

Obsolescence and its impact on reliability: a further development of internet triangulation

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ABSTRACT,

Obsolescence is fueled by technological innovations, following a predictable pattern. The resulting loss of reliability and the irrelevance sprouting thereof emphasizes the need for careful examination of information retrieval, both for consumers and academics. Results from a survey found significant differences in opinions on obsolescence. A case is made in this study to therefore consider this phenomenon in triangulation processes, establishing the need for and proposing a fifth type of triangulation to assess the obsolescence and resulting pragmatic relevance. Several considerations are addressed in this form of triangulation, resulting from the findings of this study.

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Keywords

Obsolescence, relevance, triangulation, trustworthiness, information, search engines

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1. INTRODUCTION

In a world of ever-fast changing technological innovations and increasing speed in the process of globalization, some ugly heads roar and threaten the benefits coming from these innovations and processes. Fake news is mentioned more and more in diverse media, and “this misinformation can be very difficult to correct” (Nyhan and Reifler, 2015). Furthermore, it has been proven that we increasingly rely on search engines instead of recalling information ourselves (Sparrow et al., 2011). It is therefore increasingly important to check the correctness of information. Correctness of this information knows several threats, one of which is known as obsolescence, or the so-called “out datedness” of information. It is suggested that this threat is becoming a bigger problem in recent times, as one of the causes of this obsolescence are technological innovations. Technological innovations, on its turn, are powered by world population growth. Data is playing a more and more significant role in society. The creation of new knowledge over time makes information which was published earlier obsolete or even false, no matter how well-constructed and right it seemed at first (Poynard et al., 2002).

Researches use the different types of triangulation to “increase the validity, reliability, strength, and interpretive potential of a study” (Thurmond, 2001). This can also be applied for consumer information. Consumers are getting more and more aware of their data usage, and the data on them which is being used. The availability of several tools like publicdatacheck.com, where people in the United States can check what is known about them to data companies, points to an increasing need of transparency, as well as an increased awareness of the trade in data, both on the internet and outside. However, sadly enough, not all information can be held to the same standards of reliability. The information overload, which reaches us daily, is outdated faster, as new information is constantly being produced and reaching us through different advancing technological innovations. Furthermore, a distinction between so-called information slaves and masters see a discrepancy between the needs and wants of these groups, as well as biasing information (Wijnhoven, 2012).

Therefore, in this study, I propose to explore the relationship between the outdatedness of information, which is referenced as the obsolescence of information, and its impact on reliability of information. A case is therefore made to add the factor of obsolescence to the process of triangulation. To conduct well designed research, a definition of the concepts which are being handled in such research is necessary, as it clears up the possible confusion which can arise, as well as clarify some of the concepts which are being researched, which can be found in the following section.

2. THEORETICAL FRAMEWORK

In this chapter, we will examine the concepts needed for the research, being obsolescence, reliability, and triangulation and how these concepts can influence each other, as well as results from literature search on these concepts. A short review on the concept of relevance will be given as well.

2.1 Obsolescence

Egghe and Rousseau (2000) describe obsolescence as “the (possible) decline of usefulness over time”. Following this logic, the older a source is, the less useful and therefore less relevant the source is relative to younger counterparts. However, “the concepts of usefulness and utility are clearly pragmatic in nature” (Hjørland, 2000), and thus not so simple to define as to what

obsolescence entails. In his book *The Half-Life of Facts*, Samuel Arbesman points towards technology as the factor which renders more and more information and facts as obsolete than ever before (Arbesman, 2012), this especially regarding the use of search engines to retrieve information. Technological changes and therefore technological innovations are found to be increasing during times of population growth throughout all human history (Kremer, 1993). These technological innovations are found in the management science field to follow the shape of an S, or what is commonly known in the field as technological S-curves, which describes the replacement of old technologies by new technologies on an industrial level (Christensen, 1992). This implication suggests that new and upcoming technologies, which contribute to the rendered obsolescence of our age, follow a predictable pattern and will most likely continue to exist.

Furthermore, the influence of population growth on these technological innovations should not be underestimated. As the growth rate of the world population may be decreasing, the number of people on our planet is still increasing and other than the declining growth rate, show no sign of a decreasing number in terms of absolute population (Roser, as assessed in May, 2017). The technological S-curves are proposed in an aggregate form, with a technology dying out only to be replaced by a newer one, which follows a steep slope upwards in its product performance, after a plateau of introduction, to reach a peak and then die down, only to be replaced by another, newer technology with even higher product performance as a starting level (Rogers, 2010). Whilst this pattern knows ups and downs, it is certainly applicable to our modern world of today, where these S-curves are following each other more rapidly, and therefore increase the obsolescence of information found on the internet through search engines. Technological innovations and the accompanying population growth also contribute to a growing number of scientists and so-called “citizen scientists” (Arbesman, 2012). This even further increases the need of correct information acquired through search engines on the collective storage of information which is accessible anywhere, known as the internet, as well as facilitating tools or other means of help to make an assessment available on the reliability and trustworthiness of the information found on the internet. However, the implication that the obsolescence as related to technological innovation follows a predictable pattern can be used in the availability, or more clearly, the need of these tools or means. On the flatter plateaus of the S-curve the need is less present compared to the upward slope, where technological innovations see a huge increase in production performance. Therefore, there is also a lesser present need as well in the information and fact increase, thus increasing the need to assess the reliability as well as the obsolescence of newly acquired information.

