Abstract

The Google algorithm, as a ranking and ordering structure, cannot be "objective" as long as the page-ranking mechanism produces social effects and always inadvertently and inescapably affects social priorities. Imitable units of information (memes) on the internet change according to the laws of exponential growth, like other social phenomena, which include Google rankings. Mathematically and graphically represented, the effects of mimetic inflation on Google rankings and other site-specific information can be proposed and projected. Current algorithmic policies may actually preserve and exaggerate the social priorities of the status quo in spite of "objective" intentions. These considerations in mind, the concept of "monology", "the monopoly on information", might be implemented to further analyze network effects online. Algorithmic regulation could be used to enforce artificial inequalities, to permit natural inequalities, or to enforce artificial equalities: each option has implications for the justice and fairness of online and offline environments.

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Digital Monology: The Authority of the Search Engine

"I actually think most people don't want Google to answer their questions. They

want Google to tell them what they should be doing next."

-Eric Schmidt, CEO of Google

INTRODUCTION

Why do we love Google? Well, Google connects us with what we want.

How do we know what we want? Well, Google tells us.

Although many search engine algorithms claim objectivity and neutrality, many fail to

live up to such claims because of their three-fold social effects: 1) network search engines

document subjective social priorities; 2) network search engines implement subjective social

priorities; 3) combining these two effects leads to a positive feedback loop that controls and

conspires in the power of digital information through imitation, iteration, and inflation. Even

though its appearance may be mostly benign and its effects may be mostly benevolent, a search

engine has many subtle side-effects: it facilitates big websites, estranges small websites, and

consolidates its own power over knowledge. These emergent biases might be referred to as a

type of "webjectivity": "the quality of being based on or influenced by electronic networks of

algorithmic pressures".

The "webjective" effects of networks and algorithms can have different results depending upon the designs of the networks and algorthms. Depending on conditions, the information environment on the network could result in disparate outcomes: 1) paralogy or 2) monology. One such case could be an environment of "paralogy" in the sense of Jean-Francois Lyotard, a discursive environment of self-regulating informational freedom (Lyotard); 2) another such case could be an environment of "monology", an information environment dominated by a single authority, much like a monolopy in an economy (Bakhtin). In the same sense that a "monopoly" represents "A situation, by legal privilege or other agreement, in which solely one party (company, cartel etc.) exclusively provides a particular product or service, dominating that market and generally exerting powerful control over it.", a "monology" represents "A situation, by legal privilege or other agreement, in which solely one party (institute, university, etc.) exclusively provides a particular knowledge or information, dominating that study or discipline and generally exerting powerful control over it". ("Monology" also has a more archaic meaning, "The habit of soliloquizing, or of monopolizing conversation", which should not detract from the more technical sense in which the term shall be used here.) For a better sense of what is meant by "monology" in our sense, one might turn to the concept as presented by Mikhail Bakhtin in "Problems of Dostoevsky's Poetics" (Bakhtin). Bakhtin posits that a novel, even though it contains many characters, in a fundamental sense, is ultimately only the author's voice, and thus a unifying ideological monologue. The same might be said of other media forms, which, though composed of various works, can still constitute a unifying "monology". Although Bakhtin is specifically discussing novels, he is also open to its operations in other fields of discourse:

> A monologic perception of consciousness holds sway in other spheres of
>
> ideological creativity as well. All that has the power to mean, all that has value, is

everywhere concentrated around one center-the carrier. All ideological creative

acts are conceived and perceived as possible expressions of a single

consciousness, a single spirit. Even when one is dealing with a collective, with a

multiplicity of creating forces, unity is nevertheless illustrated through the image

of a single consciousness: the spirit of a nation, the spirit of a people, the spirit of

history, and so forth. Everything capable of meaning can be gathered together in

one consciousness and subordinated to a unified accent; whatever does not submit

to such a reduction is accidental and unessential. (Bakhtin 81-82)

Although before his time, to Bakhtin's listings, one might well add the "spirit of the search

engine".

Although the internet sometimes seems to be a utopian "paralogy", there is perhaps

reason to suspect that there is a trend towards a dystopian "monology". "Webjective" effects

hold for any search engine that deigns to order knowledge in a complicated, interwoven network.

But, for the sake of elegance, the discussion can further focus on Google's PageRank algorithm

as a quintessial example of the "monologization" processes. Google serves as perhaps the most

definitive example of emergent algorithmic bias for several reasons: 1) Google is the most

ubiquitous search engine and therefore most powerful algorithm; 2) Google is the most

characteristic search engine in that the efficient and efficacious PageRank method has influenced

the way that other important websites (like Reddit, Twitter, and Facebook) order their own data;

3) Google is the most integrated search engine in that other websites and companies organize

their own data to accommodate the Google algorithms; and 4) Google has historically self-

proclaimed its algorithm "objective", and has thus essentially begged for its biases unmasked.

Because of the unique prevalence of its algorithm, the Google search engine may prove an instructive example of "webjective" effects in distorting knowledge towards "monology".

Ultimately, through the way its database sorts data and the way its interface presents data through various mechanisms (documentation, implementation, imitation, iteration, and inflation), an algorithm participates in the production of social priorities.

