RANKING
The reality, illusion and manipulation of objectivity

A book proposal

October 28, 2017

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1 Overview

Like it or not, ranking is with us. The book is about ranking, everybody with whom I talked in the last ten months seemed to agree with me that the topic is in the air. We like and dislike ranking because it is simple and objective, biased and subjective. Ranking starts with comparison. We like to compare ourselves to others and see who is stronger, richer, better, cleverer. Our love of comparison has led to our passion to make rankings. Ranking is about becoming more organized and we like the idea of being more organized!

Runners ranked based on the time they achieve a distance, a competition going back to the ancient Olympic Games in Greece, reflects objectivity. Koroibos of Elis, as we know a humble cook by profession, was the first in the \textit{stadion} foot-race. However, many Top Ten (twenty one, thirty three etc) lists based on subjective categorization and only give the illusion of objectivity. Actually we don’t necessarily like always objectivity, since we don’t mind if our performance, website, business, organization etc. have a better image and rank
as it deserves. More precisely, occasionally we cats are the victims of biased self-perception, and we are ready to believe we are lions, other times while we know well we are not, but would not mind to be perceived by others that we are, and maybe just we are the only king of the animals; Figure [1] In the latter case we need reputation management.

**Figure 1:** Biased self-perception?


Reputation management manipulates objectivity by suppressing negative aspects, and amplifying positive ones. The result of this ethical dubious procedure is a higher-than-well deserved rank.

The book discusses the Hows and Whys of our love and fear of making ranks and being ranked through many real life examples to be viewed from three different angles (reality, illusion and manipulation) of objectivity. Ranking proved to be a very efficient method in animals to avoid superfluous battle for resources (food and mate), as "pecking order" in the chicken was discovered hundred years ago, and evolutionary mechanisms led to form social ranking in our human societies.

**Ranking** converts scientific theories to everyday’s experience by raising and answering such question as: Are college ranking lists objective? How to rank and rate states based on their fragility, corruption or even happiness? How to find the most relevant web pages? How to rank employees? Just to mention an example: in the last several years Yahoo’s Quarterly Performance Review has extensively been discussed not only in the business/leadership literature, but in the popular magazines, too. It is very difficult or impossible to find objective measures to promote gifted but lay off inappropriate employees. Still, we know that employ-
ees are different in terms of their ability, performance, so we should understand the challenge to rate and rank people. Life and society is really complex, consequently our message is not so simple such as "Ranking is good!" or "Ranking is bad!". Since we permanently rank ourselves and others and are also being ranked, the message is twofold: how to prepare the possible most objective ranking and how to accept that ranking is not necessarily reflects our real values and achievements. The reader will understand our difficulties to navigate between objective and subjective and gets help to identify and modify her place in real and virtual communities by combining our human intelligence with computational techniques.

While the book takes examples from social psychology, political science as well as from computer science, it is not a book for the Science shelf. It is not even a popular science book. As Caleb A. Scharf, a famous astrobiologist wrote in his Scientific American article "So You’re a Scientist Wanting to Write a Popular Science Book?": you write a popular science book if you are not happy to write a "piece of research that precisely ten other people on the planet were genuinely interested in (one posthumously)" but would like to explain your field to a broader community. While it is true that I also would like to attract a much larger readership than my usual scientific papers do, the field of ranking is part of our everyday life. While I don’t have the intention to pretend not to adopt a scientist’s perspective, the challenge for me to combine objective analysis with subjective stories to offer an intellectual adventure and amusing text.

"So, what is the bookshelf you hope to see your book?" The answer came soon after I strolled at Barnes and Noble at Fifth Avenue two blocks from Bryant Park during my last visit to Manhattan, as Figure 2 shows:

![Figure 2: I found the bookshelf!](image)

2 Target audience

The book is offered to people whose neighbor has a fancier car, employees who are being ranked by their supervisors; managers who are involved in ranking, but they do it with
some bad conscience; business men interested in better visibility of their company; scientists, writers and other competitors who would like to see themselves at the top of a success list; college students, who are just preparing to enter the new phase of social competition, and believe that the only game in town is maximizing their GPA at any price; computer scientists, who design algorithms for recommending products for individuals based on their habits; people, who get unsought recommendations.

I recognize I violate the rules given by any "How to Write a Nonfiction Book Proposal" for not being able to define a specific target audience in terms of demography. In my mind’s eye, however, I see the book in the hands of (not only my) college students, who just entered the ranking race, and also in the ones of my fellow baby boomers, who are reflecting on their (our) past successes and failures. Young professionals, hipsters should be a good target. According to a statistics published several years ago, 10% of Americans think they’re hipsters. I would guess that readers of Ranking more often than not Netflix subscribers (over ninety millions over the world, 53% of them in the US at the end oh 2016, see http://www.businessinsider.com/netflix-subscribers-chart-2017-1 I also believe that potential readers of this book are TED talk viewers. Some sources (https://www.quora.com/How-many-TED-TALKS-are-watched-every-day suggest that there are more than three million views per day.

I take the liberty to give a (non-ranked) shortlist of books, with the hope that a nice subset of their readers might be interested in Ranking, too. Bill Bryson: A Short History of Nearly Everything (Black Swan (UK) and Broadway Books (US), 2003); if I had to choose one Gladwell’s, it is the Outliers (Little, Brown and Company, 2008) -(I know Steve Pinker’s review on What the dog saw, and Gladwell’s answer); Jarred Diamond’s Collapse: How Societies Choose to Fail or Succeed (Viking Press, 2005). I know I know... accept my apologies ... a writer should be ambitious (and hopefully not the victim of her/his ambition.)

