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Fashionable Functions: A Google Ngram View of Trends in Functional Differentiation (1800-2000)

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ABSTRACT

Computer communication is revolutionizing modern society to the same extent as the invention of writing or the printing press have unsettled the archaic or the ancient society, respectively. In the present article, this idea will be exemplified by a demonstration of how the Google Ngram viewer – an online graphing tool which charts annual counts of words or sentences as found in the largest available corpus of digitalized books – allows for checks and challenges of familiar self-definitions of modern society. As functional differentiation is considered the central unique feature of modern societies, the hypotheses focus on the testing of prominent modern trend statements and predictions, such as the secularization, politicization, economization, and mediatization of society. All hypotheses are tested through a comparative analysis of word frequency time-series plots produced by means of the Google Ngram Viewer. The results show that the importance of individual function systems to society features significant change in time and considerable regional differences. Furthermore, the findings suggest adopting a skeptical position on some of the most frequent common senses of trends in functional differentiation and corresponding self-definitions of society.

Keywords: Culturomics, Economization, Function Systems, Functional Differentiation, Google Ngram, Mediatization, Politicization, Secularization, Social Systems

INTRODUCTION

In his opus magnum *Die Gesellschaft der Gesellschaft*¹, Niklas Luhmann (1997a) makes the case for the claim that the emergence of computer communication is about to challenge modern society in the same fundamental way as the inventions of writing or the printing press have changed the face of the archaic or the ancient society, respectively. The basic idea behind this claim is that new dissemination media allow for new forms of self-observation, a fact that finally results in a new identity. In

the present article, this idea will exemplified by a demonstration of how the Google Ngram viewer – an online graphing tool which charts annual counts of words or sentences as found in the largest available corpus of digitalized books – allows for checks and challenges of old familiar self-definitions of modern society. The starting point of this venture is the distinction between autonomous function systems such as the economy, science, art, religion, etc. In fact, this form of functional differentiation is considered a core concept of modern societies (Leydesdorff, 2002; Beck et al., 2003; Berger, 2003; Vanderstraeten, 2005; Brier, 2006; Baecker, 2007; Kjaer, 2010; Bergthaller & Schinko, 2011;

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Jönhill, 2012). Without functional differentiation, there would be no difference between truth and money, a hospital would be considered the same as a bank, and there would be no sense in the critiques of doping, corruption, or the selling of indulgences. In like manner, the larger part of contemporary definitions and criticisms of modern society would have to do without their most basic categories, since all observations of secularization, economization, and mediatization implicitly refer to an underlying concept of functional differentiation.

Though generally accepted, the idea that particular function systems are more relevant to society than others is not understood without ambiguity. On the one hand, in the light of the fundamental equivalence (Vanderstraeten, 2005; Jönhill, 2012) and autonomy (Tsivacou, 2005; Valentinov, 2012) of the function systems there is no way of arguing that the political system or the economy is essentially more important than religion or sport, *per se*. On the other hand, there seems to be plenty of empirical evidence of such imbalances in terms of the just mentioned trend observations.

This contradiction can be resolved by stating that it is not despite, but because of their basic equivalence that function systems can be ranked at all because if the function systems were essentially unequal, they would already be ranked and, therefore, could no longer be ranked. In this sense, the function systems can be treated as nominal data that feature a skewed distribution whenever it comes to the analysis of concrete segments of society. Hence, modern societies so far have been defined in terms of different biases to particular function systems with the most prominent cases being the definition of society as capitalist. Though there is still little consensus on the question of whether capitalism results either from the primacy of a particular form of politics or from the primacy of the economy (Risse, 2003; Wallerstein, 2003; Foucault, 2008; Urry, 2010; Lash, 2007), most people would basically agree on the idea that present societies are subject to an economization of collective goals (Alexander, 1985). This “increasing influence of economic factors and

values on the political agenda and other areas of society” (Blumler & Kavanagh, 1999:210) includes the economization of:

- Health (Musick, 1999; Cartier, 2003);
- Art (Behnke, 2007; Velthuis, 2003; Kjaer, 2010);
- Science (Penders et al., 2009);
- Religion (Robertson, 1992), and, as a matter of course;
- Society as a whole (Habermas & McCarthy, 1985; Altvater & Mahnkopf, 1996; Chomsky, 1999; Polanyi, 1957; Schmidt, 1993; Enderle, 1997; Finch, 2007; Sayer, 1999; Schimank & Volkmann, 2008).

As a result of this “economic turn” (Smart, 2003) or fetishization of the economy (Foucault, 2008), economization emerges so omnipresent and dominant that even the proliferation of economics is taken for an indicator of economization (Çalışkan & Callon, 2010)² or a need of de-economization (Latour, 2004), respectively. Nonetheless, there is also discussion on further forms of trend statements and predictions, which includes sometimes concurrent, sometimes competing definitions of society as mediatized (Dennis, 1978; Eaman, 1987; Castells, 1996; Chomsky, 1997; Blumler & Kavanagh, 1999; Croteau & Hoynes, 2003; Schulz, 2004; Hjarvard, 2008; Mazzoleni, 2008), politicized (Chomsky, 2000; Blumler & Kavanagh, 1999), intellectualized (Alexander, 1985), or even aestheticized (Blumler & Kavanagh, 1999). Anything seems to go as long as there is not too much religion involved. Both the economization (Robertson, 1992) and the politicization (Thompson, 2006) of religion seem to be in line with the project of modernity. Any sign of religious recovery, however, seems to call for a rewriting of modern history (Martin, 2005; Martin, 2011; Bracke, 2008), even though such a “de-secularization” would not be a bigger challenge of functional differentiation and modernity than a possible “economization of every sphere of existence” (Kane, 2010:81) already is.

In view of the literature, the long-term trends in the discussion of –izations are indeed the politicization and, most prominently, economization, which take place against the background of a requiem for religion and are recently complemented by an emerging media boom.

The problem with the corresponding marginalization of the “other areas of society” (Blumler & Kavanagh, 1999:210) is not only in the fact that “(o)ther social institutions are seen (once again) as mere puppets in the hands of powerful economic trends and actors” (Stehr, 2002:4) or as subjects to the respective political counter-performances, but also in the empirical basis of this discursive bias. So far, the existence of trends is supposed rather than studied. As well, even the few contributions that call for more “observational research” (Blumler & Kavanagh, 1999:225) are so much focused on the analysis of dominant or strong function systems that they do hardly reflect why the respective focus system should be preferred to others and therefore lack the overview Poul Kjaer (2010:532) is interested in the analysis of function systems:

(T)he development of a general theory capable of linking them systematically together. When observed in isolation, the mutual supportive character of these dimensions is not obvious. Only a more general conceptual framework will make it possible to empirically observe to what degree the observed phenomenon constitute or potentially will be capable of constituting a ‘higher order’ (...).

In order to approach such a general framework and compensate for the lack of evidence for the respective diagnoses, the present article will consider both the general idea of biased constellations of function systems and the observation of particular trends in the significance of individual function systems. Both are considered hypotheses that still need to be defended.