GOOGLE LINKS: DOCUMENTATION

On its basic level, Google's database documents social priorities.

Extensive literature has been published by Google describing the form and function of their search engine algorithm and the degrees by which it documents data. In their seminal article on the subject, "PageRank Citation Ranking: Bringing Order to the Web", the founders of Google call their product a "method for rating Web pages objectively and mechanically, effectively measuring the human interest and attention devoted to them" (Page 1). Google's method has been refined and reviewed over the years, but still retains the basic system and core functionality. According to them, their unique algorithm organizes pages by backlinks and forwardlinks (backlinks being links from another page to the page; forwardlinks being links from the page to another page) (Page). The Crawler scans all the pages on the net for backlinks while the PageRank orders and sorts pages by numbers of backlinks. Those with more backlinks are more reputable, more relevant, more ranked, and thus appear higher in Google's search results. What results is a well-formatted, well-ordered list of sites: what they call "an approximation of the overall relative importance of web pages" (Page 2). The importance of Google's content then corresponds to the importance of Google function as premier search provider. And even though they have had a captive audience for years, Google's updates (Panda, Penguin, Hummingbird, etc.) and its conceptual artificial intelligence (RankBrain) continue to determine how to rank

sites better. Though better ranking systems would still not undermine the fundamentals of the ranking system itself, which are processes of documentation that are "objective" in character. Indeed, even one of Google's greatest critics, Siva Vaidhyanathan, describes how Google, in its inception, "offered what seemed to be neutral, democratic rankings" (Vaidhyanathan 2).

Google's insistence on explaining its own procedure in "objective" terms is perhaps an example of the language game of "legitimation" described by Francois Lyotard in "The Postmodern Condition":

> Legitimation is the process by which a "legislator" that deals with scientific discourse is authorized to prescribe the stated conditions (in general conditions of internal consistency and experimental verification) determining whether a statement is to be included in that discourse for consideration by the scientific community. (Lyotard 8)

According to Lyotard, this language game is played by many members of the scientific community, whereby the rules of the system justify themselves. Since "given the scientific nature of the game," and the scientific nature of the knowledge in question, for any given scientific institution administering such knowledge, "the question of its own legitimacy must be among those raised" (Lyotard 28). In other words, any institution that makes "scientific" claims must also claim itself "scientific". So, by way of example, Google, as a scientific institution, deigns to legitimize itself scientifically in the same sense that other institutions seek legitimacy on the grounds of science. Citing academic journals, conducting empirical observations, or even postulating mathematical theorems can be used as the legitimating basis for a social structure's powers, which many institutions have used, including Google.

But Google's claims to objectivity are open to criticism, through the very concept of the language game. Google's page ranking algorithm sorts by so-called "importance". But, importantly, importance is not objective, importance is not scientific, importance is merely a formal feature of the language game being conducted. In the case of Google, the "scientific" importance being measured is dependent upon the "unscientific" importance delegated by other websites. By its very nature, this type of judgement presumes the preconceived judgements of those that defined that importance. Furthermore, any given social ranking system always exaggerates through reaffirmation the social ranks and thus the social issues that already exist. Google's claimed objectivity is ultimately founded in the communal linkages of intertextuality found in the backlinks and forwardlinks of websites, which are themselves little more than the subjective assignments of the website's creators and users. In other words, Google's objectivity really is intertextuality, which really is an obscuring process of deferring to the subjectivity of the mass media. Thus, Google does not search for "objective" truth, necessarily. Google does search for "intersubjective" beliefs as affirmed by social ranking structures. Whatever the zeitgeist of interlinking websites believes important at any given moment surges to the high ranks and front pages of Google. Deferring analysis back to Lyotard, this is "the new scientific attitude" where "the name of the hero is the people, the sign of legitimacy is the people's consensus, and their mode of creating norms is deliberation" (Lyotard 30). But also, such a mutable and malleable foundation leads to the unjustifiability of science on objective grounds and the "internal erosion of the legitimacy principle of knowledge" (Lyotard 36). Google's objectivity cannot survive scrutiny, because on its most granular level it is just personal choices, and on an aggregate level it is just social agenda. By creating PageRank, Google is enabling a prioritization of certain kinds of social knowledge.

GOOGLE LIKES: IMPLEMENTATION

But also, on a higher level, Google's interface implements social priorities.

If they simply consumed intersubjective social priorities, then Google would stand halfway innocent, as a discrete observer of online events, but they also produce those intersubjective social priorities by affecting the search behavior of the user population, impinging upon its claims to objectivity even further. Inasmuch, Google's tragic flaw is the uncertainty principle: its algorithm affects its own outcomes.