Whilst obsolescence is certainly linked to new and emerging technologies and the internet as stated in the theoretical section, it is not a recent problem. Bibliography studies already struggled with a weeding policy, where obsolescence plays a main part (Chen, 1976). Furthermore, it has also been found that different scientific fields show similar characteristics when it comes to main contributions done in that field. Lehman (1960) found that for fields such as economics and political sciences, philosophy, medicine and public hygiene the time passed before outstanding contributions were doubled was approximately fifty years, whilst for mathematics, chemistry, genetics and other fields, this period accounted for twenty-five years. Whilst these differences are substantial, it is not impossible to establish time horizons within reasonable bounds, providing a way still to conduct research in

different fields, and compare accordingly (Philips et al., 2008). When looking in terms of citations used in the various disciplines, differences can also be found between several disciplines, separating them in broadly two groups with mainly social sciences such as history, economics and religion on the one hand, and mathematics, physics but also psychology on the other hand (Tang, 2008), showing that no absolute distinction can be made in terms of what types of sciences are subject to different classes of obsolescence. Citations used, half-life and the double-time seem to be widely accepted measurements of obsolescence in the academic world, as these serve as a more objective measurement as opposed to the concept of obsolescence being related to usefulness and relevance, as defined by Egghe and Rousseau (2000). Measurements on reliability are not that clear yet, seeing as a redefinition of the concept, as addressed in the theoretical section of this report, has not been accepted in science yet. Whereas reliability assesses the accuracy of research, obsolescence assesses the usefulness or relevance. However, when something is no longer useful, it could still be accurate in terms of good research conducting, or there were simply no better means at the time to reach the conclusion in said article. This distinction could be further researched. Theorized is that there is no perfect relationship between obsolescence and reliability, but certainly a strong, negative one when it comes to most fields of science. Furthermore, although the survey aimed for information consumers, participants were also asked in which field they professionalized themselves in, also showing a distinction in opinions on obsolescence, implying that academics or other professionals share these differences, something which should be taken great care of when comparing the opinions from academics on obsolescence, as well as the field these academics find themselves in. Obsolescence following the advancement of technologies and therefore the technology s-curves imply that obsolescence follows a pattern, as well as therefore the reliability of science papers, meaning that obsolescence and reliability fluctuate in predictable fashion, stressing the importance of examining these concepts in further detail.

Obsolescence has been described as having two kinds when it comes to documents: synchronous obsolescence, which looks in the past by for example examining how old the references which are used in a scientific paper are, and diachronous obsolescence, which selects a point in the past from which to look at how many sources cite a given source of interest (Diodato and Smith, 1993). However, this is only applicable to academic literature, as when gathering information on the internet with a simple Google search, the results will in most cases not come with a scientific article including references which can be checked on obsolescence. What can be checked however, is the number of other present similar results and the date of these results, as well when the latest update of any given result was implemented and visible on the webpage. This would follow the synchronous obsolescence term.

2.2 Reliability

Definitions of reliability are a widely-discussed topic in literature. Several authors ask for a redefinition after examining the existing definitions in both quantitative and qualitative research (Reiche, 1972, Golafshani, 2003). Definitions of reliability boil down to “the repetition of results and the similarity with the results on the first test, that is, the test is replicable” (Golafshani, 2003). Perhaps another term would be more well-fitting, as looking for information does not involve re-testing and therefore we have no way of assessing the level of reliability as described by the several definitions, but there is certainly some sort of concept related to reliability which is being assessed when deciding on whether to use certain information or

a source. Wang and Vassileva describe two facets of reliability as being truthfulness and similarity, also being related to the concept of trustworthiness as well (Wang and Vassileva, 2003). Jones (2012) describes trustworthiness as “a way of actively and positively engaging with the fact of the other’s dependency, made possible by our capacity to recognize such dependency and to consider in our deliberation.” Whenever a Google search is made and any of the results is used for its information, we create a dependency. This dependency translates to the fact that we trust this information to be correct. We “rely” on this information and likely, this is probably where the confusion of reliability and its appliance to every day information consumption comes from.