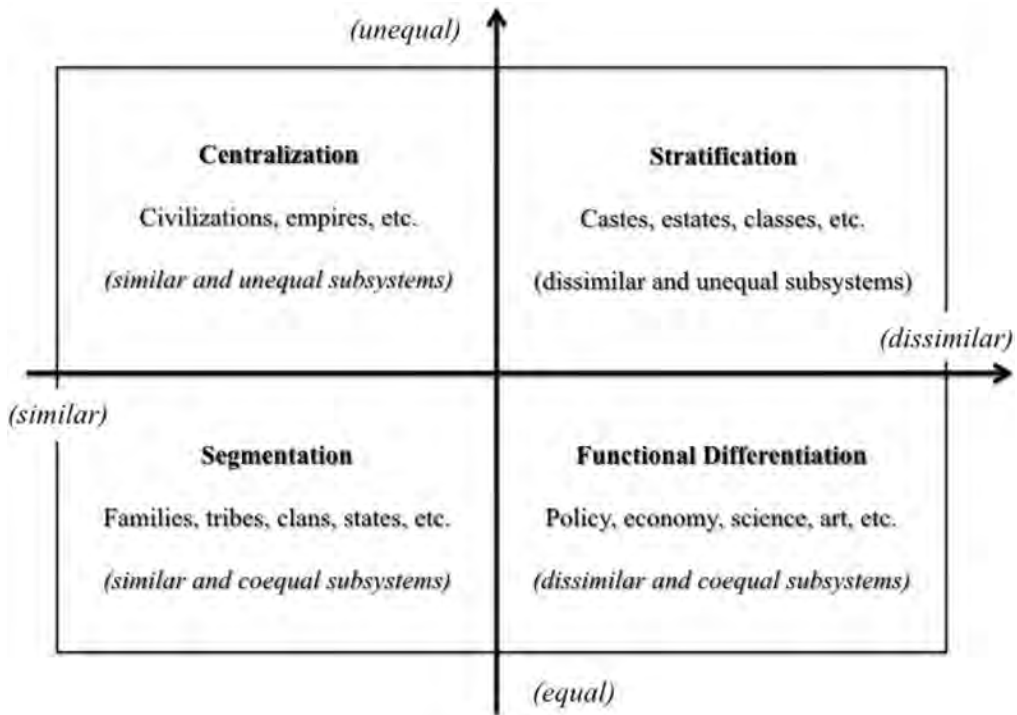
Subsequent to a theory statement, the present article asks for the empirical validity of the most popular statements of trends in functional

differentiation. Namely the secularization, politicization, economization and mediatization of society will therefore be re-conceptualized in terms of hypotheses and tested against the results of a Google Ngram Viewer analysis of the most frequent function system references in the Google Books corpus for the year 1800 through 2000. The results not only show that the importance of individual function systems changes over time and across language areas, but also give reason to believe that at least one of the four mentioned trends is an intellectual artifact rather than a true fact.

THEORY STATEMENT

“Ever since there has been sociological theory it has been concerned with social differentiation” (Luhmann, 1990:423). Differentiation refers to an intrasystem process of subsystem formation (Luhmann, 1977, 1997b). The first known forms of subsystems within society were families and tribes. Families coexisted with other families of the same tribe in the same manner as tribes coexisted with other tribes. As a result, early societies are said to be differentiated into identical and co-equal segments of society. However, in the course of the Neolithic revolution, the situation changed as soon as location decisions condensed to locational advantages and disadvantages in such a way that individual settlements ascended towards centers, while others turned into periphery. This center-periphery differentiation was soon complemented and superposed by stratification, which is commonly associated with the formation of hierarchical social orders, such as the Indian cast system or the Occidental Estates of the realm. Such stratified societies defined persons into ranked hereditary communities and allowed for only limited social mobility, if any at all. Conversely, in the European case, it was mobility that finally changed the static order. Be it the movable types of Gutenberg’s printing press, the Central-European rural exodus, or the fact that too many commoners had been granted entry into the gentry, in all cases, the constitu-

Figure 1. The forms of differentiation



tive distinction of nobles and commoners was for its own part superposed by a distinction so fundamental to modernity that animals can no longer be divided in the following way:

(a) belonging to the Emperor; (b) embalmed, (c) tame, (d) sucking pigs, (e) sirens, (f) fabulous, (g) stray dogs, (h) included in the present classification, (i) frenzied, (j) innumerable, (k) drawn with a very fine camelhair brush, (l) et cetera, (m) having just broken the water pitcher, (n) that from a long way off look like flies. (Borges & Weinberger, 1999:231)

In fact, modern man considers it absurd to assume that a siren and a pig represent the same type of animal as soon as they both belong to the emperor or are drawn with the same kind of brush. "Modern society is no longer characterized by a stratification of lineage, clans and families, but by a differentiation of function

systems" (Vanderstraeten, 2005:476). Today, society therefore cannot only be differentiated into a) similar and even segments, b) similar and uneven centers and peripheries, and c) dissimilar and uneven strata, but into d) dissimilar and even function systems, as well (Figure 1).

Despite their obvious existence, and despite their importance to modern society, there is still little consensus on necessary and sufficient conditions for the definition of function systems. Nevertheless, when looking at existing working definitions and non-exhaustive lists of function systems (Reese-Schäfer, 1999:176f, 2007:120; Künzler, 1987:327, 1989:100f; Andersen, 2003:159; Stichweh, 2005; Baecker, 1994; Henkel, 2010:183; Luhmann, 1997a:11), a hardcore list of 10 function systems can be extracted: Policy, the economy, science, art, religion, law, health, sport, education, and the mass media.³ These function systems differentiate society by the binary re-coding of communication according to a specific symbolically general-

Table 1. The function systems of society

System	Code	Media	Program	Function
Policy	Inferior/Superior	Power	Ideology	Control
Economy	Non-/Payment	Money	Price	Distribution
Science	Un-/True	Truth	Theory	Knowledge
Art ⁴	Imitation/Innovation	Style	Taste	Creation
Religion	Immanent/Transcendent	Belief	Confession	Revelation
Legal System	Wrong/Right	Norm	Law	Commitment
Sport ⁵	Failure/Success	Achievement	Goal	Performance
Health System ⁶	Sane/Insane	Illness	Diagnosis	Therapy
Education ⁷	Un-/Placeable	Career	Test	Placement
Mass Media ⁸	Non-/Informative	Record	Topic	Reproduction

ized communication medium. Each function system applies only one single code, which it also applies exclusively. For example, science, and only science, is all about the medium truth, which is binary coded as true or untrue. Scientific programs and theories decide on when the code of science is properly applied. The function of science is to provide society with ongoing knowledge communication (Table 1).

While it can be considered impossible to belong to both the estate of the nobles and the estate of the commoners or to two castes at the same time, persons can be included in all of the function systems. This multi-inclusiveness of function system applies to organizations as well, which are, also regarded as multi-referent (Tacke, 2001; Simsa, 2001), polyphonic (Thygesen & Andersen, 2007; Andersen & Born, 2007), or multimedia organizations (Roth et al., 2010).

Combined with the basic assumption that no function system is essentially more important than the other, the multimedia character of persons, organizations, and further segments of society are the basis of the observation of individual differences in the frequencies of function system references. It is precisely because of the mutual exclusiveness and functional equivalence of the individual function systems that individual persons, organizations, nation states, or cultural areas are likely to feature

different frequency distributions of particular function system (p)references. “On this background, it is possible to understand asymmetries, crowding-out effects, and negative externalities between functionally differentiated spheres as a central source of tension and conflict in modern society” (Kjaer, 2010:494). The present article will explore these tension zones and, in doing so, regard society as a system of accessible communications. In this sense, the article takes the language border as a better distinction than national, i.e. geopolitical borders, and will refer to the English, French, and German language areas as societies.

HYPOTHESES

The basic assumption of the functional equivalent and mutually exclusive nature of function systems represents an excellent groundwork for the null hypothesis, which the present article proposes to test. Representing coequal nominal data, function systems can be assumed equally relevant to social systems. The null hypothesis is, therefore, as follows:

H0: Function systems relevancies exhibit a uniform distribution in social system.

On the other hand, empirical research seems to indicate an unequal distribution of function system relevancies. The alternative hypothesis reads as follows:

H1: Function systems relevancies exhibit an unequal distribution both in the course of time (H1.1) and across cultures (H1.2).

Pursuing the alternative hypothesis and linking to the discourse on major trends in functional differentiation, the article, furthermore, considers the assumed unequal distributions subject to constant change similar to “changes in economic cycles and international competition [that] create preferences for certain kinds of language and explanations” (Cornelissen & Kafourous, 2008:14). The second alternative hypothesis, thus, suggests testing the most popular common senses on trends in functional differentiation:

H2: Societies feature relatively stable trends in functional differentiation, including (H2.1) the secularization, (H2.2) the politicization, (H2.3) the economization, and (H2.4) the mediatization of society.

The second hypothesis will be tested against both weak and strong definitions of the respective trends. Trends will, consequently, be analyzed with regard to their incidence in one or several cultural areas as well as to their individual course and their relative importance.