In his "A Discourse on Knowledge" Michel Foucault describes the process of information flow by which the institutions that list and sort knowledge affect how users seek and find knowledge and how users seeks and find knowledge affect how institutions list and sort knowledge:

> Will to truth . . . relies on institutional support: it is both reinforced and accompanied by whole strata of practices such as pedagogy (naturally), the book system, publishing, libraries, the learned societies in the past, and laboratories today. But it is probably even more profoundly accompanied by the manner in which knowledge is employed in society, the way in which it is exploited, divided and, in some ways, attributed. (Foucault 219)

Users search for information in Google's search engine engaging in precisely the "will to truth". And search engines operate at the modern digital centralization of the "book system, publishing, libraries", etc.. Foucault is showing that questions and answers are not innocent, but imbedded into their own social effects. The parent's lesson affects the child. The teacher's lesson affects the student. Google's lesson affects the user. The way that Google presents information to us affects how we will use that information and corresponds with the authority and gravity we

attribute to that information. Particularly, information on the front page of Google is accorded a higher standard of importance than information on the last page of Google. As Foucault further describes, "Only one truth appears before us, and we are unaware of the prodigious machinery of the will to truth, with its vocation of exclusion" (220). Although we come to think we know the "truth", there are many pieces of information that we never come to know, buried beneath the apparatus that presented us with the "truth" in the first place. In such a manner, the front page of Google acts in precisely the way that "one truth appears before us", while users forego even glancing at the thousands of other pages that are by unseen and unknown, lost to the dustbins of the internet. Inconspicuously, Google's algorithm of dissemination operates in the background and we operate "unaware" of the "vocation of exclusion", because our knowledge of that too is excluded by the inaudible and invisible mechanisms of the algorthm beyond the interface.

Users are affected by this knowledge and thus reassign their own social priorities in accordance with this knowledge. Google's schema changes how users on the internet hierarchize their own information. Subsequently, this changes the way users assign backlinks and forwardlinks, the priorities by which these links are assigned, and which links get assigned and which do not. Google's manufactured order is continually warping and morphing the landscape of links that interconnect the internet at large, which is itself a microcosm of human knowledge. According to one of Google's greatest critics, "Google, the most flexible yet powerful information filter we use regularly, could come to exercise inordinate influence over our decisions and values" through the way in which it lists and sorts knowledge (200 Vaidhyanathan). Thus, by maintaining page ranking, Google is continually enforcing a prioritization of kinds of knowledge.

GOOGLE LOOPS: IMITATION, ITERATION, INFLATION

Combining the above effects – the documentation of social priorities plus the implementation of social priorities – leads to a self-reinforcing process. Google's algorithm is a positive feedback loop that affects its own outcomes in a far-from objective fashion, resulting in the distortion of the information so expressed: imitation, iteration, inflation.

Such behavioral loops pervade social processes. Long before digital media, in the print media, this has been known as the phenomenon of fame. We all want to look at what others are looking at. In the world of economics, this is known as monopolistic capitalism. The rich get richer; the poor get poorer. In the world of politics, this is known as imperialism. Power seeks to further empower itself. In the world of genetics, this is known as population expansion. The number of creatures reproduced is proportional to the number of creatures reproducing.

Rene Girard suggests that such self-reinforcing social behavior can be described in terms of imitation or "mimesis" (Girard Ch. 1). Desires are themselves just the copies of other desires, just as texts are just copies of other texts. Richard Dawkins and Susan Blackmore further suggest that the imitable behaviors, so-called "memes", propagate and inflate in populations just as organisms multiply in ecosystems (Dawkins Ch 11, Blackmore). This leads to rates of propagation in a Malthusian sense, where the exponential growth rate of information follows the exponential growth rate of creatures.

These phenomena certainly apply to the internet in general and Google in particular. Personal information, especially our "digital reputation", grows and decays exponentially in what Frank Pasquale has referred to as "an era of runaway data" (19 Pasquale). In the most obvious example, high ranked sites on Google's front page get exposure, so they get high ranks which means they get back on Google's front page. In general, those with high ranks, links,

clicks get higher ranks, links, clicks. The rich get richer… Trending! Viral! Meme! Those with low ranks, links, clicks get lower ranks, links, clicks. The poor get poorer. Who? Thus, this principle of exponential mimetic growth is built into the Google algorithm. In a digital ranking pool in general, or in the Google search engine in specific, the exponential growth of high ranked sites would outcompete the exponential growth of low ranked sites that do not grow. Those with high ranks keep high ranks. Those with low ranks keep low ranks. This is structurally inescapable, since this is the structure of the mechanism by which the information is sorted, distributed, and received, the algorithm that constructs the database itself. As any viewer can tell, the more views something has, the more views it probably will have. The best way to get lots of views is to already have lots of views. The worst way to get lots of views is to have few views. Thus, Google comes with implicit mimetic behavioral incentives. Google rewards attention seekers with high ranks: speakers, leading followers, being cited, being loud, hording forwardlinks. Google punishes attention givers with low ranks: listeners, following leaders, citing sources, being soft, sharing forwardlinks. Overall, the algorithms would reinforce and reiterate those choices made already. With such behavioral incentives influencing its results, Google cannot claim objectivity, far from it. Rather, the ranking algorithm creates a culture of users who are incentivized to game the ranks, but who are disincentivized to give back ranks to the community. This is the internet culture that breeds trending and trolling and other "viral" behaviors. In the short term and long term, especially with the addition of paid advertisements and personalized search results, this could have all sorts of strange social effects. All of these processes tend towards ingrown, self-absorbed, close-minded cloistering; not the overflowing, other-thinking, open-minded menagery ("paralogy") that the internet could be. The process of

imitation, iteration, and inflation has effects upon culture, not all of which are necessarily desirable.