However, trustworthiness as described as a dependency on something outside of our control and the term of reliability, which assesses the accuracy of research, can be used interchangeably as well since information consumption by using a search engine can be compared to an investigation being conducted. Furthermore, whilst these are interesting things to discuss and the author agrees with a redefinition of the term reliability, the term reliability will remain to be used in the remainder of this paper. Obsolescence and reliability are closely linked in the terms that a more obsolete article is less reliable, implying a negative relationship, as for example decisions on the reliability of a machine and its replacement are predominantly based on the obsolescence of said machine (Nair and Hopp, 1992). Similar characteristics of the concepts of obsolescence and reliability include that both concepts differ in different scientific fields, and both have an impact on the strength of research. Further characteristics will be given after careful examination in the results section of this paper.

2.3 Triangulation

In older times, triangulation was a method used to orientate one’s self using various instruments and points on a map. More recent times found an application of triangulation in research. Denzin (2009) proposed multiple types to perform triangulation.

1. Data triangulation, which examines several factors attached to the data, being space, time, and person, on three different levels. As the factor of time already is considered in this type of triangulation and therefore also a check for obsolescence is being performed, this type of triangulation has no need for further implementation of the factor of obsolescence.
2. Theory triangulation is a method which involves placing contradicting hypotheses and articles next to the hypotheses, assumptions and theories which guide another article. This to assess the utility and strength of the written paper. Here, there is a call for an assessment on obsolescence. As theory triangulation seems like a good method to strengthen one’s paper, the contradicting and opposing theories could be well out of date, and more recent literature could agree with the hypotheses outlined in the original article. Even more shocking, there is a high probability that most positive published study results are false due to bias and the method of conducting the research (Ioannidis, 2005). Whilst this is assessed in Methodological triangulation, no such thing is assessed during theory triangulation, as well as a check on obsolescence of the articles to be used whilst performing this triangulation method.
3. Investigator triangulation involves different authors, preferably with different backgrounds, examining the same data. Again, no obsolescence is considered here. Differences in opinion on the relevance of data could possibly influence the strength of this triangulation method. An assessment in the differences of opinion on the factor of obsolescence is therefore important, so that a consideration can be made whilst performing this method which takes the factor of obsolescence into account, increasing the resulting strength should an investigator

triangulation method be used on a paper. 4. Methodological triangulation checks the method which was used to arrive at a conclusion and results of an investigation and thus a fact. Included in this check are the possible bias which could occur as well as the research methods. Since different research methods consider the factor of time (for example, longitude studies), there seems to be no need to investigate a possible implication of the factor of obsolescence here.

Thus, there is an established need to assess obsolescence in both investigator and theory triangulation. Whereas theory triangulation has a focus on the academic side of information retrieval, investigator triangulation sees both applications in the scholarly side of information assessment as well as the consumer assessment. After all, consumers often use the information retrieved to tell their friends or peers about it, which can be debunked by the person the information is told to. Therefore, the adding of obsolescence to theory triangulation will mainly focus on academics' use of search engines, and the investigator triangulation addition of obsolescence to the process will be seen from a consumer's, or what is previously mentioned, "citizen scientist" point of view on information retrieval through search engines. However, as two kinds of triangulation have this problem rather than one where one could simply add an element on obsolescence checking, it is more feasible to propose a new type of triangulation which considers obsolescence in more detail, and can be used by both groups.

2.4 Relevance

Relevance is closely related to obsolescence, in the sense that when a source is rendered obsolete, it is no longer relevant. "The relevance of knowledge depends on its usefulness to achieve specific goals" (Hjørland, 2009), and as seen in the theoretical section on obsolescence, obsolescence and usefulness are closely related as well. It is therefore important to consider both relevance and obsolescence as concepts which can contribute highly to triangulation processes. Hjørland proposes the following definition of relevance:

"Something (A) is relevant to a task (T), if it increases the likelihood of accomplishing the goal (G) which is implied by T" (adapted from Hjørland, 2009). Considering this definition, the opposite of relevance, irrelevance, of which obsolescence is a main cause, can have different dimensions. It can be not applicable to the task, it does not match the goal of said task, or it is not the best choice to accomplish the goal. Obsolescence seems to be related to the last part, and is the focus of the remainder of this paper. Whilst the first two dimensions are certainly interesting as well, it might be a good basis for further research on this topic, as this research focuses primarily on obsolescence. As the concepts of obsolescence and irrelevance are so closely related, the research focuses also on the implications on irrelevance, as also measured by reliability. Surely, an irrelevant document is not the choice that will be made, as one can read in the methodological section of this paper. However, since the concepts of obsolescence and irrelevance are closely related, the author feels confident in measuring the obsolescence and drawing also a conclusion on the irrelevance as well with the information gathered on the obsolescence variable. The need to include relevance as well in this consideration on obsolescence is also associated with the information overload present on the internet, as it can be theorized as well that due to technological innovations, not only more knowledge becomes obsolete faster and faster, it is therefore also harder to weed out irrelevant information. This stresses the need also for careful examination of irrelevance. Whilst this paper mainly focuses on

obsolescence however, irrelevance will also be considered.