METHOD

The key assumptions proposed in this article are the temporal change of and the intercultural differences in the importance of particular function systems to particular societies. The major problem becomes how to measure this importance in a context that can be expected to allow for somewhat representative information on societies as a whole.

The importance of concepts is often defined in terms of the frequency of their occurrence in

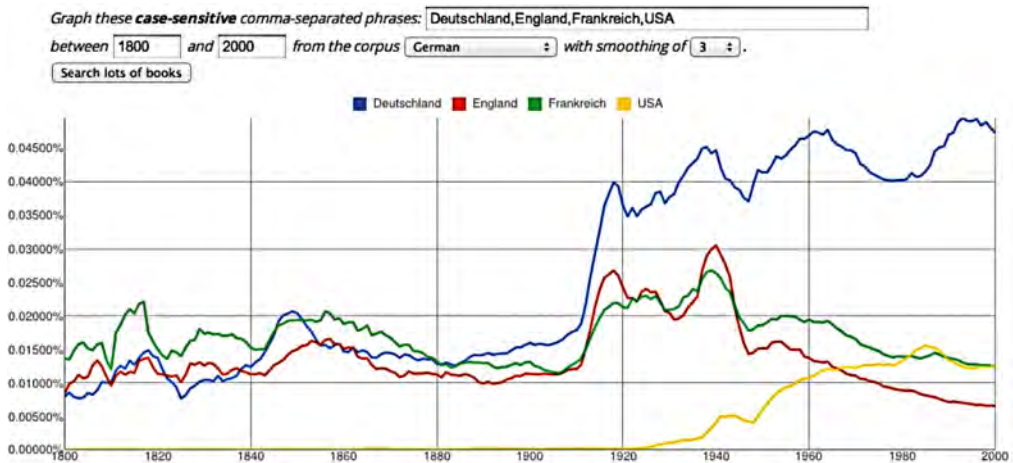
given corpora, which is considered “the simplest and most impartial gauge of word importance” (Kloumann et al., 2012:1) or the popularity of objects, ideas, and persons (Ophir, 2010; Bohannon, 2011)9. Given the scope of the present research question and the corresponding scale of the research field, research utilizing the Internet as the largest possible corpus would make sense. Despite the fact that web search engines are said to return word frequency estimates that are highly consistent with established methods (Blair et al., 2002), the problem with Internet word frequency analyses is that the analysis of this most recent media hardly allows for long-term trend analyses. Hence, the present discussion of popular trends in functional differentiation analyses changes the frequency distributions of function system references in the second largest available text data collection.

Since its start in 2004, the Google Books project has digitalized some 15 million of the estimated 115 million books ever published. In 2007, a Harvard research team (Michel et al., 2011) recognized the research potential of the Google Books corpus, performed considerable quality checks, and finally reported the compilation of a representative corpus of more than five million books or 500 billion words covering seven language areas and a time span of 600 years. The development of this enormous data soon raised hopes of a golden age of digital humanities (Johnson, 2010), which would open up new types of historical knowledge (Ophir, 2010), as it has already given birth to the discipline of culturomics as “the application of high-throughput data collection and analysis to the study of human culture” (Michel et al., 2011:181). The access to the Google Books corpus is facilitated by the Google Ngram Viewer - an open-access interface that allows for trending (Manovich, 2012) in terms of the production of customized time-series plots for entered search terms.

Such, the Google Ngram Viewer can be used to re-present well-known information in a compact and intuitive way (Figure 2).

In relation to the German language area, figure 2 illustrates how the importance of the

Figure 2. Word frequency shares of Deutschland, England, Frankreich, and USA in the German language Google books corpus (source: own Google Ngram enquiry)



concepts of Germany, England, France, and the USA varied between the year 1800 and 2000. The graph shows that it was not until the eve of World War I that the concept of Germany became dominant in German books. Furthermore, with regard to Germany, we find top peaks of popularity during the early Nazi era, the Wirtschaftswunder, and the German reunification as well as interim lows after the lost World Wars and in relation to the Protests of 1968. The overall trend, nonetheless, is positive, which is not the case for France and England. Both countries lost relevance after World War II and were overtaken by the USA in the mid 1980s. In this sense, the Google Ngram Viewer also allows for the qualitative analysis of quantitative data, e.g. in terms of the assumption that the USA became more important to Germany and perhaps was the most important occupying power.

Furthermore, the Viewer can be used to detect the need for research and for the developing of research questions (Figure 3-4).

Contrasting the German and the English distribution of the concepts of money (blue), power (red), and love (green) we find that love and money started to feature common characteristic in the English context as of the late 1940s, while love seems to be closer to power than to

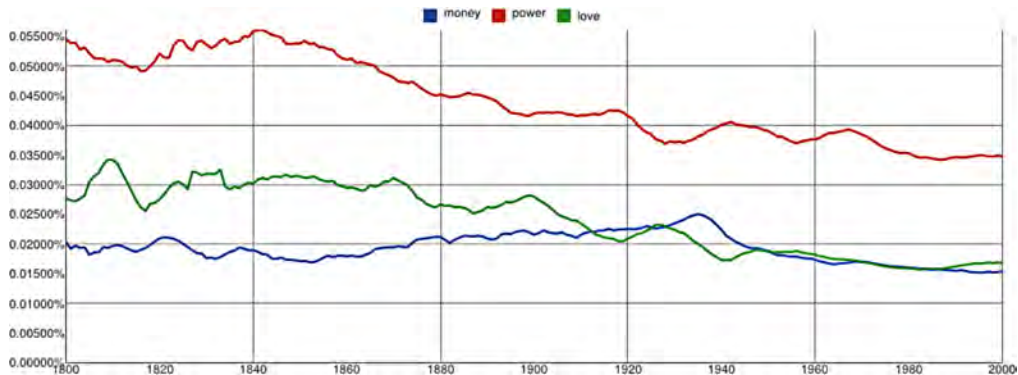
money in the German context, if at all. Far from representing proof for anything, the presented evidence can, nonetheless, be considered a reason for further research.

In some cases, a Google Ngram View might even be used for validity tests of more or less prominent hypotheses (Figure 5-7).

For example, regionalization is sometimes said to be an effect of globalization (Kacowicz, 1999; Amin, 1999). The Google Ngram View of the respective concepts, however, does not support this idea. Rather, we find evidence for the opposite effect, being that in all the three language areas, the concept of regionalization enjoyed a modest popularity before globalization boomed, which is most evident in the French case, which featured a noticeable trend in regionalization between 1960 and 1975. It is not until the mid 1980s (US-American English) or the early 1990s (British English, French, German), respectively, that the globalization discourse reached the level of the respective regionalization discourses. Moreover, the findings suggest that the globalization discourse could have had its origins in the French discourse and the largest impact on the German discourse.

Testing its own hypotheses, the present article will focus on the analysis of trends in the English, French, and German Google Books

Figure 3. Word frequency shares of money, power, and love in the overall English language Google books corpus (source: own Google Ngram enquiry)



1-gram corpora 1800-2000.¹⁰ Due to the sheer size of the databases concerned, further in-depth analyses will be conducted using the Google Million, an English-language corpus of only one million words designed to fulfill the same representativeness requirements as the larger English version(s), however, with improved handling characteristics.

In this setting, the null hypothesis will be rejected in favor of the alternative hypothesis (H1) when the time-series plots produced by the Google Ngram Viewer feature an unequal distribution of the occurrence frequencies of all function system designations. Moreover, the plots will be analyzed with regard to variations of occurrences in the course of time (H1.1) and across cultures (H1.2).