3 About the Author and his Marketing Options

The author, a Henry Luce Professor of Complex Systems Studies http://people.kzoo.edu/~perdi/ teaches interdisciplinary classes and is cross-appointed with a physics and psychology departments. He has an extensive experience to explain thoughts to students even without having preliminary knowledge. Péter Érdi, who grew up in Budapest, combines the perspectives of a Central European intellectual and a professor of complex systems studies in a decent small Midwestern liberal art college.

He gave many invited talks in the overlapping area of computational and cognitive and social sciences. Specifically, he gave a keynote lecture about a more technical version of the topic on the International Conference On Intelligent Computing, Liverpool,UK August 7-10,
His interest in ranking emerged from his scientific analysis of patent citation networks. Among others the lecture "Patent Citation Network Analysis: Ranking: from web pages to patents" was given in Barcelona on the Int. Conf. on Artificial Neural Networks in 2016. See also

http://ic-ic.tongji.edu.cn/ (closed now, this is another story).

The author is the Editor-in-Chief of the Elsevier journal Cognitive Systems Research, vice-president of the International Neural Network Society, wrote well-accepted books published by such publishers as Princeton Univ. Press, MIT Press and Springer.

As an owner and founding director of a study abroad program, he is connected to several dozens of colleges and universities.

YouTube videos:

Institute of Advanced Studies, Durham, UK: https://www.youtube.com/watch?v=4KIuVubqdTQ
Science of Success Symposia: Harvard Univ: https://www.youtube.com/watch?v=8JWTrBU28tg
European Meetings on Cybernetics and Systems Research: https://www.youtube.com/watch?v=drBHxI2pzwJw
Univ. Michigan: http://www.eecs.umich.edu/cse/dm_11_video/erdi.mp4

The author is a very active member of the scientific community, well-known not only in the US and Europe, but also in Japan, where he is supposed to give a lecture series in 2018. He will be invited to give promotion lectures at Columbia University, Boston University, UC Berkeley, Univ. Michigan etc. There is an interactive website/blog aboutranking.com about the book with the ambition to reach a broader community.

4 Competitive titles

There are several excellent books, which discuss different specific aspects of ranking, from the mathematical algorithms to ranking academic institutions, countries or political candidates.

The book Who’s #1?: The Science of Rating and Ranking written by the mathematicians Amy N. Langville and Carl D. Meyer https://www.amazon.com/Whos-1-Science-Rating-Ranking/dp/069116231X (Princeton Univ. Press, 2012) grew up from the authors’ studies on mining the Web, and offer a broad overview on the mathematical algorithms and methods used to rate and rank sports teams, political candidates, products, Web pages etc., and is naturally located on a shelf for math books.

Sauder analyzes the history and present practice of evaluation and ranking of the quality of higher education institution, particularly law schools. Ranking not only reflects but also shapes social hierarchy. The book well demonstrates our paradoxical emotions to ranking, quantification of performance are both needed very much and also source of anxiety.

Rather parallelly, _Ranking the World: Grading States as a Tool of Global Governance_ (Cambridge Univ. Press, 2015) edited by Alexander Cooley and Jack Snyder (Editor) describes our paradoxical emotions to ranking. International ranking of states performance are characterized by about hundred different indices, from "Human Freedom Index" via "Corruption Perceptions Index" to "World Happiness". The pattern is that ranking organizations are not totally independent, and some ranked countries (say, China and Russia) occasionally reacted angrily to the performance analysis, still they are interested in the result.

Majority Judgment: Measuring, Ranking, and Electing (MIT Press, 2011) by by Michel Balinski and Rida Laraki is about ranking political candidates, and the authors argue that "The intent of this book is to show why the majority judgment is superior to any known method of voting and to any known method of judging competitions."

I was somewhat positively surprised that the narrative of all the three social science books seems to be conform with the take away of my own planned book: we like ranking with the hope that it reflects objectivity, but frequently the objectivity is illusion only, and might be subject to manipulation. The challenge is to write a popular, easily readable integrative book on ranking and rating in accordance with both the modern theories of social and computational sciences and the everyday's experience.

5 Chapters

0. Introduction

This part contains four personal stories about my early encounters with comparison, rating and ranking, and illustrate well the multi-facet relationship between ranking and objectivity.

0.1. How to lead the popularity list? Own a soccer ball!

I take the liberty to copy the first two paragraphs of the book to illustrate my recollection to a story how a a class of boys in the elementary school answered unanimously for the question 'Who is your best friend?"
It is not possible to play soccer if you don’t have a ball! But we had one! We played! I grew up in Budapest (well, in Pest and not in Buda, as my wife did; but I promised her not to make jokes anymore about the cultural differences in the two parts of the city) soon after the war. The elementary school had students (actually boys; no co-ed existed that time) from Angyalföld, (the now disappearing working class’ Land of Angels) and Újlipótváros (‘New Leopold Town’) particularly popular among middle-class intellectual citizens of Jewish origin. While there was an obvious social contrast in the background of our parents, (and I don’t speak here about the sad family stories hidden by their (well, our) parents from the New Leopold Town kids), the love of soccer bridged the gap. In the early nineteen-fifties Hungary had the worlds’ best soccer team led by Ferenc Puskás, whose left foot made him one of the greatest players of all time. This book is about ranking, and I think I share the opinion of many others, who believe that he was one of the two best-known Hungarians of the 20th century (Béla Bartók is arguably the other). The Hungarian team was unbeaten during thirty three games from 1950-1954 and the run ended in the 1954 World Cup final in a historical loss against West Germany (it was the first big postwar success of the new Germany). I will go back to this story later analyzing the sadness of being second best. So, soccer was extremely popular, almost all of us played almost every day for eight years.