3. METHODOLOGY

As there are several tools embedded in various scholar search engines available for academics to check for obsolescence, there seems to be no need to implement a new, facilitating tool or method to address this. Tools include update checkers on various scholarly websites, such as Wiley Online Library, and Google Scholar provides a tool in which one can check how many cited the article one is looking for already, giving an assessment on the impact of a paper, as well as the oldness or obsolescence. However, there is no talk yet on embedding these tools in the process of theory triangulation. An extensive literature search will be therefore conducted on this, resulting in a step by step plan to perform a theory triangulation test which accounts for the obsolescence. The operationalization on synchronous obsolescence will be used in this analysis.

A survey will be conducted to establish differences in opinion on obsolescence, proving that such differences should be accounted for in investigator triangulation as well, since these different opinions can influence the strength of the outcoming results of the investigator triangulation process.

The older a source is, the more likely it is to lose its reliability, or trustworthiness. Trustworthiness will be assessed by letting participants choose between two similar sources of information, whilst these participants are indicating on a five-point scale their view on the trustworthiness of the selected source of information.

H: There are differences in opinion concerning the obsolescence, which impacts the reliability of a given source among the participants.

This hypothesis states that some of the participants might view an older source as less reliable than others, therefore having different opinions on the proposed relationship as in the first hypothesis. As mentioned before, usefulness and utility are pragmatic in nature (Hjørland, 2000), strengthening our case for an implementation of this phenomenon in the investigator triangulation process.

To simulate search engine use as closely as possible, different kinds of sources will be used and shown to the participants, asking different questions relating to the source each time as to prevent participants from wishful answering.

Finally, a general question on when one would render a source obsolete will be asked, as the goal is to check whether or not there is a difference in opinion among the participants on obsolescence. The focus will be on this question, as every participant is asked to answer, as opposed to the different source materials also present in the survey, from which participants can opt out on. The different sources which were asked are recipes, manuals, information leaflets accompanying medicines, entertainment, route descriptions, and news articles, after which a more general question was asked on the direction of the field the participant was working or studying in, as well as a final, general question on obsolescence. In most cases, a Chi-square goodness of fit test can be used to calculate the significance, however, for the recipes category, a Fisher's exact test was more appropriate, and for information leaflets, Cramer's V was used as the Chi-square tests did not show enough information.

The data was collected over five days, from twenty-three participants filling out a survey with a number of sources

information consumers are using when conducting internet searches, being recipes, manuals, patient information leaflets, entertainment information, route descriptions, news articles, and professional information for school or work. These instances of information were chosen after asking around several peers what their internet searches consisted of mostly. For these kinds of information, participants were shown two images of results when conducting a search. The images were time stamped, with one image having a more recent timestamp than the other. Asked was which of the two results shown the participant would use, implying that the participant would choose the result which was deemed more reliable. The answers would show whether the participants choosing one of the images was also the more recent time stamped image, implying that the older image is not as reliable as the more recent one. Furthermore, when choosing a more recent result the older result is irrelevant, as the images consisted of basically the same information, but with some updated facts on the more recent one, rendering the older one obsolete and thus no longer relevant. This would follow the negative relationship assumption between the concepts of obsolescence and reliability, meaning that the more obsolete and the older the timestamp, the less reliable and thus the older image would be chosen less than the more recent timestamped one. More information on the survey as well as the simulated search results used can be found in the appendices of this paper.

4. RESULTS

The null hypothesis for each variable is stated as follows: *There is no difference in the opinion of the participants on obsolescence.* The alternative hypothesis states that *there is a difference in the opinion of participants on obsolescence.* For the variable of recipes, a Chi-square goodness of fit test was used, which rejected the null hypothesis. For manuals, a Chi-square goodness of fit test was used, giving a result of 16,892, (df = 1, n = 37), less than a critical value of 3,84, failing to reject the null hypothesis. Arriving at the information leaflets section, it can be immediately noted that the sample size is very small (n = 11), meaning that it is not wise to conduct a Chi-square test as the expected values assumption of this test (expected values should exceed 5) is not being met, and no further tests therefore could be conducted on this part. The data gathered for the entertainment variable was a simulation search, showing two images which were almost identical, except for the date stamp and two different names of actors starring in a movie. The image showing the most recent date had the correct actor stated. Participants were simply asked to answer the question of which actor played in the movie. About two thirds (66,7%) of the participants answering this question (n = 36) ticked the right box. A Chi-square goodness of fit test (Chi-square goodness of fit = 4 > 3,84 critical value, df = 1, n = 36) shows that this data is however statistically significant which means we can reject the null hypothesis. A Chi-square goodness of fit test was also used in the route descriptions section, (Chi-square goodness of fit = 3,64 < 3,84 critical value, df = 1, n = 44), however the null hypothesis cannot be rejected based on this data. The variable of news articles has a similar result (Chi-square goodness of fit = 0,783 < 3,84 critical value, df = 1, n = 44), being unable to reject the null hypothesis. For professional information, the test showed an insignificant result (Chi-square test goodness of fit: 9,362, df = 9, n=43), however the association with the professional field and the view on obsolescence from the participant can be called strong (Cramer's V = 0,859 p = 0,661). Lastly, the general question of when one would render a source obsolete shows a difference (Chi-square goodness of fit = 40,588