Exemplifying the process more technically (or algorithmically), even the creators of Google admitted from its inception that "There is a small problem with this simplified ranking function . . . which we call a 'rank sink'." (Page 4). The rank sink, in effect, is an algorithmic anomaly arising from the repeated re-ranking of cross-linked websites. As the creators of Google describe it themselves:

> Consider two web pages that point to each other but to no other page. And suppose there is some web page which points to one of them. Then, during iteration, this loop will accumulate rank but never distribute any rank (since there are no outedges). The loop forms a sort of trap… (Page 4)

In other words, Google's original algorithm had some glitches that resembled feedback loops in the network where rank would "sink" into self-reinforcement. Much to their credit, the team at Google points out the problem and offers a mathematical solution, a work-around that eliminates such anomalies. But, though the creators acknowledge that their process accidentally, algorithmically boosts rank to disproportionate levels in "rank sinks", they do not seem to acknowledge the fact that all websites cross-link with each other and thus the entire internet at large is itself a kind of massive conceptual "rank sink". In human knowledge, there "are no outedges". In the closed system of website linkages, centers of attention build rank and thus attract other centers of attention which further build rank. This is not to say that the Google search results are themselves inflations processed algorithmically, but to say that they are processed socially, external to Google, where they are inflated, and then returned to Google as such. They too are imitated, iterated, and inflated by their own self-referencing procedures, just

like the "rank sinks" that plagued early Google prototypes. This results in the "monologic" unification of Google. This is consistent with Mikhail Bahktin, who goes to far as to suggest that "monology" is a salient feature of semantic systems in general:

> Semantic unity of any sort is everywhere represented by a single consciousness and a single point of view. This faith in the self-sufficiency of a single consciousness in all spheres of ideological life is not a theory created by some specific thinker; no, it is a profound structural characteristic of the creative ideological activity of modern times, determining all its external and internal forms. (Bakhtin 81-82)

PROCESSES AND CASES: THE RANK GET RANKER

RANKING PROCESS

The social processes of Google's ranking system can be analyzed in stepwise fashion. The elegance of thinking about social phenomena mimetically, and perhaps what Google means by "objectively", is thinking about them quantitatively. The mimetic growth rate of social metrics can be framed mathematically because the discrete units of information can be readily enumerated. Sociologically speaking, when using Google, the pages with the highest ranks will get the most clicks, the pages with the most clicks will get the most reposts, and the pages with the most reposts will get the higher rankings. Algorithmically speaking, when using Google, the new rank is proportional to the old rank in a stepwise process: old rank yields Google page yields usage yields backlinks/forwardlinks yields new rank. This is more precisely described in the table and figure below (Appendix A: Table 1). As the new rank becomes the old rank in a repeating generational process, the numbers iterate and reiterate, thus growing exponentially as the cascading effects accumulate. In the case of Google, the equation iterates every time the

Crawler reassesses and reanalyzes the internet landscape, each new set of ranks being the production of and producer of themselves through mimesis.

RANKING CASES

The social effects of Google's ranking system can also be analyzed on a case by case basis using mathematical formulations. Because the growth of Rank is proportional to the Rank, the general form that the ranking process follows is described by an exponential inflation equation. How precisely these ranks inflate and deflate over time depends upon the precise procedures of the algorithm, which are as of now confidential and unknown to the greater public (Schwartz). But, different cases of arrangements of algorithms can produce different outcomes, so there are many plausible cases that exponential growth of Google PageRank could follow. Each case shows a different effect a search engine's algorithm might have on social priorities, depending upon operating conditions. All of these cases can be generated from and follow the general case of mathematical inflation, but each case corresponds to a different condition and a different equation under which the algorthm might operate. The six cases represented are described as follows:

1.   **Linear Inflation Case**: all sites would grow with the assumption that the growth rate of rank is proportional to the rank. The higher rank you have, the higher rank rate you get: Google hyper-exaggerates social priorities. This case would result in ranks rising over time relative to themselves, all ranks rising equally. This case would result in the absolute Ranks rising over time, but the relative ranks staying the same.

2.   **Quadratic Inflation Case**: all sites would grow exponentially with the assumption that the growth rate of rank is proportional to the rank. The higher rank you have, the higher rank rate you get: Google hyper-exaggerates social priorities. This case would result in ranks rising over

time relative to themselves, higher ranks rising faster and lower ranks rising slower, leading to an eventual mimetic monopoly of high rank sites that increasingly marginalizes low ranked sites. This case is credible, since high ranking sites are likely to rise in rank faster than low ranking sites, on average. Furthermore, because Google has adopted a monetized ranking system in recent years, permitting companies to purchase top slots on the Google front page, the meritocratic ranking system and the plutocratic advertising system mutually reinforce each other, yielding such Quadratic rankings.