But now we are in a classroom of forty boys. "Who is your best friend?" - we had to write the answer for the question asked by our teacher. Thirty seven votes went to Péter Erdélyi. He had a wonderful sense of humor, but it was not the reason of his big win. His dad was a director of a state owned (what else?) company called "Cultural articles" dealing with expensive soccer balls. Well, we lived in a poor country, so everything what we could buy in the shops was expensive. So, Péter was the only boy in the class who had a real soccer ball... (I told this story many times during introductory classes on network theory demonstrating star-like organization, as Fig. 3 shows. Please note, that a teacher asked us, and our answers were anonymous. We really were so thankful to have the chance to play with a real soccer ball, that we felt Péter was our best friend. No doubt he led the popularity list in the whole year.

This example illustrates that the selection of the "Best" is objective, it is not illusion and not manipulated.

0.2. Rating and ranking of soccer players

This is a story what I saw in the Hungarian sport newspaper at the end of any season: "Let’s the objective numbers speak!" Objectivity here means that players were ranked on
the (obviously objective) average of their (obviously subjective) grades given by a journalist sent to the game. The story illustrates that ranking based on subjective rating generates the illusion of reality, see Figure 4.

0.3. A not-so beautiful tale: biased ranking

An illustrative example for intentional biased ranking when a voter controls election based on a popular Hungarian tale. A set of animals escaped from their homes and fell into a trap. They became very hungry, and there was not any food around. So the wolf suggested to eat the most worthless one. The wolf assigned himself to be the judge, and counted:

Woolf-boolf o! So great!, fox-box also great, my dear-my beer very great, rabbit-babbit also great, cock-bock also great, my hen-my-ben, you are not great.. and they ate the hen... so on...next time cock-bock became food... (thanks to Judit Zerkowitz for the translation from Hungarian), This is a great example how objectivity is manipulated.

0.4. Is a horse bigger or smaller than a cow?

Ferenc Jánossy, an engineer-turned economist from a legendary Hungarian family (he was the step son of George Lukács, one of the founders of the philosophy of "Western Marxism") wrote a book in Hungarian with the title "The measurability and a new measuring method of economic development level" and it was a revelation that time. Jánossy explained his
The first issue is how qualitatively different objects can be compared quantitatively. Every child knows that an elephant is bigger than a sparrow. They would agree without the least doubt that the cow is smaller than the elephant, but bigger than the sparrow. Ranking animals according to size, they would place the cat between the cow and the sparrow without any hesitation. But suddenly the child is faced by the problem of the horse. Where should the horse go? Is it bigger or smaller than the cow? When comparing objects of different characteristics, ranking is no longer so simple because taking into consideration various features may lead to various ranking results. (The horse is taller, yet shorter than the cow.).."

This is an example to gives a hint that we may get different ranking by using different criteria.

1. The reality of objectivity

1.1. Comparison, ranking, rating and lists

In this section these four basic concepts are introduced.

Why do we compare ourselves with others? Are we born with the desire of comparing ourselves with others, or we just learn in childhood that we should win a game to demonstrate we are better, stronger etc than the others.

We like comparison (from Muhammad Ali’s famous "I am the greatest" via "The grass is always greener on the other side of the fence". Actually Ali stated even more: 'I’m not the
greatest. I’m the double greatest. Not only do I knock ’em out, I pick the round. I’m the boldest, the prettiest, the most superior, most scientific, most skillfullest fighter in the ring today."

The idea behind "The grass is always greener" goes back to the poet Ovid (43 BC - 17 or 18 AD). In his "Art of Love" he wrote, "The harvest is always richer in another man’s field". There are other proverbs with the same sentiment: "The apples on the other side of the wall are the sweetest", "Our neighbor’s hen seems a goose", and "Your pot broken seems better than my whole one". These all have the idea of others having it better off, even if it’s not true.

**Ranking**, is a formal procedure to make relationship between a set of items based on some criterion. So, we can state for any two items, the first is either 'ranked higher than', 'ranked lower than' or 'ranked equal to' the second. Continuing this procedure a ranked list is obtained. However, **rating** assigns a number to each item. The chess player’s Elo’s rating is a generally accepted. Each players actual strength is characterized by a number. This number is subject of change after knowing the result of any new game, if you win against a higher rated player it matters more than to win (not to speak about loose) against a lower rated player.

Ten Commandments seems to be an unranked list. However, in the rabbinic literature there are different interpretations whether or not some items have higher rank than others. Say, Rabbi Yehudah HaNassi said: Be as scrupulous in observing a minor commandment as a major commandment, because you do not know the value of each commandment; (Pirkei Avot 2:1). (Pirkei Avot is generally translated as Ethics of the Fathers.) Actually the situation is more complicated. In the rabbinical Judaism to refer to the 613 commandments (mitzvah) given in the Torah at biblical Mount Sinai and the seven rabbinic commandments instituted later for a total of 620. "There IS a value to each mitzvah; we just don’t know what it is. A specific mitzvah may be worth dozens of other mitzvot. Only the Master of Opinions knows how the comparison between sins and merits is made; (Rambam, Mishneh Torah, Hilchot Teshuvah 3:1-2). Our obsession with chart rankings, top ten list etc. might be considered as some secular echo of the litanies of faith.