Figure 4. Word frequency shares of Geld, Macht, and Liebe (money, power, and love) in the German language Google books corpus (source: own Google Ngram enquiry)



Figure 5. Word frequency shares of globali(z/s)ation and regionali(z/s)ation in the overall English language Google books corpus (source: own Google Ngram enquiry)

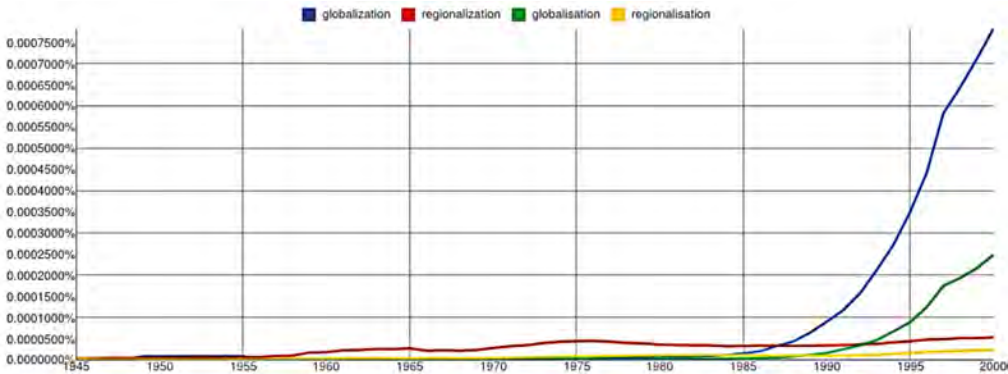


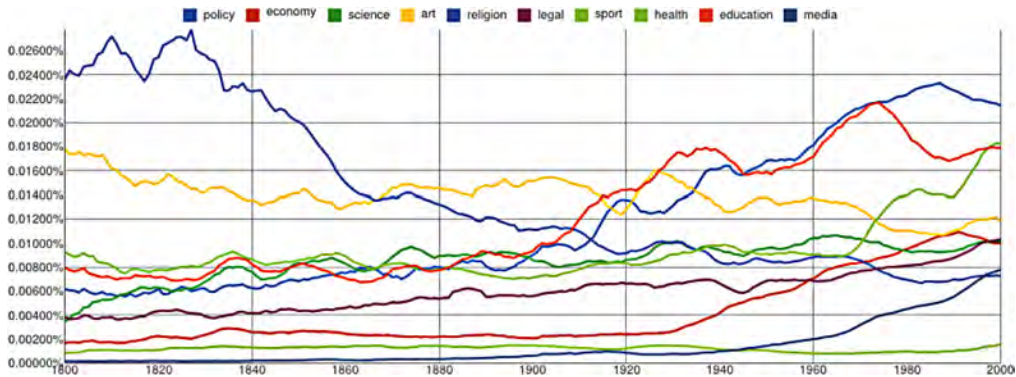
Figure 7. Word frequency shares of Globalisierung and Regionalisierung in the German language Google books corpus (source: own Google Ngram enquiry)



Figure 6. Word frequency shares of globalisation and régionalisation in the French language Google books corpus (source: own Google Ngram enquiry)



Figure 8. Word frequency shares of the names of the function systems in the overall English language Google books corpus (source: own Google Ngram enquiry)



The hypotheses H2.1-2.4 will be weakly confirmed if the output of the Google Ngram Viewer query supports the respective trend assumptions in at least two out of three language areas. In concrete terms, the plots should display a decrease in the importance of religion (H2.1: secularization) as well as an increase in the importance of policy (H2.2: politicization), the economy (H2.3: economization), and the media (H2.4: mediatization), respectively. A strong confirmation would, moreover, call for (the loss of) a dominant position in the texture of function system references for all language areas.

Meeting concerns that the function system designations might not represent the most frequent function system reference in the corpus, the Top 2000 1-grams of the Google Million corpus will be scanned for further function system references. The list of the ten most frequent references to function systems relevant to the hypotheses H2.1-2.4 will also be entered into the Google Ngram Viewer and the result compared to the outcome of the query for the names of the function systems.

RESULTS

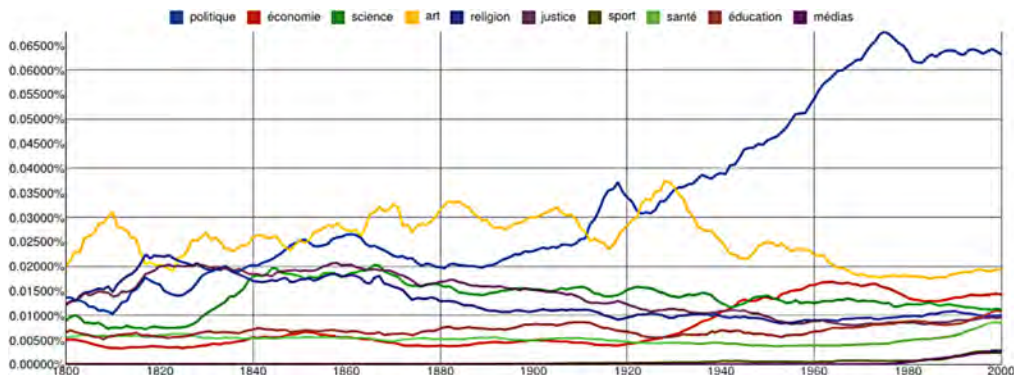
The ten function systems exhibit unequal occurrence frequencies that vary within and across all the language areas:

In the English case (Figure 8), at the beginning of the sample period, law is the most dominant function system followed by religion and art. At the end of the period, policy gained on law, which ranks second and is followed by health and education. Currently, religion ranks ninth, outperformed even by the formerly marginal economy and mass media system.

A closer examination of the function systems relevant to the trend hypotheses 2.1-2.4 calls attention to the word frequency shares of policy, the economy, science, religion, and the mass media system. The decline of religion ($\bar{r} = 0.25$)¹¹ and the rise of policy ($\bar{r} = 3.7$) are the most striking trends. Religion is outperformed by policy during World War I and by science in the early 1930s, with the latter being a result of slow, but steady growth. At about the same point in time, the formerly marginal economy takes off ($\bar{r} = 5.0$). In 2000, the economy and science share about the same numbers of mentions in the Google Books corpus (100ppm)¹² and are, therefore, both lower-middle ranking function systems: Law and policy (240-220ppm), health and education (180ppm), and art (120ppm) relegate the first five ranks. On the verge of the millennium, religion was finally outpaced by the mass media. Together with religion, mass media (80ppm) shares the penultimate ranks. Sport is last (>10ppm).

In the French case (Figure 9), art initially ranks first in front of religion, justice, and

Figure 9. Word frequency shares of the names of the function systems in the French language Google books corpus (source: own Google Ngram enquiry)



policy. Between World War I and World War II, it was overtaken by the political system, whose increase ($\bar{r} = 4.9$) to a remarkable frequency of 680ppm experienced a smaller counter trend around 1980. Uncontested since the last confrontation with law, which occurred between 1945-1960, policy is ranked first. In 2000, policy occurred twice as often as law and three times more often than art. As of the late 1920s, after an increase of economic communication ($\bar{r} = 3.0$; 150ppm), the economy ranks third, closely followed by science, education, justice, religion, and health. Mass media and sport come last.

A comparison of the English and the French data uncovers the higher relevance the French function systems have in their corpus. The word *politique*, however, must be considered an exception to this rule because it is both a noun and an adjective. Complemented by the adjective(s), the English and the German political performance would be about the same as the French. Still, it is notable that *politique* is more important to its corpus than words like *man*, *life* or *work* are to the English, given that the first refers to both gender and genus and the latter is both simultaneously a noun and a verb. Additionally, despite a considerable decline ($\bar{r} = 0.67$ as of 1800, 0.53 as of 1930), second ranked *art* (200ppm) is still more important to the French corpus than second and third ranked *health* and *education* are to the English.

The German data displays the largest variances and the broadest scope of changes within a language area. In the early 19th century, Germany seems 'governed' by law as well as science, art, and religion. The latter triad appears to share a common destiny in terms of their collective decline up until the 1960s, when science and art finally separated from the downtrend of religion, which appears to have stopped since the 1980s. After a most notable increase ($\bar{r} = 7.0$), since the early 1960s, *Politik* (280ppm) has ranked first, followed by the legal system (220ppm) as well as art and science (130-140ppm). Economy (120ppm) is ranked fifth due to an increase in importance dating back to the late 19th century rather than to the late 1920s, like in the case of both the English and the French.

However, there is also a media trend, which started in the mid 1960s, whose calculation in terms of a growth factor does not make much sense because, just like in the case of the English and the French, the media seems to appear from nowhere. In the German case, the same applies to the economy. At least a comparison with the political curve seems revealing to some extent, as both curves feature a certain parallelism between World War I and the mid 1950s.