> 15,51 critical value, df = 8, n = 51), rejecting the null hypothesis.

Summarizing, the entertainment variable and the general question on obsolescence do reject the null hypothesis. There seems to be a strong association between field of work or study and the accompanying view on obsolescence. The other variables show no statistically significant differences to establish different opinions on obsolescence in these categories among the participants. The table summarizes the variables measured, the tests used and the outcome of these tests. It also provides a comparative ranking on when the information source is most likely outdated in comparison to the other information sources measured, where 1 is outdated the fastest and 6 the slowest, as also based on the literature search. As news is changing every day, this is on number one. As medicine, as seen in the theoretical section is one of the professional fields with one of the shortest half-lives, this is rated second. Manuals is third as manuals are related to technological innovations and new products, which see a growing rate as can be read in the theoretical section as well. Lastly, route descriptions, entertainment, and recipes are ranked in that order as the information in those information fields tends not to change that rapidly.

Information source measured	Comparative ranking	Test result
Recipes (n = 39, df = 2)	6	Chi-square goodness of fit: 20,462 null hypothesis rejected
Manuals (n=37, df = 1)	3	Chi-square goodness of fit: 16,892 null hypothesis rejected
Patient information leaflets (n=11)	2	Not enough data
Entertainment (n=36, df = 1)	5	Chi-square goodness of fit: 4 null hypothesis rejected
Route descriptions (n=44, df = 1)	4	Chi-square goodness of fit: 3,64 null hypothesis stands
News articles (n=46, df = 1)	1	Chi-square goodness of fit: 0,783 null hypothesis stands
Professional information (n = 43, df = 9)	Depends mainly on the field	Chi-square goodness of fit: 9,326 null hypothesis stands Cramer's V = 0,859
General question on obsolescence (n=51, df = 8)	Not applicable	Chi-square goodness of fit: 40,588 null hypothesis rejected

Table 1. Summarizing Statistics and comparative ranking

5. DISCUSSION AND LIMITATIONS

In this section, all the findings from both the literature search in the theoretical section of this report as well as the results from the survey conducted will be combined and analyzed to come with a feasible solution to the problem on obsolescence and its impact on reliability. Future research ideas are also present. In the second sub section, limitations of this study will be given.

5.1 Solution-based discussion

The results of the survey show a difference in opinion on obsolescence among the participants. Furthermore, the literature search found that there are also differences in obsolescence among different fields of science as measured in citations, half-life, and the double-time before outstanding contributions in that field were made. These results thus emphasize the need for the implementation of obsolescence in triangulation processes. Furthermore, although the survey aimed for information consumers, participants were also asked in which field they professionalized themselves in. This also showed a distinction in opinions on obsolescence related to their field, implying that academics or other professionals share these differences, something which should be taken great care of when comparing the opinions from academics on obsolescence, as well as the field these academics find themselves in. Obsolescence following the advancement of technologies and therefore the technology S-curves imply that obsolescence follows a pattern, as well as therefore the reliability of science papers, meaning that obsolescence and reliability fluctuate in predictable fashion, stressing the importance of examining these concepts in further detail.

Obsolescence, as described by Egghe and Rousseau (2000), is linked to a decline in usefulness over time, implying that it is no longer relevant or to be used. Whilst this is pragmatic, the other measurements in literature on obsolescence, being measurements such as the half-life, double time and citations used, can be combined with this pragmatic view to establish a new triangulation type, which mainly focuses on relevance and obsolescence. This triangulation type, instead of using another theory, investigator or an assessment on the methods used, will use a measurement on obsolescence to deem the article being written as relevant or not. This obsolescence assessment will focus on the citations used in the paper, and will address the irrelevance dimension of best choice. The metrics on half-life, double time and years of citations used can be combined in a single metric, however, future research is needed on this as the scope of this study is too narrow for setting up such a formula. Based on the survey conducted in this research however, several considerations need to be made when conducting such a triangulation method. First, a need for this fifth form of triangulation must be established, keeping the goal of triangulation processes in mind. There needs to be reasonable doubt present that readers and peers can doubt the reliability of a paper which is based on citations and other sources. Second, the fields in which the sources are coming from have different half-lives, implying that a careful consideration needs to be made as well and that not every source can be subject to the same standards of obsolescence when it comes to half-life measurements. This is also a consideration to make in possible future research on the combined measurement formula for obsolescence. Third, and on a related note with the second point, is the fact that the survey found an association between the field of study or work and the view on obsolescence, implying that reader's perceptions on obsolescence differ. The audience and the diversity thereof is therefore an important factor when conducting this triangulation process. Fourth, one should