When to use ranking and rating? A ranking question asks you to compare different items directly to one another (e.g., "Please rank each of the following items in order of importance, from the #1 best item through the #10 worst item"). A rating question asks to compare different items using a common scale (e.g., "Please rate each of the following items on a scale of 1 – 10, where 1 is ‘very very bad’ and 10 is ‘excellent’"). Both types of questions have their relevance. Examples will be given for different types of rating scales, such as verbal (say, from poor to excellent, hate - neutral - love), graphic rating scale (pain scale helps to give a self-report in a medical exam room, and numerical (of course grades in school, SAT, etc.) We permanently have the problem of converting subjective qualities into objectively-looking
numbers. I will enclose a postcard my son sent me in his twenties from a vacation in Tunisia. Figure 5. It contained a list of rated items. Actually it was quite informative.

How to rate your pain? Each spring I take some physical therapy for maintain my neck mobility. It is a big help. But I have always difficulties to tell a number to characterize the level of pain. What does it mean that it is zero? How do I describe the efficiency of the therapy? I resonate somewhat with the excellent non-fiction writer Eula Biss, who mentions five types of pain, such as physical, emotional, spiritual, social, and financial, well, and it is also understand what recently a pain management website wrote: "Numbers Don’t Tell the Whole Story, Experts Say Better Pain Assessment Measures Needed". Still, when I say to my therapist Sandi: "well, maybe three", he decodes my tacit message "it could have been much much worse".

As you see Ranking is about a recurring question: how objective is the ranking/rating procedure? Something is objective if it represents the external world without bias and presuppositions, while subjective as resulting from personal preferences. Somehow we combine the two approaches.
1.2. Comparison: "thief of joy" or driving force towards future successes?

We permanently compare ourselves with others. High school class reunions, say, are wonderful opportunities to compare our success in any aspects of life from attractiveness via career and intelligence to marriage. The self-evaluation of our own attitudes, abilities and beliefs is based on comparison with others. This observation turned to be a celebrated theory of social psychology, called social comparison theory published by Leon Festinger in 1954. We don’t necessary like to see that we are over weight compared to our former teammates, but generally (well, I wrote.. generally, so not always...) we have the social skills to control our envy feelings. The quote attributed to former U.S. president Teddy Roosevelt, "Comparison is the thief of joy", still we can’t stop to compare. Social psychologists still analyze our motivation to compare, and in their book "Friend and Foe: When to Cooperate, When to Compete, and How to Succeed at Both" Adam Galinksy a social psychologist from Columbia University) and Maurice Schweitzer (from the Wharton School of Business at the University of Pennsylvania) write that "when it comes to using social comparison to boost your own motivation, here is the key rule to keep in mind: Seek favorable comparisons if you want to feel happier, and seek unfavorable comparisons if you want to push yourself harder." You may not be able to quit your social-comparison habit, but you can learn to make it work for you.

Upward and downward comparison: person compares herself with other who are better/worse than her. There are from literature to pop culture, reflected also in the idiom "Keeping up with the Joneses". Here I add just one example from my own life: "As a young adult I had two close friends, say John and Joe. In the seventies and early eighties people did not necessarily have a car in Budapest. If they had, most likely it was an "Eastern" car, the most common was called Trabant produced in East Germany. It adopted two-stroke engines, what was very obsolete even that time. It was said that two people needs to its construction, one who cuts and one who glues, as it was from plastic. There was a story I remember: A donkey and a Trabant meet the Thuringian Forest. "Hi car!" - greeted the donkey. "Hi donkey! - answered the Trabant. "It is not nice to call me donkey, if I addressed you as a car. You should have called me at least as a horse!" I bought a six year old Trabant in my mid-thirties as my first car. It was not a status symbol, but it had four wheels. John does not have any car (not only he could not afford it as a mathematician, but he had high diopter glasses, could not get driving license). Textbooks suggest that the positive effects of any downward competition is gratitude what I certainly felt. While I don’t believe I felt the textbook’s negative effect (scorn), but I might have experienced some superiority. Joe, who worked for a French company soon got a "Western" car, actually a Renault type. Did I felt any hope or inspiration, the positive effects of upward comparison of the textbooks? Probably my aspiration increased to afford (well, in a distant future) a Western car. As concerns
negative effects, I cannot deny I was envy. Was John unhappy or frustrated? Absolutely not! Relevance is a necessary condition of social comparison, and he was absolutely not interested in having cars!

1.3. Social ranking in animal and human societies

"Rank does not confer privilege or give power. It imposes responsibility." (Peter Drucker)

Groups of animals and humans need a healthy balance between cooperation and competition to ensure evolutionary efficient strategies.

1.3.1. Pecking order

You can make science when you are just ten, as the incredible story of the discovery of pecking order suggests. Thorleif Schjelderup-Ebbe (1894-1976) grew up in a flourishing family in Oslo, Norway. The family spent the summers in a suburb, where their house had a yard of chickens. The family story told that he became terribly interested in chickens, mostly about their social relationship. He made observation and notes how chicken A masters chicken B, and chicken B masters C, so on...and based on these observations he coined the term "pecking order". Pecking order determined the dominance hierarchy within a chicken population. Chickens not only rank themselves, but also accept their place. The ranking prescribes the priority of access to resources, mostly food and mates. If you are a chicken, neither a "top chicken" nor a "bottom chicken", you will accept that the top guy comes first, and will avoid superfluous conflict. When a bottom guy is around your selected mate, he will know that it is your turn.

The men, who discovered how social hierarchy is organized in chickens, was not very successful to navigate in the human hierarchy. As a college student, he was influenced by the first female professor in Norway, Kristine Bonnevie. Since she erroneously believed that an article criticized her was written by Schjelderup-Ebbe, withdrew her support, and he never managed to obtain reputation in his own country. Still, Schjelderup-Ebbe’s concept led to the detailed studies of dominance hierarchy from insects to primates.