3.   **FrontPage Linear Inflation Case**: only the highest ranked sites, those on the front page, would grow exponentially. If the site rank is the highest rank, then the rank increases: Google exaggerates social priorities. This case would result in the relative ranks of the highest-ranking sites rising over time, but rest of the ranks stagnating and dwindling off. This case is more realistic, since the front page of Google is the highest profile, highest class, highest influence page. Does anyone even skip a page? How many times have you gone through the entire first page, found the second page, third page, etc.? In other words, the first page gets all the attention, and so gets all the rank rate growth.

4.   **FrontPage Quadratic Inflation Case**: only the highest ranked sites, those on the front page, would grow exponentially, at squared the rate of the linear inflation case. This case has similar to the linear case, but has more exaggerated behavior.

5.   **Leveling Inflation Case:** Google would implement an algorithmic adjustment policy such that the ranks of all sites would be derated to trend towards equality. To counteract self-fulfilling ranking, Google would have to deflate by the Rank: Google could level social priorities. This case would result in some high ranks falling and low ranks rising over time, leading to all sites with equal ranks. Far from being practicable, this case is self-defeating,

since differential ranking is the entire purpose for which the Google algorithm sorts in the first place.

6. **Derated Inflation Case**: Google would implement an algorithmic policy such that the ranks of all sites would grow exponentially at an equal rate, having been derated according to rank. To counteract self-fulfilling ranking, Google would have to deflate the RankRate by the Rank. In this rank, the higher rank you have, the higher rank you get: Google could derate to preserve social priorities. This case would result in the absolute Ranks rising over time, but the relative ranks staying the same, just as in a linear case. This case is perhaps reasonable, since counteracting inflationary monopolies would seem to legitimize Google's ranking schema.

These cases are explained mathematically by their respective conditions and equations in the table below (Appendix A: Table 2). The first and second cases show clear, unfettered, monopolistic growth of larger sites to the exclusion of smaller sites. The third and fourth cases show a controlled, steady-state of social priorities and site ranks. These algorithmic cases are further shown in graphs (Appendix B: Figure 1-6). The graphs were plotted based on the corresponding inflation equations modeling the behavior of website ranks under the algorithmic and mimetic forces of search engines. Each graph shows a different tabulated algorithmic case. In the graphs, the x axis measures iterations over time and the y axis measures absolute and relative ranks. The left graphs show absolute ranks and right graphs show relative ranks (absolute rank being the actual numerical rank; relative rank being the rank relative to other sites on a 100% scale). The different shaded bands correspond to the different ranked websites (only ten websites were modeled). The wider the band at any given iteration, the greater ranked the site at that moment in time.

CONCLUSION

As a socialization process, the Google search engine both documents and implements, and thus inescapably affects the outcomes of its search results. Google cannot be objective, nor can Google even be inactive, but is constantly complicit and active in listing and sorting the social priorities of the world wide web. That Google operates in this manner matters because it affects social life at every level. As Turkish activist Zeynep Tufekci has argued, "Nowadays, the function of gatekeeping for access to the public sphere is enacted through internet platforms' policies, algorithms, and affordances (Tufekci 134). In other words, it really does matter what Google does, since, in effect, Google is the Roman forum; Google is the Athenian agora; Google is the Tiananmen square. Google is the place where public discourse happens. But Google itself is not special. The explicit algorithm of Google's search engine is simply the implicit process of any search engine, information platform, news outlet, or multi-media provider. All of these are networks and therefore all fall subject to the intrinsic processes characteristic of networks. Far from being exceptional, Google is simply the most obvious exemplar of the rule. In other words, whatever the means, the objectivity of science and subjectivity of personhood must be considered. Clearly, imitation, iteration, and inflation are distorting forces on knowledge. We must think about these things, now or never, because our very thinking is becoming more and more "dependent on a very small number of corporate platforms and search engines (or, more accurately, one search engine, Google)" (Tufekci 135). Who should order the internet? How should the internet be ordered? Should the internet be more closely regulated? Is Google the "best" worst option? These are unavoidable questions that must be answered critically as the information age reaches self-awareness.