INTERIM DISCUSSION

So far, the findings indicate both considerable changes within and significant differences between the language areas. Moreover, with regard to all language areas, the results seem to support the hypotheses H2.1 (secularization) and H2.2 (politicization), even if there is some evidence for the fact that the trends have stopped towards the end of the sample period. Despite considerable increases in the frequencies of all the three designations of the economic system and the mass media system, both systems are still far from being dominant in their respective language areas. So far, the results would suggest rejecting the hypotheses H2.3 (economization) and 2.4 (mediatization), at least in their strong variant.

RESULTS RELOADED

In order to re-test the hypotheses, in particular H2.3 and 2.4, the present article presents the results of an additional analysis of the English Google Million corpus (only, as other corpora proved unmanageable with the available hardware). First, the 10 separate fractions of this user-friendlier corpus were merged to a 8GB SPSS file. The corpus was then transformed into a ranked word frequency list of books published between 1800 and 2000. The 2,000 most frequent entries of this list were, thereupon, qualitatively analyzed for their function system references.

As a first result, some 230 words with a clear function system reference were identified. The only function system missing among the 2,000 most important words of the corpus was sport, with the designation itself as the first reference ranking far beyond the 6,000th position. For each of the function systems relevant to the hypotheses H2.1-2.4, the ten most frequent references were identified and analysed for their performance in the general English corpus using the Google Ngram Viewer (Figure 11-14).

Just like the performance of the concept itself, the broader view of religion also shows a

downtrend of religion that is somehow moderated as of the second half of the 20th century (Figure 11). The results are in line with the previous multi-language analysis. Contrasting the trend of the religious system and the concept of secularization, the finding is that both graphs move against each other, which is first of all true for God rather than for his son and the other key concepts of the religious system, though the downtrend is featured by all of the ten most important religious ngrams.

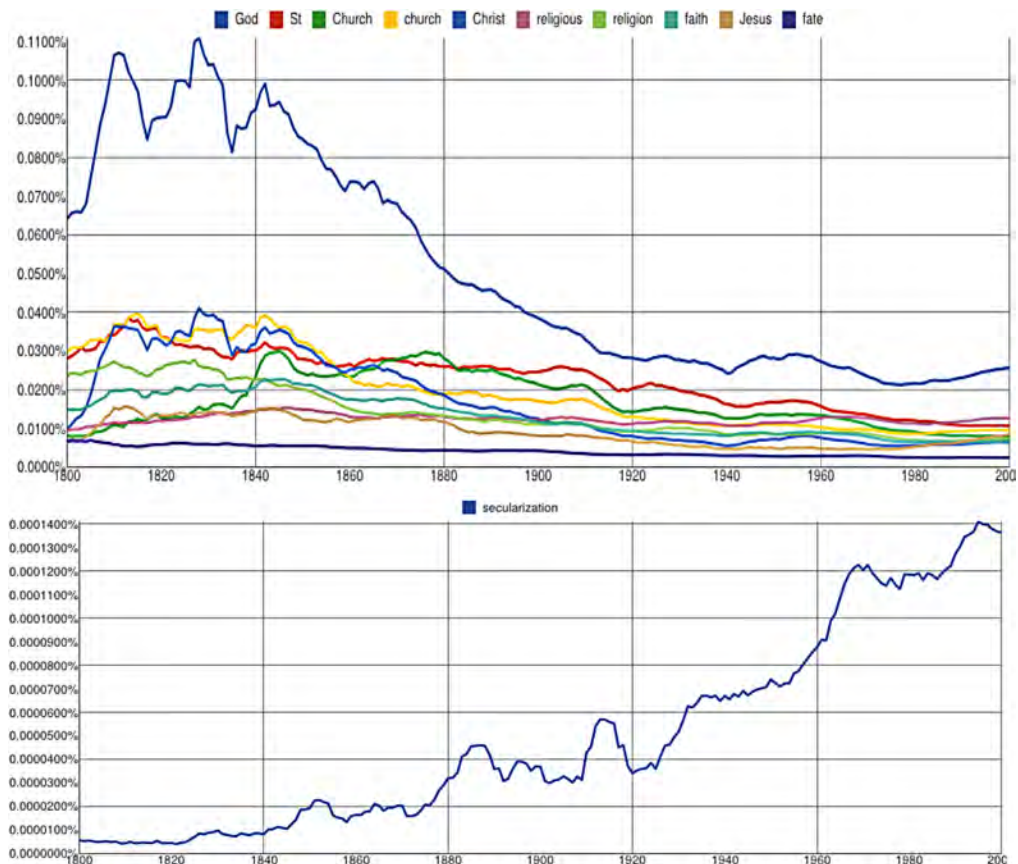
The political references also display a moderate downtrend, however, findings are less evident than in the case of religion (Figure 12). The sharpest fall is observed in the cases of king, King, and General. In return, two out of ten concepts (government, political) become more important. In any case, this result means a significant relativization of the outcome of the previous analysis: The upswing of the concept of politicization is not attended by signs of an increasing importance of the political system.

Except for the term economic, which starts to rise at about the same time as the German word for economy, the economic frequencies seem to be stagnating since their peak between the two World Wars (Figure 13). Obviously, not starting until the early 1980s, the larger-scale discovery of an economization or commodification of the society was, therefore, late, wrong, or both.

As for the mass media system, the terms books and Book were deleted due to lack of further explanatory value and replaced by more contemporary media concepts (Figure 14). All media system references feature an overall upward trend, with the only slight exceptions being the more ancient terms, literature and published. The findings reinforce the earlier results and add to a greater picture of the evolution of the media system.

Looking at the word frequency shares of each ngram-bundle, again, we find that the economy can hardly be considered more relevant than secularized religion or even the emerging mass media system. The still dominant political terms achieve twice the scores of the economic terms.

Figure 11. Broadband trending the religious system against secularization (source: own Google Ngram enquiry)



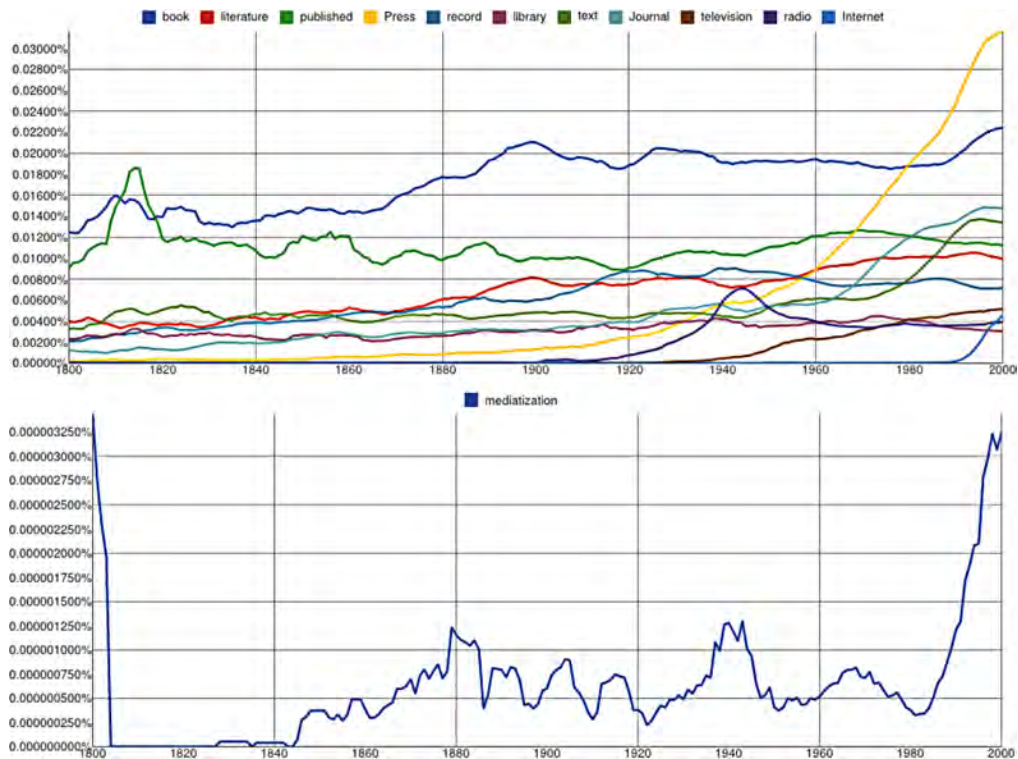
DISCUSSION

The first striking finding of the presented analyses is that the Google Ngram Views of functional differentiation actually react to history, which is true with regard to both the interregional and the regional level. On the one hand, all language areas display a decline of religion as well as clear evidence of the impact of Black Friday on the takeoff of policy and the economy. On the other hand, the results also reflect particularities related to the histories of the individual languages areas: The German time-series plot (Figure 10) displays a veritable program change for an entire language area from a realm of priests, poets, and philosophers