1.3.2. Dominance, prestige, hierarchy

Evolutionary mechanisms leading to hierarchies regulated the access to resources, such as food and mates. From a physiological point of view, the mechanisms determining the rank of an individual are very similar in primates and humans. In case of various monkey species, higher testosterone level was measured in higher ranked individuals than in lower level animals. Similar correspondence was found in humans as well: in an experiment, the testosterone level of young male tennis players found to be rising in case of victory, but falling in case of defeat, whereas no change was detectable during training. Ranked list of topics to be discussed:

• Hunting skills resulted in reproduction success
• Two ways to the top: dominance and prestige are distinct yet viable avenues to social rank and influence
• There is a balance between our intention to improve our status and to have a stable status hierarchy.
• Can biochemistry change your rank/status?
• Hormones, stress and ranking
• If you want to be a colonel, be tall!
• Handshake and prestige
• Why higher status implies more extramarital sexual affairs?

1.4. Ranking is fun: Erdős Number

Saffron is the best Indian restaurant at Kalamazoo, MI, and we had a dinner in this spring with close friends there. (If you are from Budapest and live in Southwest Michigan, the best candidate for finding a born American friend, if he has a wife from Prague). As I entered asked Tom: "I see a guy here should be from your math department, there is a car with the plate "Erdos ≠ 1", do you know him? The car is owned by Allen Schwenk, who is among the 512 mathematicians who were coauthors of the prolific legendary Hungarian mathematician Paul Erdős (1913-1996). Allen was Erdős’s coauthor in four papers contributed to graph theory, a field of math which was so popular at Kalamazoo, that Erdős traveled there frequently. Thirty years after the collaboration Allen still spoke with such enthusiasm about Erdős’s influence what you can imagine after seeing his plate.

Erdős published around 1,500 mathematical articles in his lifetime, mostly co-written. He had 512 direct collaborators; (actually the last paper was published in 2015, almost two decades after his death) these are the people with Erdős number 1. The people who have collaborated with them (but not with Erdős himself) have an Erdős number of 2 (around 10000, those who have collaborated with people who have an Erdős number of 2 (but not with Erdős or anyone with an Erdős number of 1) have an Erdős number of 3 (as myself).

In the context of ranking, it is not only a nice story worth to know how mathematicians accept more than semi-seriously Erdős number, as measure of mathematicians nobility, but gives a unique example for the self-organizing mechanism of a wise and democratic community.

1.5. A success story: ranking the web

Google is Google is Google is Google. Its social success is reflected by becoming a verb: to google. It means search for information on the World Wide Web using the search engine Google. The World Wide Web is a collection of web pages connected by links, while
Internet is a system of interconnected computers. The information on the web started to increase dramatically around 1993, so we needed help to find relevant information by navigating quickly and efficiently on the web. So, you give a query, i.e. you google say writing "ranking the web". I got now as an answer a ranked list of more than 500,000 items. Here "ranking the web" is considered as one keyword, so the the first page of the results can be seen as Figure 6.

Figure 6: The first page of Google's answer to the query "Ranking the web". August 28th, 2017

The answer was created by an algorithm. Readers from the humanities, there is no reason to stop reading! An algorithm is nothing else, than a recipe for preparing meals, i.e. a finite list of instructions. Google co-founders Sergy Brin and Larry Page created an algorithm, called PageRank (PR) to rank websites based on their relevance. (I am not sure why it is not called Brin-Page algorithm). Some variation of this algorithm produced the result see above. There were some initial search engines, but Google was much better. The new algorithm was able to answer two questions about each page, in response to each search query. How relevant is the page to a specific query, and how important a relevant page comparing to other relevant pages. Not all citations have the same weight! A link from an important site counts more! (The book "Google’s PageRank and Beyond: The Science of

Now there are a number of companies who measure and ranking the popularity of websites, (Ranking.com, Alexa Internet, comScore, Compete, Quantcastm and Nielsen Holding). Maybe Alexa is the most popular traffic ranking service today. It provides a numerical rank based on the data that they collect. Nobody is surprised that Google leads the popularity list (does it have a soccer ball?), there is some \textbf{rank reversal} on the second place (Facebook versus Youtube) if you use different ranking systems.

While links and content are the most two important factors to determine ranking, but it is now open that Google uses about two-hundred other factors, domain age is one of them. It is fun to understand that ranking on the web is a combination of people’s opinion and mathematical algorithms created by humans.

1.6. Rating chess players: another success story

Arpad Elo (1903-1992) was born in Hungary and moved with his parents to the US when he was ten. While he was a physics professor at Marquette University at Milwaukee, and was also the founder of the United States Chess Federation. He created a rating system to characterize the relative strength of chess players. The stronger player generally beats the weaker one. But not always! A game has an \textit{expected score}, the larger the difference between two players, the smaller the chance the weaker player’s success. If a strong player looses against a player with a very low score, her/his points will be strongly reduced. To avoid math I used the very qualitative terms "strong" and "weak", the Elo system precisely defines these terms. It will be discussed why the Elo system became popular, what is the probability of a chess grandmaster losing a game against an opponent making random moves? The rating system, as it is specified now implies that 100 points difference predicts 64% win (for higher rated) vs 36% (for lower rated). Today (Sept 6th, 2017) the Norwegian world champion Magnus Carlsen leads the list with 2827 points, and Vassily Ivanchuk (Ukrainian chess grandmaster and current World Rapid Chess Champion now in the fall of 2017) who is now #32 has 2727 points. It will be discussed how Elo rating system is used outside ranking chess players etc....