establish time boundaries to compare studies across fields, as described by Philips et al. (2008). These time boundaries can act as an assessment point for readers as well, being more clear on the timestamp accompanying the various sources used, enabling comparison between different fields of studies with different half-lives. Again, this consideration could also be considered when possible future research can establish a formula combining several obsolescence metrics. Such a formula can also prove to be practical in information consumer context, giving information consumers a grip on the reliability of information. Instead of using citations as a measurement however, half-life of the subject field could be considered, as well as the double time. This can also be helpful and be of assistance when reducing the waste of information on the internet. However, there is still the consideration to be made that perceptions from readers on obsolescence might differ as well, resulting in different views on the reliability of an information source. Whilst the formula is an objective way, the views on usefulness and relevance is a pragmatic one. The considerations could be helpful as well to tackle this pragmatic "problem", with as starting point an awareness that there might be different perceptions on the obsolescence and relevance triangulation process, possibly influencing the perceived strength of this process. A call for an open dialogue on this problem is to be advised by the author.

After the completion of these considerations, a go or no-go decision could be made, depending on various factors of which the author deems important, as well as the perceived feasibility of such a process by the author. When having decided on performing the triangulation, there should be an awareness that the strength as perceived by the author might not be perceived as strongly by the reader. On the other hand, this is also a consideration the reader might make, especially when the reader is from a different field of study than the article from the author. The reader can assess the different measurements of the field of the author in terms of obsolescence by for example looking at the half-life of that specific field before determining whether the source used in the triangulation is obsolete and impacts the strength of the research sufficiently enough to doubt that strength.

Further research could be done on the differences in perceptions within the same field of science among academics, using different measurements as well as personal perceptions on obsolescence in that field. Applications for these plans on triangulation are also appropriate for other settings than academic journals and articles, and are recommended to use when performing any triangulation, but especially when data is a big and important factor, in for example the business world, where data is being updated on a constant or even an exponential rate, and is created every second (Marr, 2015), but can also relate to product innovations as already seen by the aforementioned technology s-curves, as revenues can be seen declining after virtual obsolescence has been reached by the knowledge acquired through research and development activities within companies (Pakes and Schankerman, 1984). However, application and understanding of obsolescence is vital in all sorts of professionalism, as "avoidance of updating, and its consequence, are insufficiently researched" (Pazy, 1996).

5.2 Limitations

The biggest, foreseeable limitation to this study is that the data, literature review and therefore the results are already outdated whilst writing this. A more extensive, larger scale research could debunk this limitation, for example by conducting a time series experiment. A different, unaddressed consideration in this study which can influence the perception on obsolescence as well is the

resistance of change inherent in humans overall, and might be an explanation to the clinging of old and outdated facts, resulting in a tendency to rely more on information which can be considered obsolete to objective standards. Furthermore, great care should be taken when using citations as a measure of obsolescence and half-life in different fields, as publication dates on journals can be misleading (Garfield, 1978), and therefore these measurements can be subject to bias associated with these publication dates, possibly be showing misleading data when conducting analysis. When looking at the option many participants used in the survey to deliver commentary, some mentioned that there were some advertisements in certain web search results displayed, making them not pick those, even though they were more recently placed than the alternative, implying that commercialization could possibly have a decreasing effect on the overall reliability, a concern which is already widely noted in the world of science, with the call of opening a dialogue (Small and Mallon, 2007).

6. CONCLUSION

The aim of this study was to establish a need for implementing the concept of obsolescence, and resulting from that, relevance in triangulation processes. This is in accordance with the finding resulting the literature search from an academic viewpoint that there are differences within scientific fields as well in terms of citations, half-life and the double time of outstanding contributions within that field. The general question on views of obsolescence show significant differences in answers, thus perceptions differ greatly. However, whereas obsolescence can be objectively measured by combining the different measurements, relevance as a pragmatic option can be tackled by a raised awareness of the different perceptions of the readers. The resulting findings from the survey support the claim that these different perceptions exist.

Future research could focus on establishing a formula by combining the different measurements of obsolescence, whilst considering that different scientific fields have different outcomes on several of these measurements.