to a national economy. This politico-economic campaign started soon after the death of Karl Marx, which is considerably earlier than in the other two cases. In the English and French language area, it was not until Black Friday that the economy became at least moderately relevant. In the English case, it seems to be the two World Wars, the Cold War, and decolonization that led to an uptrend of policy that stopped and moderately declined around GATT Uruguay and Perestroika. In the French case, the plot even seems to tell the story of the beginning and end of the Fourth Republic as a struggle of the political and the legal systems¹³.

The results, therefore, not only support the hypothesis that modern societies feature an un-

Figure 14. Broadband trending the mass media system against mediatization (source: own Google Ngram enquiry)



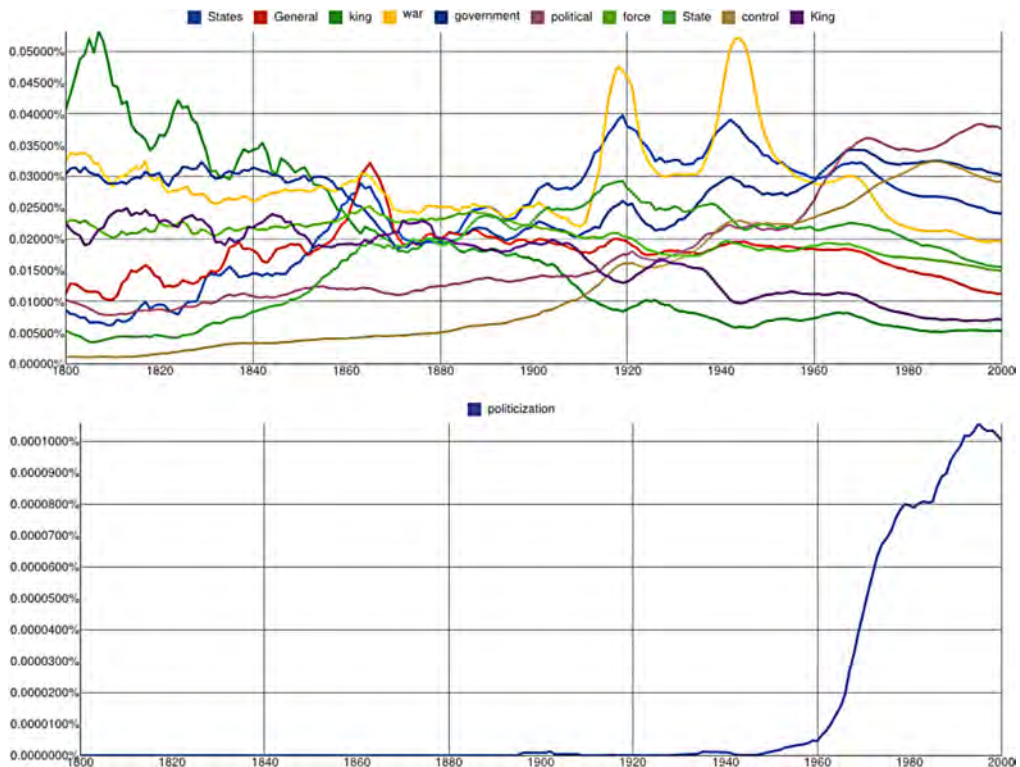
even distribution of function system references (H1), but also show that these distributions themselves are subject to changes in time and across cultural borders. The hypotheses H1.1 and H1.2 are, hence, supported by the results.

Both the word frequency plots of the names of the function systems (Figure 8-10) and the broadband trending of the ten most frequent religious words in the Google Books corpus (Figure 11) support the secularization hypothesis (H2.1). The dethroning of both the denomination and the most frequent religious terms is evident throughout and across the entire sample(s). Referring to both a state and a trend, the secularization hypothesis can, as a result, be corroborated both in the weak and the strong variant. While the first method also supports the idea of a politicization of the three societies, the politicization hypotheses (H2.2) must be relativized in view of the results of the

second. In this sense, the hypotheses can only be defended because of the dominant position the political system (still) takes up in terms of word frequency shares in all of the three societies. In this sense, politicization is a state description rather than a trend statement. As a result, H2.2 is corroborated in its weak variant.

Despite the remarkable growth figures the economic word frequency shares feature in all of the three corpora, the results of both methods suggest rejecting the economization hypothesis (H2.3) in both the strong and the weak variant. In fact, in two cases, the period of the potential trend was rather short (E: 1930-1990; F: 1925-1975). The trends are stopped in all of the three language areas, in none of which the economy ever reached a dominant position throughout the entire 200 years. The only economic term that displays a potentially ongoing uptrend, which was only temporarily

Figure 12. Broadband trending the political system against politicization (source: own Google Ngram enquiry)



inverted since 1900s, is the term economic itself (Figure 11). Even this statement, however, has to be relativized because it is true only in the English case, while an analysis of the French and the German frequency shares would display countertrends starting as early as the mid 1950s (German) or the mid 1970s (French).

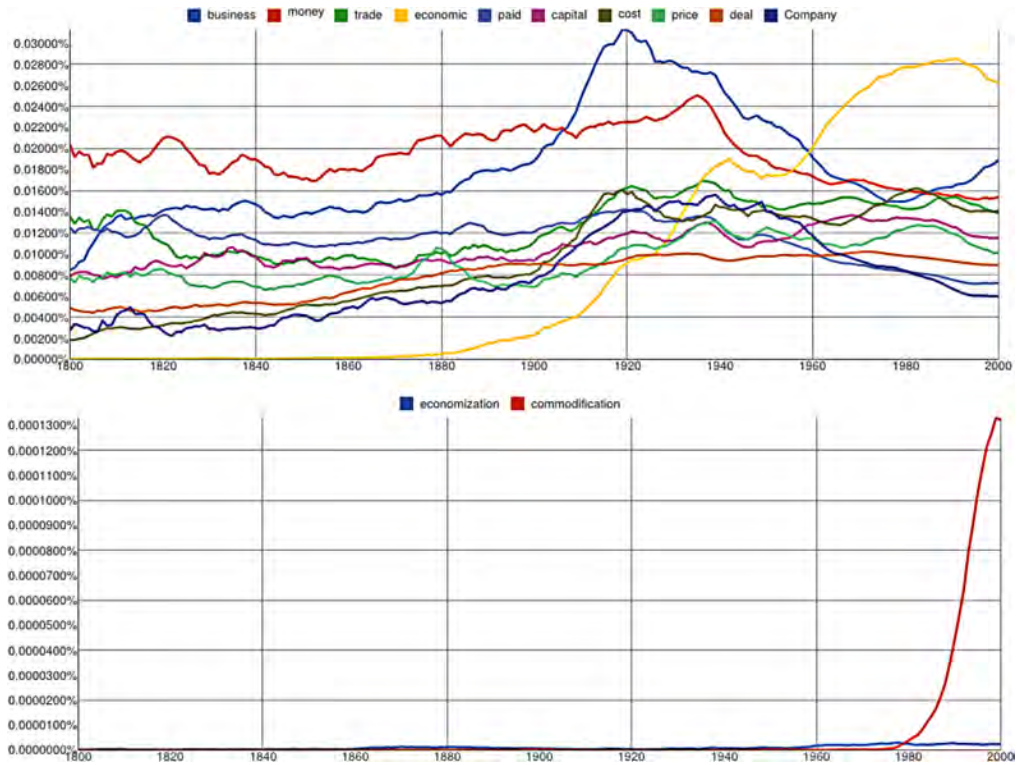
The mediatization of society (H2.4), in return, however, seems to be an actual trend. Starting in the 1940s (English), 1960s (German), and 1980s (French), the terms media, Medien, and médias feature a modest, but constant uptrend. On a larger scale, the results are also consistent with the analysis of the function system denominations. While the media system never reaches a dominant position in either of the language areas, the trend remains uninterrupted throughout the entire sample period. Even books are still popular in books. Only radio features

a period of de-growth (1940-1970), which, meanwhile, seems to have stopped. The most significant pacemaker in mediatization is the Press, which reaches larger amounts of word frequency shares than the strongest reference to the economic system. The mediatization hypothesis is, as a result, weakly corroborated by the present Google Ngram views of functional differentiation.