Appendix A: Tables
Table 1: Google Search Engine Ranking Cycle

Step	Process	Formula
A1	Google begins with an Old Rank.	$OldRank$
B1	Google runs PageRank and sorts websites from highest to lowest according to ranks.	$OldRank \rightarrow GooglePage$
C1	Users on Google search and find websites, most often ones with high ranks, least often ones with low ranks.	$GooglePage \rightarrow Usage$
D1	Users redistribute backlinks and forwardlinks on their websites according to websites they have seen on Google.	$Usage \rightarrow BLinks \ and \ FLinks$
E1	Google runs the crawlers and discerns the number of backlinks and forwardlinks per website and uses the backlinks and forwardlinks to distribute ranks to websites.	$BLinks \ and \ FLinks \rightarrow NewRank$
A2	Google ends with a New Rank.	$NewRank$
…	… ad infinitum … etc.	
Total	Google uses the old ranks of websites to determine the new ranks of websites.	$OldRank \rightarrow NewRank$
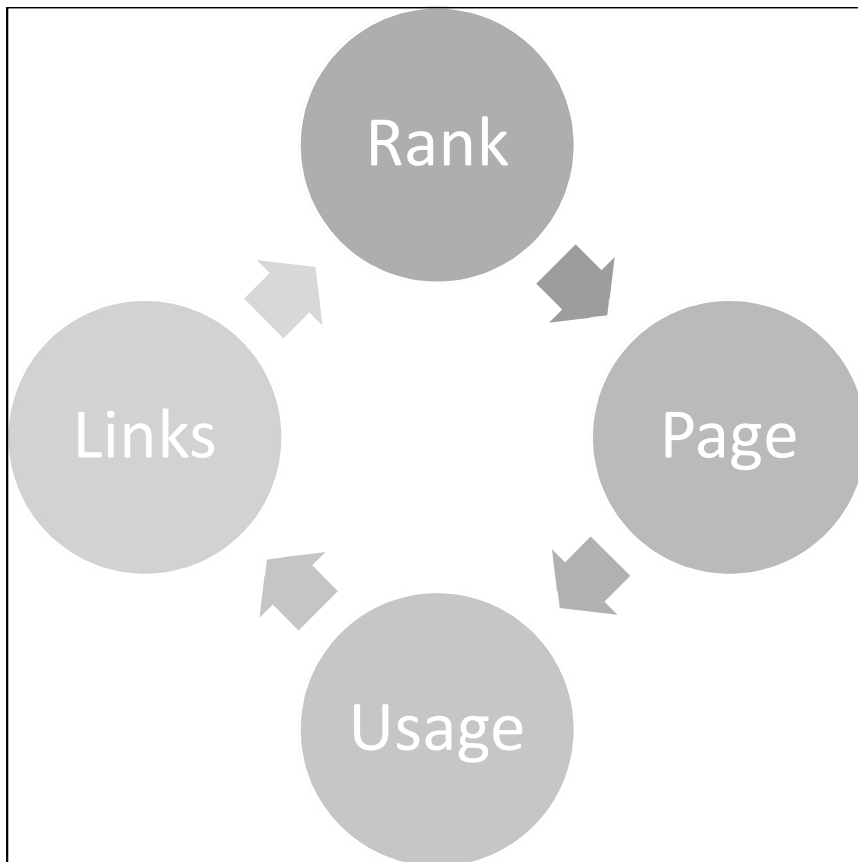
Google Search Engine Ranking Cycle

Table 2: Google Search Engine Ranking Cases and Equations

| Case	Condition	Control	Equation
General Case		$g(OldRank) = 1$	$NewRank = OldRank + \dfrac{f(OldRank)}{g(OldRank)}$
Linear Case	$f(OldRank) = OldRank$	$g(OldRank) = 1$	$NewRank = OldRank + OldRank$
Quadratic Case	$f(OldRank)$ $= (OldRank)^2$	$g(OldRank) = 1$	$NewRank = OldRank * (1 + OldRank)$
FrontPage Linear Case	$IF\ FrontPage$ $f(OldRank) = OldRank$ $ELSE$ $f(OldRank) \approx 0$	$g(OldRank) = 1$	$NewRank = OldRank + OldRank$ $NewRank = OldRank + 0$
FrontPage Quadratic Case	$IF\ FrontPage$ $f(OldRank)$ $= OldRank^2$ $ELSE$ $f(OldRank) \approx 0$	$g(OldRank) = 1$	$NewRank = OldRank * (1 + OldRank)$ $NewRank = OldRank + 0$
Leveling Case	$f(OldRank) = 1$	$g(OldRank) = \dfrac{1}{f(OldRank)}$	$NewRank = OldRank + \dfrac{f(OldRank)}{f(OldRank)}$
Deflated Case	$f(OldRank) = 1$	$g(OldRank) = \dfrac{1}{f(OldRank)^2}$	$NewRank = OldRank + \dfrac{f(OldRank)}{f(OldRank)^2}$

Appendix B: Graphs

Linear Case Rank Numbers
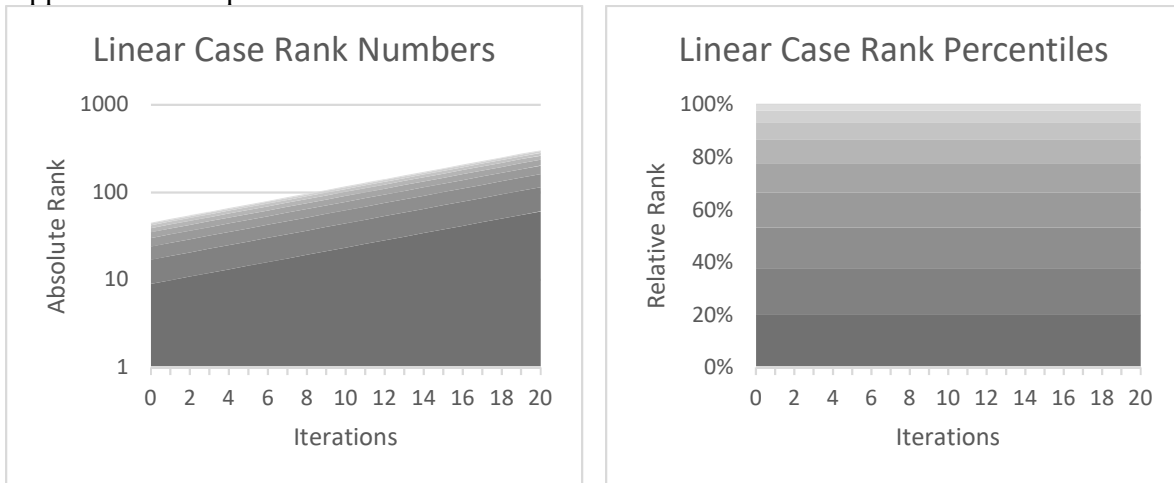
Figure 1: Linear Inflation Case