1.7. Yes, math is cool (but don’t close the book!)

\textit{Who’s #1?: The Science of Rating and Ranking} is certainly an excellent book for math people, and there are now workshops on the mathematics of ranking. We leave for the mathematicians to discuss the problem of objective ranking. Objectivity is trying to represent outside world without bias and presuppositions, while subjectivity is resulting from personal cognition or preferences. However, the message form Math is clear: "objectivity is a higher
value, similar to justice: it might be not fully attainable, but it is worth striving for". The game "rock–paper–scissors" goes back to the Han dynasty of ancient China. Can we rank the three objects in terms of their relative strength? Since rock crushes scissors, paper covers rock") and scissors cut paper, the ordering is circular. The game is played between two players, and recognizing non-random behavior in opponents may be exploited to win more frequently than chance suggests. The brief cultural history will tell the Reader how the ancient game went from playground decision-maker to an Internet phenomenon.

Then we move to the world of Reddit, a web content rating and discussing website, self-described by the slogan "The front page of the internet". Its algorithm is open sourced and freely available. Reddit’s hot ranking uses the logarithm function (to read this book you don’t need more math just the ability to discriminate between algorithm and logarithm (for the sake of safety: it wanted to be a joke) to weight the first votes higher than the rest. Generally this applies: The first 10 upvotes have the same weight as the next 100 upvotes which have the same weight as the next 1000 etc…

There is a general observation of that ranking word frequencies and city populations shows some statistical regularities. There are always predecessors, but it is referred as Zipf law after the observation of Harvard linguist George Kingsley Zipf published in 1949 that there exists a proportional relationship between the frequencies of words in texts. Later it was observed in many languages, that the frequency of most common words is proportional to inverse of the rank. For example, the word "the" is the most commonly used word in the English language. The second most common, "of" is used about half as much as the first. The third, "and" is used about a third as much as the first, and so on.

Size of cities in the US (and in many other countries) show the same pattern... and it is not the end... corporation sizes, income rankings and many other ranking items have similar statistics. The understanding and management of these ranking patterns is possible and necessary.

1.8. The "best" and the "most" mania

It is time now to discuss our love to ordered lists. BBC E-cyclopedia defines listmania as "media obsession to categorise anything into lists, be they musical artistes, memorable sporting moments, quotations, words of the year etc etc". A list of reasons are given why our brains and mind love lists. Believe or not (why not?) I spent six minutes to collect the list here starting from [http://edition.cnn.com/](http://edition.cnn.com/) and use at most one click:

- 8 best Istanbul hotels
- 5 ways you’re losing money without even realizing it
- 7 best places to stay in Napa Valley
• 12 amazing hotels perfect for animal lovers
• The best photos from the solar eclipse
• 10 of the best beaches near airports
• 8 tips for surviving long flights
• 4 questions to ask yourself before retiring

Our brain process external information perceived by all of our sensory systems. The incoming information is useful only if we are able to comprehend, and lists help to organize new information. Many of us prepare To-Do lists. It is a prioritized list of all the tasks that we need to carry out generally "soon". So, first we make a list of everything that we have to do, then make a ranked list with the most important tasks at the top of the list, and the least important tasks at the bottom. Actually it is not so simple to prepare a To-Do list, and the question is whether we have some "best" algorithm of constructing one. There are different features of tasks we have to do it, say urgency, expected penalty for postponing, the time to should assign to do the job, etc. You certainly can not postpone to pick up your kid from the kindergarten. If your boss asks you to tell your quick opinion about a situation (maybe in a form of list) at noon, you will decide whether you do it before or after lunch (well, an eager beaver could do instead of lunch). Some people believe that a LONG To-Do list is the proof of their value and indispensability. Not speaking about the sad fact that cemeteries are full with indispensable people, successful people are able to outsource their tasks, as most famously Tom Sawyer did with the whitewashing of the fence.

A list of topics to be discussed:

• A list of reasons why our brains love lists
• Never, ever be #1! (hmm, I was...)
• Al Capone: "Public Enemy No. 1" (Chicago in 1930)
• Listmania: listverse and listicle
• The wisdom of crowds

1.9. The tragedy of being the SECOND best

"Feeling second best is probably the worst feeling in the world." The Filipina American author Melissa de la Cruz wrote "I’m tired of being your best friend. I’m tired of being second best. I won’t settle for that anymore. It’s all or nothing, Schuyler. You have to decide. Him or me."

I can’t help it, I should go back to soccer, discussing the final of the soccer world cup in 1954, when Germany (that time West Germany won 3:2 against Hungary. While the West German football team’s World Cup win was a real turning point in post-war German history.
The aftermath in Hungary is a particular illustration of the effect of a sport event in a poor country for politics.

Children bestseller writer (and attorney; it might be an excellent combination) Rachel Renée Russell in an article in Dork Diaries "When you feel like you’re always second best" kick around the feelings of middle school girls:"I feel like I’m always second best. I’m always the backup friend, the third wheel. When my teachers tell us to get into pairs, I’m always the one left out. All my friends partner up, and I’m left standing there awkwardly. I’m sick of being everyone’s second choice. No matter how hard I try, I’ll never be good enough. Please help me!" RRR is ready with a possible answer "So, what if instead of waiting, you picked someone yourself? What if instead of looking dejected, you plastered a big old grin on your face, walked right up to someone before she could choose someone else, and said, “Want to pair up?!?”"

Not only middle school girls have this problem: "Being second is to be the first of the ones who lose" as the arguably the most influential Formula One driver Ayrton Senna (1960-1994) told.