LIMITATIONS AND FUTURE RESEARCH QUESTIONS

One of the most serious limitations of the Google Ngram Viewer is that it allows for case-sensitive queries in ngram only. Ngrams can, consequently, not be bundled into one single graph, just as the queries cannot be for lemmas.¹⁴ To compensate for this circumstance, the ten

Figure 13. Broadband trending the economy against economization and commodification (source: own Google Ngram enquiry)



most frequent references to each of the function systems relevant to the trend hypotheses were identified in the English Google Million corpus

and tested against the performance of the mere function system name. The deeper look into the corpus also helped to at least estimate the impact

Figure 10. Word frequency shares of the names of the function systems in the German language Google books corpus (source: own Google Ngram enquiry)

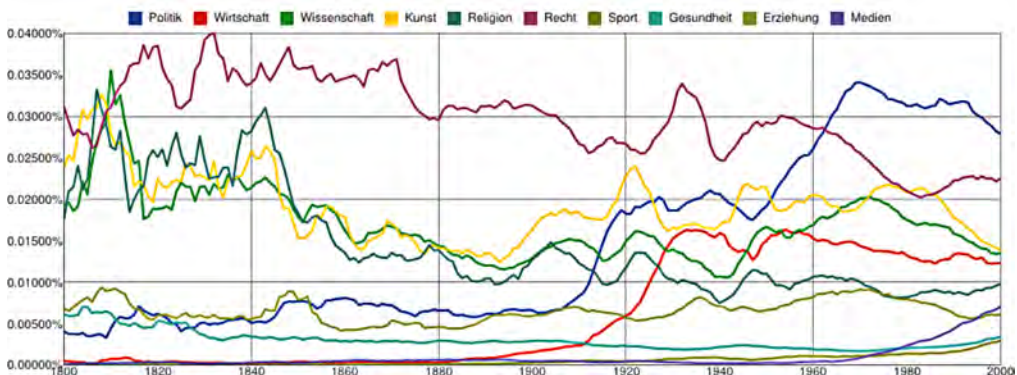
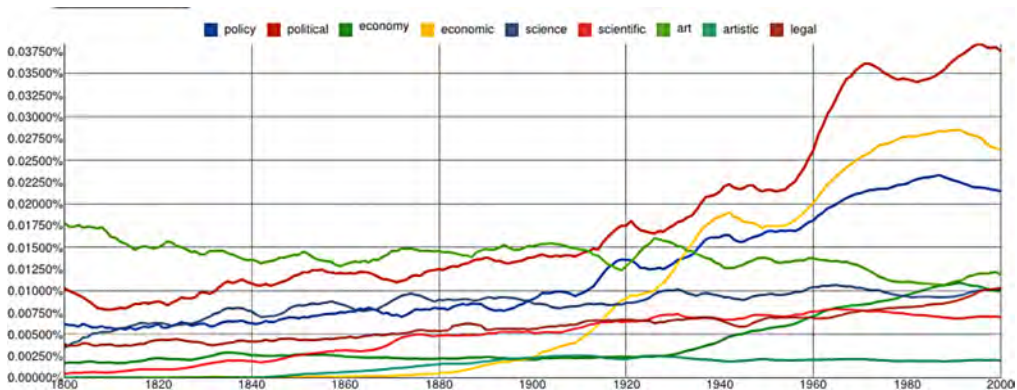


Figure 15. Adjectives with function system reference in the English language Google books corpus (source: own Google Ngram enquiry)



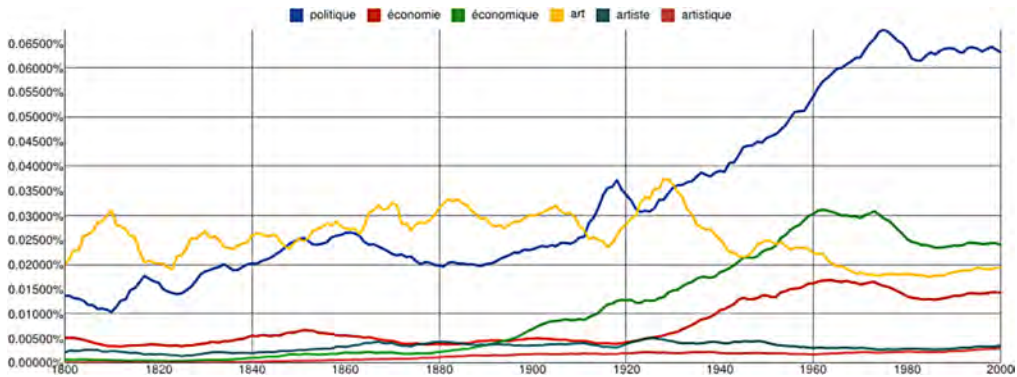
of word selection biases. Hence, it is admitted that the word selection has an important impact on the results, e.g. if the function system names were replaced by the corresponding adjectives, then the politico-economic twin-star would actually dominate (Figure 15). Such a focus on the adjectives, however, did not prove reasonable because it would have brought considerable problems related to the comprehensive flexion of adjectives common in both the French and the German language, given that the Ngram Viewer does not allow for graph bundling. Moreover, a larger impact of adjectives can only be observed in the English and the French case (Figure 16), while in the German (Figure 17), the adjectives hardly change anything. Even the most frequent adjective is only one indicator among others in the function systems' Top 10. It is, therefore, particularly interesting that the political and economic adjective(s) counter-perform the master-trends indicated by the vast majority of the other indicators of their function system, whereas the religious does not. Combining this finding with the fact that the trend diagnoses, politicization and economization, also do not meet the pulse of their respective function systems, again, the results substantiate suspicions that both trends may be evoked rather than observed.

Word ambiguity was another issue in the definition of indicators for function system

references and, at times, this also applied to the function systems' names. The problems related to politique already have been discussed (Fn. 7). However, the fact that both the adjective and the noun refer to the same function system prevented the exclusion of the word. In other cases, such as right or droit, true, and power, some of the strongest indicators for the respective function systems had to be excluded due to potential ambiguity biases.

Further critique may come into play with the fact that studying the key media of the Gutenberg Galaxy might not be the key to the emerging Internet society. However, there is evidence that online and offline contents do not differ all too much (Stern, 2004). At the same time, the advantages of a books corpus are evident: Book content can be considered subject to stricter selection and, therefore, a better indicator for importance. Moreover, the Internet corpus does allow for research within the sample period of several hundred years. Further research limits are, as a matter of course, related to restricted language competences and the corpus data size. In fact, it would be best to compare all language areas and analyze 2- or more-grams, e.g. with regard to word co-occurrences, in order to get much deeper context-information. Future research on "Big Data" (Boyd & Crawford, 2012) in general and the present topic in particular could, therefore,

Figure 16. Adjectives with function system reference in the French language Google books corpus (source: own Google Ngram enquiry)



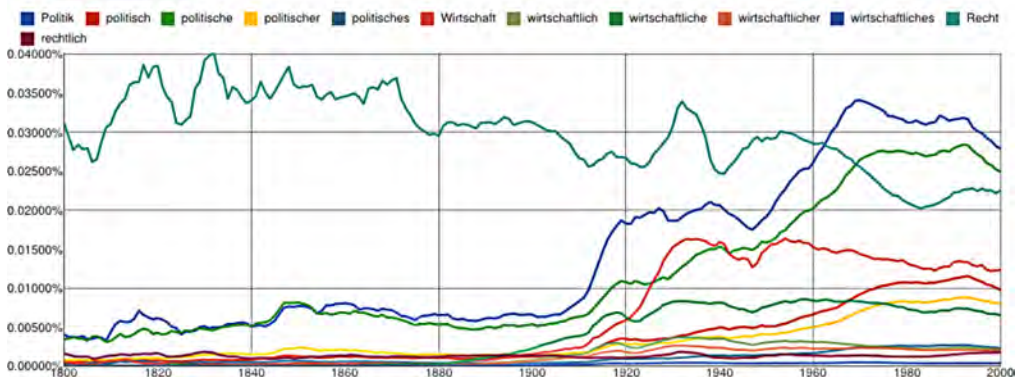
call upon international cooperation and access to more powerful computer resources.