Quadratic Case Rank Numbers
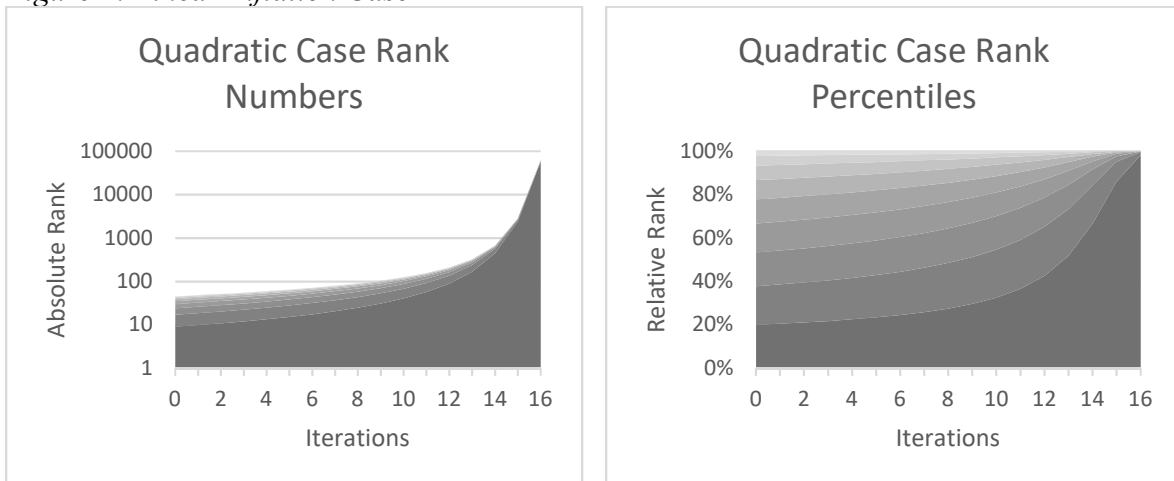
Figure 2: Quadratic Inflation Case