Abel Kiviat was the 1,500m silver medalist in the 1912 Olympics in Stockholm. He supposed to win when Arnold Jackson "came from nowhere" to beat him by a mere one-tenth of a second. About 70 years later, at age 91, Kiviat admitted in an interview: "I wake up sometimes and say: ‘What the heck happened to me?’ It’s like a nightmare."

The classic studies in psychology on Olympic medalists clearly state that silver medalists tend to be miserable because they’re comparing themselves to the gold medalists; bronze medalists, on the other hand, are comparing their outcome to those who came in fourth and beyond, and so they tend to be more pleased with themselves than the silver medalists — even though the silver-winners technically beat them. The men’s epee individual competition in the Olympic in Rio de Janiero in 2016 is analyzed. I will tell details of the story in the book itself.

2. The illusion and manipulation of objectivity

In the second part of the book the Reader will get examples, stories and analysis of the very fact that ranking procedures may lead to illusion of the objectivity. There are two different reasons why we may deviate from objectivity. As Eeyore told to Pooh: "We can’t all, and some of us don’t. That’s all there is to it." (The Hungarian version is more explicit, here its Google translation to English: "One does not want to, the other can not"). So, sometimes we don’t want to be objective, in other times we don’t have the cognitive ability to do so. To put in another way, biased ranking might be due to our cognitive limits or just simply intentional, as we learned from Woolf-boolf. As Malcolm Gladwell mentioned in
his New Yorker’s article about college ranking: "Who comes out on top, in an any ranking system, is really about who is doing the ranking". Manipulation of objectivity has a huge history, and now people and organizations struggling for reputation elaborate sophisticated techniques to get a better position in the ranking game.

2.1. The Ignorant and the Manipulator: sources of biased ranking

Bertnard Russel, a British philosopher, mathematician and Nobel prize winner actually in literature, said that "One of the painful things about our time is that those who feel certainty are stupid, and those with any imagination and understanding are filled with doubt and indecision." Much earlier, even Confucius stated that "Real knowledge is to know the extent of one’s ignorance". The wisdom of these philosophers was supported by studies of social psychologists Dunning - Kruger, who justified their hypothesis stating that persons of low ability suffer from illusory superiority due to their cognitive bias, as Figure 7 illustrates:

![Dunning-Kruger Effect](image)

**Figure 7:** The nonmonotonous relationship between self-confidence and expertise

In an Op-Ed article *When the World Is Led by a Child* of the New York Times David Brooks writes "He is thus the all-time record-holder of the Dunning-Kruger effect, the phenomenon in which the incompetent person is too incompetent to understand his own incompetence. Trump thought he’d be celebrated for firing James Comey. He thought his press coverage would grow wildly positive once he won the nomination. He is perpetually surprised because reality does not comport with his fantasies."

It is known that competent students underestimate, while incompetent students overestimated their class ranks. I may tell a story from my teaching experience. Since the Dunning-Kruger effect reflects a very important psychological mechanism of biased ranking, it will be discussed in more broader context. Young drivers grossly overestimate their skills
and response times. Literary and movie characters often embody Dunning-Kruger effect, so their ranking ability is biased.

It is a good place to discuss here the term **Rank and Yank**. It describes a process by which a company ranks its employees against each other, makes life changing decisions and actions. Often the firm terminates the employment of the people at the lowest end of the ranking. The pros and cons of applying *forced ranking* is analyzed. While it encourages competition, CEOs have the difficult problem how to avoid unhealthy *dog eat dog* situation.

This part will be completed by analyzing the famous Animal Farm paradox: "All animals are equal, but some animals are more equal than others."

### 2.2. Two stars in the world of ranking: colleges and countries

We will turn here to Campbell’s law: and the illusion of objectivity. Donald Campbell (1916-1996) was a social scientist with an extremely broad interest. Campbell’s law, as it is mentioned now states that "The more any quantitative social indicator is used for social decision-making, the more subject it will be to corruption pressures and the more apt it will be to distort and corrupt the social processes it is intended to monitor." Managers in any area from law enforcement to health care, travel industry to education have to report numbers to characterize the performance of their firm. Campbell and others don’t say that numbers, and quantitative evaluation is bad. The fear of receiving a low ranking affects the managers decision about future action. The very fact that numerical data are susceptible to manipulation or distortion does not suggest to give up the hope of of using these data to improve social programs and institutions. While the increase in high stakes testing leads naturally to an increase in cheating by those being measured by those tests... this is not a sufficient reason to replace these tests by more subjective methods of evaluating student progress.

#### 2.2.1. School and College Rankings

A recurring theme in our complex world whether it is possible to summarize the performance of an organization faithfully with a single score? Schools are complex social organizations that serve a variety of purposes, and measuring their progress toward these goals is obviously tricky. Can we really say that this school is a “B+” and that school down the street is a “D”? Should we? Students, admission offices, college administrators are the big stakeholders of the college ranking game.

Malcolm Gladwell already explained the nuts and bolts of college rankings in a New Yorker article (*The Order of Things. What college rankings really tell us* in 2011). He describes the evolution of the *U.S. News* ranking systems, and the difficulties of being "comprehensive and heterogeneous". (Malcolm’s italic). There are competitive ranking agencies.

