general. Candidates could be terms like binary or electronic, but this is not further examined.

Synecdoche (a specific kind of metonymy) is caused by a relationship in which a part of something refers to the whole, or vice versa, e.g. suits → businesspeople. It is likely that digital is a synecdoche, where a central principle in computer technology (i.e. digital) now refers to the whole (i.e. digital technology). This applies to both digital -humanities, -natives and -literacy. Also in phrases like “*the digital has become part of everything*” the term digital (both literary and semantically) is a synecdoche.

Folk etymology is caused by false analogies²⁰ (e.g. similarity of names), e.g. Hamburg-er (native of Hamburg) → hamburger → cheeseburger. The change could be in form, meaning or both (Rundblad & Kronenfeld, 2003). In Norwegian digital is often used as a term to distinguish the new from the old (called electronic or analog). Examples include new digital and old electronic literature or digital (streamed) music and (music on) CD. Digital may appear more modern than electronic, but often the original semantics are not well reviewed before the

²⁰ <http://www.ub.edu/diccionarilinguistica/print/6815>

terms are used in a new context. This has clear similarities with *folk etymology*, i.e. change in terms caused by misconceptions about origin.

Ellipsis is caused by proximity of terms where a part of a complex expression acquires the meaning of the whole, e.g. fall of the leaves → fall (autumn). Grzega's (2004) *Excessive length of words* is a motivation for ellipsis. Ellipsis takes place all the time and may be the predecessor for synecdoche, e.g. "... digital equipment for field recording ... has proven to be higher in fidelity and lower in price than the best analog system, ..., the digital has a 20 dB advantage in signal-to-noise ratio, ..." ²¹. "the digital has become part of everything" may also be an example of a more long-lasting ellipsis.

Broadening or **narrowing** happens when terms acquires a more general/specific meaning, e.g. Hoover (vacuum cleaner) → any type of vacuum cleaner. An example of specialization is computer memory that originally carried no distinction between internal and external. Today memory only applies to internal storage (Covington, 1981). The understanding of digital as binary or only related to electronic may be an instance of narrowing. However, digital technology is not a broadening of digital.

Although Grzega's (2004) **prestige, fashion** (including buzzword or filler) are not regarded as a semantic change, it seems like this is one of the motivations for the widespread use, e.g. when someone *wants digital music in a funeral*. Digital students attend to digital classes at digital schools with digital classrooms and digital exams. Using hard to understand professional terminology in a new context gives prestige.

Conclusion

The results of this study show that we have semantic changes for the term digital. In many areas, the central attribute of discreteness now is used to denote the whole of "information technology." This is an example of synecdoche. In addition, the use of digital to denote specific kinds of music (streamed or CD) or literature (digitized print or screen only) has clear similarities with folk etymology.

As more and more information becomes digital and most people are "digital natives," there is reason to believe that the fascination of the term will decline, and its usage will follow the same trend as seen in online stores for computer and electronics, where the products have regained their original terms such as TV and compact camera (Cramer, 2015). This means that books, literature, music, and

²¹ from Karl Signell's paper, "Digital Equipment for Field Recording: Pro and Con," delivered at the 1984 annual meeting of the Society for Ethnomusicology.

addiction again will become the normal phrases and that we will rather find new terms to denote “rarities” such as printed books.

References

- Agarwal, A., & Lang, J. H. (2005). *Foundations of Analog and Digital Electronic Circuits*. Amsterdam: Elsevier.
- Aissopou, E. K., Bournia, V. K., Protogerou, A. D., Panopoulos, S., Papaioannou, T. G., Vlachoyiannopoulos, P. G., Sfikakis, P. P. (2015). Intact Calibers of Retinal Vessels in Patients with Systemic Sclerosis. *Journal of Rheumatology*, 42(4), 608-613. doi:10.3899/jrheum.141425
- Andersen, P. B. (2009). Digitaldata. *Store norske leksikon*. Retrieved from <https://snl.no/digitaldata>
- Blank, A. (1999). Why Do New Meanings Occur? A Cognitive Typology of the Motivations for Lexical Semantic Change. In A. Blank & P. Koch (Eds.), *Historical Semantics and Cognition* (pp. 61-90). Berlin, Germany: Mouton de Gruyter.
- Bloomfield, L. (1933). *Language*. New York: Holt.
- Caso, A. L. (1980). The Production of New Scientific Terms. *American Speech*, 55(2), 101-111. doi:10.2307/3050500
- Ceruzzi, P. E. (2012). *Computing : a concise history*. Cambridge, Mass: MIT Press.
- Colburn, T. R., & Shute, G. M. (2008). Metaphor in computer science. *Journal of Applied Logic*, 6(4), 526-533.
- Covington, M. A. (1981). Computer Terminology: Words for New Meanings. *American Speech: A Quarterly of Linguistic Usage*, 56(1), 64-71. doi:10.2307/454479
- Cramer, F. (2015). What Is ‘Post-digital’? In D. M. Berry & M. Dieter (Eds.), *Postdigital Aesthetics: Art, Computation and Design* (pp. 12-26). London: Palgrave Macmillan.
- Dewdney, A., & Ride, P. (2013). *The Digital Media Handbook*: Routledge.
- Fitzpatrick, K. (2011). The Humanities, Done Digitally. *Chronicle of Higher Education*, 57(36), B26.
- Gilster, P. (1997). *Digital literacy*. New York: Wiley.
- Gold, M. K. (Ed.) (2012). *Debates in the Digital Humanities*. Minneapolis: University of Minnesota Press.
- Goodman, N. (1976). *Languages of art : an approach to a theory of symbols* (2nd ed.). Indianapolis: Hackett.
- Grzega, J. (2004). *Bezeichnungswandel: Wie, warum, wozu? Ein Beitrag zur englischen und allgemeinen Onomasiologie*. Heidelberg, Germany: Winter.