Future expeditions in the corpus might then not only open up further and more snapshots of trends in functional differentiation, but also allow for an answer to the question of whether or not functional differentiation is indeed a master trend in present societies. In this sense, an extended Google Ngram View of modern societies could inform on the actual state and trend of modernity itself.

CONCLUSION

The English, French, and German societies actually display politicization, at least in terms of a prevailing, though not trendy, high weight of political communication. A recently re-enforced mediatization can also be observed in all the three cases, albeit as a trend rather than a state description. Secularization seems to characterize both a state (as religion, actually, is not dominant anymore) and a trend, which, however, might have stopped during the last years of the sample period when religion virtually arrived in the 21st century (George, 2005).

Figure 17. Adjectives with function system reference in the German language Google books corpus (source: own Google Ngram enquiry)



The biggest surprise resulting from the presented research certainly is that an analysis of the largest available text corpus does not corroborate the perhaps most prominent state description and trend prediction related to functional differentiation. Starting as a trend in line with the rising popularity of the early socialist movement, the “economization of society” never resulted in a high weight of the economy and stopped rather early (German: 1950ies, French: 1970ies, English: 1990ies).

If it is true that economists “perform” economies, then the presented results also support the idea that economization critics perform economization and that both parties jointly perform an economy bias in social sciences that is incongruent with the average to marginal relevance of the research object. In this respect, it is congruent that the different dictions and notations of economization or commodification are as marginal entries in the English language corpus as misspellings or exotic forenames are. This fact is emphasized not to prove the marginal relevance of research in economic risks and benefits, but rather in terms of a suggestion to consider re-focusing research foci and drawing increased attention to function systems beyond the politico-economic double stars of social science. Maybe even the solution to the present “economic” “crises” is not in more, but rather in less attention to the economy. In any case, further critiques of economization necessarily contribute to economization and are, therefore, (drivers of) the problem they try to solve. If high weights of particular function systems are indeed a problem, then vigilance is needed with regard to the political system rather than to the economy. Even more light, however, could be shed on those areas over which the strong interest in (the interplay of) the political and the economic system has casted large clouds over throughout the last decades. Apart from a certainly necessary re-cultivation of neglected landscapes of functional differentiation, there is hardly any reason why researchers should be biased to particular function systems and there is even less reason for resentments towards a

mediocre function system or for complicity with the most dominant, respectively.

In this sense, the present article gives us a first indication of the transformative power of computer communication. If big data analysis actually corroborates the finding that the idea of an economization of society is an artifact rather than a fact, then this will indeed change the face of modern society.

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ENDNOTES

1 The first volume of which has recently been translated into English language (Luhmann & Barrett, 2012).

2 The fade-out of the fact that the proliferation of a scientific discipline represents a process of scientification rather than economization can also be observed in Anders Blok's (2011) reply to Michel Callon's (Callon, 2007; Callon, 1998; Çalışkan & Callon, 2009, 2010) performativity of economics program. Blok is right in pointing out that markets are not only performed by economists, but also by politicians, however, he also takes economists for representatives of the economy and hopes that an ethically guidance of both performers and counter-performers will "generate not only civilized markets, but also civilized politics" (Blok, 2011:271), in the end.

3 Families (Henkel, 2010; Mayntz, 1988; Tyrell, 1979; Fuchs, 1999; Aderhold, 2004), love (Leupold, 1983; Burkart, 2005; Künzler, 1987), the moral (Reese-Schäfer, 1999, 2005; Schwelger, 2008), culture (Burkart, 2005; Henkel, 2010; von Rosenberg, 2009), social work (Baecker, 1994; Fuchs, 2000; Maass, 2009; Wagner, 2006; Scherr, 2001), sexuality (Lewandowski, 2004), tourism (Stichweh, 2005), and venture communication (Bohn, 2004) must be considered disputed candidates. We argue that the function of art is in the creation of artworks in the sense of the distinction of artworks and imitations or chance (Luhmann, 1997:978f; also 1995b, 2000a), i.e. in the creation of new (!) artifacts, while the copying of yet existing artifacts would rather be a matter of the mass media system. Taste is a program that displays sense of style(s).

5 Sport does not appear in the list of function systems proposed by Werner Reese-Schäfer (2007: 120; also Baraldi et al., 1999). However, in view of recent works (Bette, 1999; Cachay & Thiel, 2000), we consider sport a function system. In doing so, we do not have the special case of competitive sport in mind, but rather sport in general. As a medium of sport, we propose achievement, while a certain goal defines what is success or failure. The social function of the system is performance communication.

6 The program of the health system (Luhmann, 1990a) is not, as often proposed, the Hippocratic oath. Rather, diagnoses define what is sane or insane. The health systems' medium is illness (Baraldi et al., 1999: 116), not treatment, or therapy. Therapy, not health care, is

- the function of a system that only works if there is enough diagnoses of illness and, therefore, reason enough for therapy communication.
- ⁷ An achievement placed within the context of others makes education. In fact, the function of education is placement by means of tests that fathom what or who is placeable within a given context. Placeable/un-placeable, therefore, is the code of education (Luhmann, 2001: 59/73), while the carrier is its medium. In this sense, competition (the French *concours*) is a form of education, not a characteristic of sport.
- ⁸ The function of the mass media system (Luhmann, 1996, 2000c) is the cross-social construction of the reality (Luhmann 1997:591 f), i.e. its self-definition. While the topic defines what is information or non-information, the record(ing) is the medium of the mass media system.
- ⁹ The present interpretation of word importance does not refer to where word importance is inversely related to word frequency (Baeza-Yates & Ribeiro-Neto, 1999). Such an indexical approach to word importance would only make sense if the present article was interested in comparing the discriminatory abilities of the concepts involved. All function systems, however, are on the same level of analysis and, therefore, feature the same degree of discriminatory power.
- ¹⁰ The data from 1500-1800 is likely to feature biases due to insufficient sample sizes: "The oldest works were published in the 1500s. The early decades are represented by only a few books per year, comprising several hundred thousand words. By 1800, the corpus grows to 98 million words per year; by 1900, 1.8 billion; and by 2000, 11 billion" (Michel et al., 2011:176).
- ¹¹ Fold change of the relative word frequency calculated in terms of the ratio of the visually assessed word frequency of 2000 and 1800: $\hat{f} = e(2000)/e(1800)$.
- ¹² The abbreviation ppm represents "parts per million", i.e. the relative word frequency per million words in the Google Book corpus in 2000. The unit *per million* is used to avoid longer chains of digits after the decimal point. The most common English words account for 45,000ppm (4.5%: *the*), 30,000ppm (3%: *of*) and 23,000ppm (2.3%: *and*). *Time*, the most frequent noun in the Google Million corpus, has an appearance of 1,300ppm. *Law*, for example, appears about four times less than *time* and about two times less than *life*, which is still about as important as *men*, *English* or *family*.
- ¹³ *politique* is both a noun and an adjective; the adding of adjectives like *légal/e* or *juridique*, however, has only minor effects on the big picture (ca. 50ppm).
- ¹⁴ A search engine for the Google Books corpus designed by Marc Davies (2011-) allows for these and further options, however, for the American English corpus only.

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