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9. APPENDICES

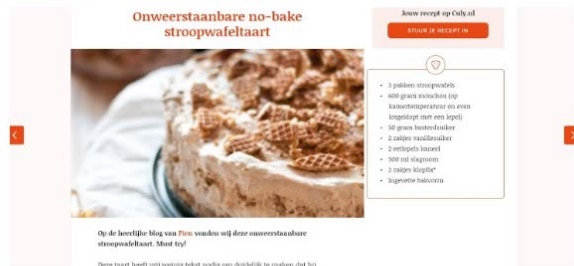
9.1 Appendix A

In the screenshot below one can see the first question on recipes. Two recipes are featured, not accompanied by a time stamp. The question asks which one of these two recipes the participant would use, with an option to select “I do not know” as an answer as well. Below that, a question was also asked why participants chose for recipe A or B, with multiple options Figure 1. Appendix A – first question on recipes available such as “One recipe seemed more tasty than the other”, and room for the participant to give their own answer as well. This question mainly serves as a control question, so that participants may get used to the style of questioning of the survey.

Recept A



Recept B



Welke van deze twee recepten zou je gebruiken? *

- Recept A
- Recept B
- Ik weet het niet

Figure 1. Appendix A – first question on recipes

9.2 Appendix B

In the screenshot below one can find the two search results for the second question on recipes. These were time stamped, as can be seen in the column on the left. The same question was asked as the first question (see appendix A), as well as why participants chose either A or B, however, different from the first question, an option to select “one recipe was more recently placed than the other” was also added.

Recept A

Aardbeitaart
 30-40 MIN
 GEPLAATST OP 04-09-2005

INGREDIENTEN & PERSONEN

- 6 eieren (M)
- 200g suiker
- 1 eetlepel water
- 50g bloem
- 1 theelepel bakpoeder
- boter
- bloem
- 225g aardbeien
- 100g witte chocolade
- 250g mascarpone
- 5 eetlepels rum
- 3 eetlepels aardbeienjam

HULPMIDDELEN
 Springvorm (25cm)

Voorbereiding
 Bevat p.p. ca.:
 515 kcal
 2155 kJ
 eiwit 16 g
 vet 24 g
 koolhydraten 47 g

Bereidingswijze
 Mix 6 eieren (M) met 200g suiker,-- voeg 1 eetlepel water toe en klop dit ca. 10 minuten.--
 Verwarm de oven voor op 190°C (hetelucht 175°C)--
 Klop het mengsel in een kom boven de pan met kokend water (au bain marie)

Statistiek: Recepten: 4.862, Bewaard: 8, Koopgroepen: 0, Koopboeken: 0, Beoordeel: ★★★★★

Recept B

Aardbeientaart
 30-40 MIN
 GEPLAATST OP 06-09-2012

INGREDIENTEN

- Koekjesdeeg (voor circa 12 vormpjes 8 cm)
- 125 g boter-65 g suiker-1 el-250 g bloem-30 g suiker-30 g amandelpoeder-snuifje zout-snuifje vanillepoeder
- Schuim om af te werken: 100 ml eiwit 200 g suiker
- Saniëtbakkerstroom voor de vulling
- zie recept uit de boerenbondkookboek
- 1 liter melk-1eieren-100gr a 150gr suiker-50gr vanillebloem en 50gr bloem, 1pakje vanillesuiker minnege of slagroom voor afwerking en sarbeien

Voorbereiding
 hier dezelfde recept maar dan afgewerkt met banaan en frambozen

Bereidingswijze
 Dit kan je met frambozen, sarbei of ander fruit naar keuze in een koekjesdeeg of koekjesdeeg van de boerenbond kookboek

Statistiek: Recepten: 4.842, Bewaard: 148, Koopgroepen: 0, Koopboeken: 18, Beoordeel: ★★★★★

Figure 2. Appendix B – second question on recipes

9.3 Appendix C

After the recipes section, a question was asked whether the participant sometimes conducts internet searches on manuals. When answered yes, the participant would see the following screen. When answered no, the participant was directed to the next section.

In the manual section, two similar images were used, both time stamped. On one image with the more recent date it was stated that this was an updated version. Asked then was which manual the participants would use. When the answer for the more recent manual was selected, the participant was redirected to a screen asking for reasons why they chose that manual, among which the answer “it was more recently dated than the other”.