- Haugan, S. (2014). Mest digitale i verden. Retrieved from [http://www.forskningsradet.no/prognett-finnut/Nyheter/Mest digitale i verden/1254000473774&lang=no](http://www.forskningsradet.no/prognett-finnut/Nyheter/Mest_digitale_i_verden/1254000473774&lang=no)
- Haugeland, J. (1981). Analog and Analog. *Philosophical Topics*, 12(1), 213-225. doi:10.5840/philtopics198112150
- Hayles, N. K. (2008). *Electronic Literature : New Horizons for the Literary*. USA: University of Notre Dame.
- Janson, T. (2004). *A Natural History of Latin*. England: Oxford University Press.
- Lavagnino, J. (2007). Digital and Analog Texts *A Companion to Digital Literary Studies* (pp. 402-414). Oxford: Blackwell.
- Luján, E. R. (2010). Semantic Change. In S. Luraghi & V. Bubenik (Eds.), *Continuum Companion to Historical Linguistics* (pp. 286-310). London, England: Continuum.
- National Library of Norway. (2016). NB N-gram beta. Retrieved from http://www.nb.no/sp_tjenester/beta/ngram_1/
- A New Class of Computing Aids. (1948). *Mathematical Tables and Other Aids to Computation*, 3(23), 217-221. doi:10.2307/2001905
- Noreng, H., Knudsen, T., Sommerfelt, A., & Bødtker, K. E. (1995). *Norsk riksmålsordbok : Bd. 5 : Første tilleggsbind : A-hogstplass* (2nd ed.). Oslo: Kunnskapsforlaget.
- Nygård-Hansen, H. P. (2016, Feb 17). Vi trenger et integreringsprogram for digitale innvandrere. *Aftenposten*, p. 73.
- Prensky, M. (2001). Digital Natives, Digital Immigrants Part 1. *On the Horizon*, 9(5), 1-6. doi:10.1108/10748120110424816
- Prytz, Ø. (2016). *Litteratur i en digital tid*. Oslo: Scandinavian Academic Press.
- Robison, R. J. (2014). How big is the human genome? In megabytes, not base pairs. *Precision Medicine*. Retrieved from <https://medium.com/precision-medicine/how-big-is-the-human-genome-e90caa3409b0>
- Rundblad, G., & Kronenfeld, D. B. (2003). The inevitability of folk etymology: a case of collective reality and invisible hands. *Journal of Pragmatics*, 35(1), 119-138. doi:10.1016/s0378-2166(02)00059-0
- Saussure, F. d., & Harris, R. (2013). *Course in General Linguistics*. London: Bloomsbury Publishing.
- Schonbein, W. (2014). Varieties of Analog and Digital Representation. *Minds and Machines*, 24(4), 415-438. doi:10.1007/s11023-014-9342-x
- Schreibman, S., Siemens, R., & Unsworth, J. (Eds.). (2004). *A Companion to Digital Humanities*. Chichester: Blackwell.
- Terras, M., Nyhan, J., & Vanhoutte, E. (Eds.). (2013). *Defining Digital Humanities : A Reader*. Farnham: Ashgate.
- Tranøy, K. E. (2015). Analog: teknikk. *Store norske leksikon*. Retrieved from <https://snl.no/analog%2Fteknikk>

- Wangenstein, B., & Språkrådet. (2015). *Tanums store rettskrivningsordbok* (Bokmål, 10th ed.). Oslo: Kunnskapsforlaget.
- Wangenstein, B., UiO, & Språkrådet. (2005). *Bokmålsordboka : definisjons- og rettskrivningsordbok* (3rd ed.). Oslo: Kunnskapsforlaget.
- Wijaya, D. T., & Yeniterzi, R. (2011). *Understanding semantic change of words over centuries*. Paper presented at the Proceedings of the 2011 international workshop on DETecting and Exploiting Cultural diversITy on the social web, Glasgow, Scotland.