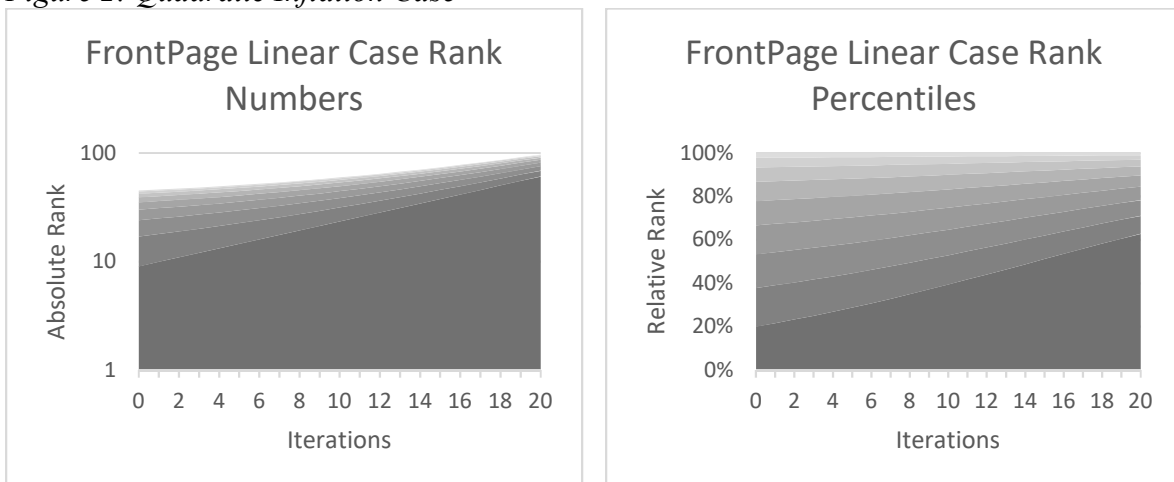## FrontPage Linear Case Rank Numbers

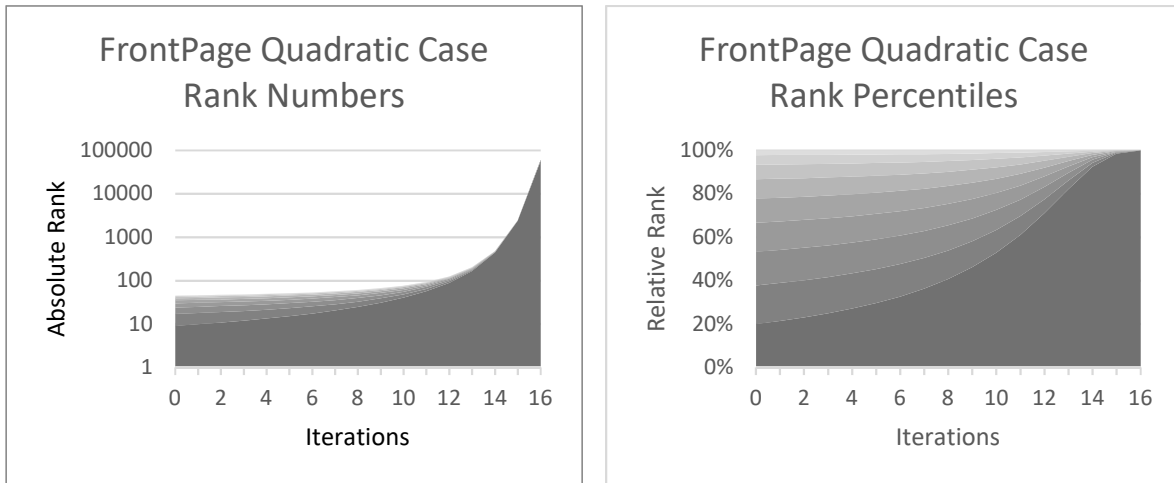*Figure 3: FrontPage Linear Inflation Case*

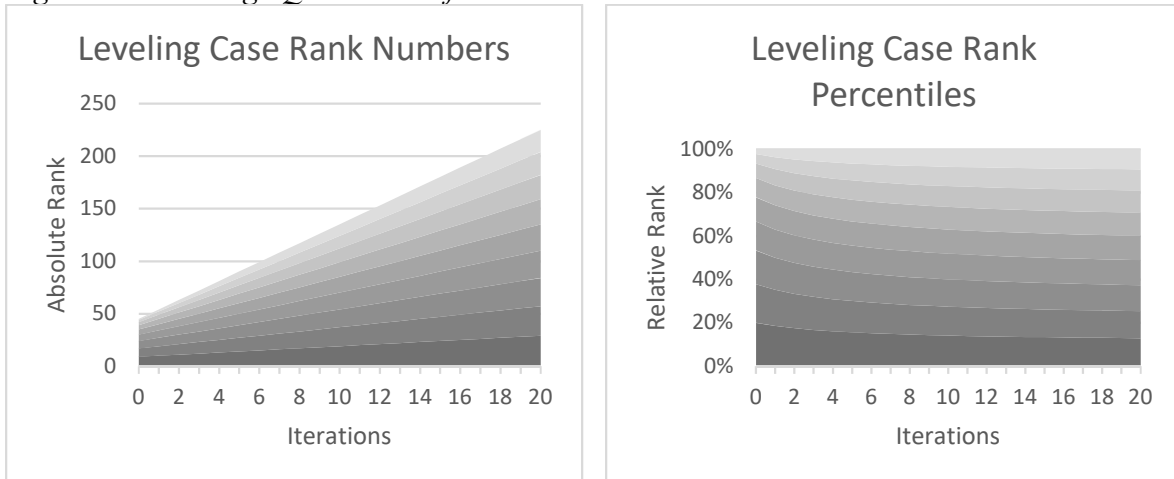*Figure 4: FrontPage Quadratic Inflation Cases*
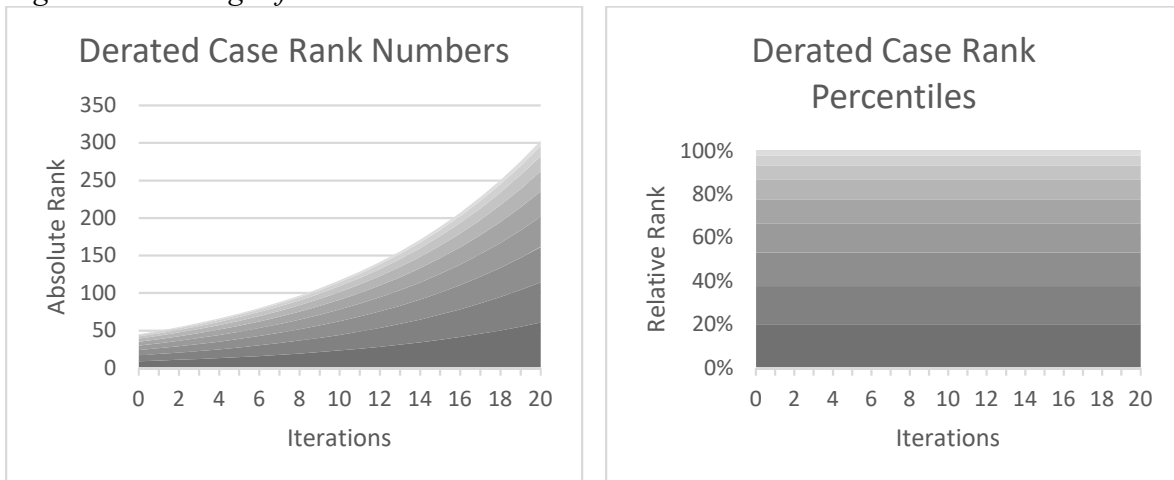

Figure 5: Leveling Inflation Case

Figure 6: Derated Inflation Case

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