Handleiding A

Gebruikershandleiding.com

Philips 40PUK6809

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Hardware uitgegave: 05-09-2015

Werkless | Uitgever | Pagina's: 198 | Pagina's: 198

Ultra Slim 4K Ultra HD Smart LED TV

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 40PU6809
 40PU5809
 50PUK6809
 50PU5809
 50PU6809
 58PUK6809
 58PU5809
 58PU6809

Handleiding B

Gebruikershandleiding.com

Philips 40PUK6809

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Hardware uitgegave: 03-02-2011

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Ultra Slim 4K Ultra HD Smart LED TV

40PUK6809
 40PU6809
 40PU5809
 50PUK6809
 50PU5809
 50PU6809
 58PUK6809
 58PU5809
 58PU6809

Figure 3. Appendix C – question on manuals

9.4 Appendix D

For patient information leaflets, no altered screenshots were given. General questions were asked on the importance according to the participants on the reliability of this information, and from what year the participants think that the information in the leaflet should be revised, taking the year of 2017 (the current year) as point of stance.

9.5 Appendix E

The entertainment question used two almost identical screenshots. However, both were time stamped and the screenshots listed a different actor, as can be seen in the screenshot of this question. The screenshot containing the more recent date had the correct actor listed. Asked was which actor acted in this movie, therefore urging participants to rely on one of the screenshots and thus measure reliability and whether participants are looking for the difference in the screenshots, being the date.

Stel: je hebt laatst een film gezien en een acteur kwam je er erg bekend in voor. Je besluit het eens op te zoeken op internet. Onderstaand zijn twee afbeeldingen die je bent tegengekomen in je zoektocht. Daarna worden er wat vragen gesteld over deze resultaten.

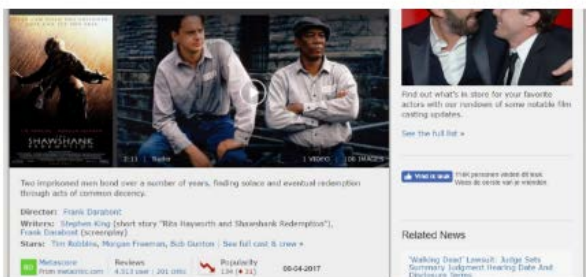


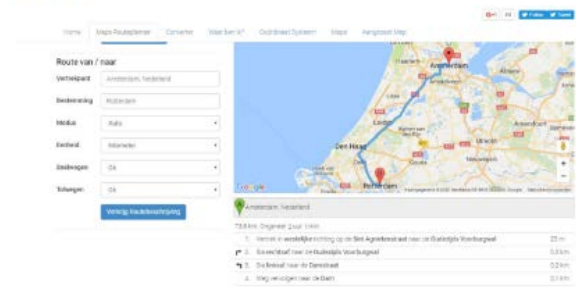
Figure 4. Appendix E – Entertainment question

9.6 Appendix F

The route description question used a similar approach as the other questions accompanied by images, namely time stamping the images, providing different data and asking the participants their decision based on the data presented. The route descriptions listed different travelling times for the same route. The participants were then asked what time they would start travelling from the starting point, where the answers listed the information given in the screenshots. Participants who selected the answer given by the most recent time stamped screenshot

were redirected to another section and were asked to state the reason on why they choose that option.

Route A



Route B

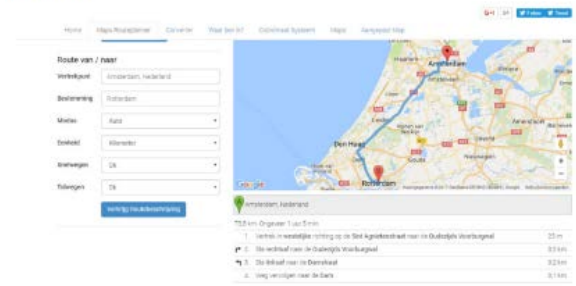
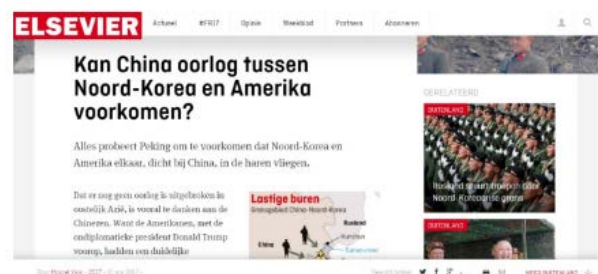


Figure 5. Appendix F – route description question

9.7 Appendix G

Below one can find the screenshot for the question on news articles. Both were time stamped and asked was which article, which are both on the same subject, the participants would read.

Artikel A



Artikel B



Figure 6. Appendix G – news article question

9.8 Appendix H

The last few questions were questions on more professional information, meaning that participants were asked in which professional field they find themselves in, and when they deem information related to that field old. After that, the last and final section asks when participants would rather go looking for new information, and a scale for different years was given.

It should be noted, as some participants did as well, that the dates are not that clearly indicated on the simulated search results as presented in this survey. However, these search results are screenshots from real life internet sources which already had time stamps. The time stamps were only changed for the date, and not for the layout or such, to simulate a real internet search and implying therefore as well that the date on some web pages as used in this survey could be more clearer for internet users.