"The Times Higher Education World University Rankings are the only global performance
tables that judge research-intensive universities across all their core missions: teaching, research, knowledge transfer and international outlook. We use 13 carefully calibrated performance indicators to provide the most comprehensive and balanced comparisons, trusted by students, academics, university leaders, industry and governments.” Of course, there are out of blue weighting factors. As concerns the large categories, their numerical values were set as:

- Teaching (the learning environment): 30%
- Research (volume, income and reputation): 30%
- Citations (research influence): 30%
- International outlook (staff, students, research): 7.5%
- Industry income (knowledge transfer): 2.5%

Emanuelle Tognoli, a clever and charming (well, hope not be attacked as sexist) French professor of Complex Systems and Brain Sciences, Florida Atlantic University made a remarkable comment on my blog:

As we develop computational literacy in the decades to come, perhaps we will adopt "personalized rankings (my boldface:PE), just like we do of "personalized medicine": each and everyone will be able to weight the factors (rank=30% teaching + ...) and write their own equations (or have a website write it for them with sliders) to see their unique customized rankings depending on their own priorities. This is in effect what cognition tries to accomplish when selecting a University or buying a new computer the plain old way, with the limits we know inherent in the manipulation of high dimensional state spaces. Then the information source or authority would change its role, it would have to spend more time explaining why the factors matter so that the user can make an informed decision when adjusting the weights. Do you think dear Peter that those multitudinous rankings would be as successful and popular as their rigid counterparts? Would they be more/less useful? How will they affect the users (me trying to find a good University)? Human stakeholders in the ranked entities (those Universities)? And the people who commit resource to set up those rankings (Times Higher Education ranking said Universities)?"

right about in the middle of the pack. Maybe fifth among the ten schools listed. Of course, Penn State doesn’t have a law school.” Those lawyers put Penn State in the middle of the pack, even though every fact they thought they knew about Penn State’s law school was an illusion, because in their minds Penn State is a middle-of-the-pack brand. (Penn State does have a law school today, by the way.) Sound judgments of educational quality have to be based on specific, hard-to-observe features. But reputational ratings are simply inferences from broad, readily observable features of an institution’s identity, such as its history, its prominence in the media, or the elegance of its architecture. They are prejudices."

I think the story might have a positive interpretation. As we see the actual ranking numbers now, Penn State Law Schools (actually they are two of them) have intermediate ranks, the experts’s prejudice correlates very well with the actual value, so we may see their judgment as the **predictive power** of the collective wisdom. Comparison does not have any alternative in the global world of higher education. Self-declaration and self-evaluation do not convince students, peers and other stakeholders anymore. We don’t have a single ideal ranking system. Even at the superficial level there is a dichotomy between excellence in research versus in teaching. However, potential students might be more interested in the quality of their local environment, and an ideal ranking system should evaluate both teaching and research output on a department-by-department level.

In their book *Engines of Anxiety: Academic Rankings, Reputation, and Accountability* Wendy Espeland and Michael Sauder clearly demonstrate that school ranking provides not only a passive mirror, but drives the dynamics of changes. I am just interviewing people (please note, right now I am working on a book proposal) to learn more how rankings change admission decisions, and will tell some stories from the perspective of an admission dean.

### 2.2.2. Ranking of countries

As we all know humankind organized itself to live in geographical units, called countries. Historically, people prefer to belong to a country, and they like to be around people with whom they have lots in common. While there are people, however, who believe the idea of countries is outdated and source of conflicts, still countries survive as means of controlling people, organizing society and managing the distribution of wealth.

There are almost infinite numbers of possibilities to rank countries, and many Readers will agree with me that one of the most important question to answer is how happy a country is. The UN General Assembly initiated in 2011 to measure the happiness of people of the member countries. The measurement is mostly based on a simple task. A significant number of people are asked: ”Please imagine a ladder, with steps numbered from 0 at the bottom to 10 at the top. The top of the ladder represents the best possible life for you and the bottom of the ladder represents the worst possible life for you. On which step of the ladder would you say you personally feel you stand at this time?”
Pay more tax and be happy!

The report issued in 2017 ranked Norway as the happiest country. (The Reader already knows that the phenomenon of pecking order among chickens was discovered in Norway, and the Norwegian Magnus Carlsen has the highest Elo number. The neurobiologists Readers remember well than the (more or less) Norwegian May-Britt Moser and Edvard Moser were awarded by the Nobel Prize in Physiology or Medicine in 2014 for discovering certain types of neurons called grid cells, responsible for spatial information processing. So far so good, but how to measure happiness? It was remarkable to see the reaction of the Prime Minister Erna Solber: "even if we top this statistic now we must continue to prioritise mental healthcare."

Actually there is no statistically significance among the first five countries: Norway - 7.54; Denmark - 7.52; Iceland - 7.50; Switzerland -7.49 and Finland - 7.47. The Central African Republic has the lowest score -2.69.

Like or not, developed mental health-care implies using more antidepressants. Increasing antidepressant utilization and decreasing national suicide rates have been reported recently from the happiest country.

The other side of the story is related to the list of suicide rates. High suicide rates had a history in Hungary provable by statistics going back for more than a century. Between 1960 and 2000 in the majority of years, the suicide rate of Hungary was the highest in the world. I belong to that camp who believes that Hungarians have some problem with their (our) self-identification. We have a arguable isolated language, and the country has never been an emancipated member of the West and lost its Oriental origin. There is some improvement in the last twenty years. Interestingly changes are not directly related to socioeconomic level, Lithuania and South Korea are now among the "leading" countries.

Countries identified as political states are ranked and rated now by a huge number of criteria, adopted by organizations, sometimes related to specific countries (frequently to the US). In the book *Ranking the world. Grading States as a Tool of Global Governance* (CUP, 2016) edited by Alexander Cooley and Jack Snyder, professors of political science at Columbia University, ninety five indices were introduced to evaluate and compare states. They are lumped into categories, such as Business and Economics, Country Risk, Democracy and Governance, Environment, Media and Press, Security Issues and Conflict, Social Welfare, Transparency.

But individual ranking just reflects particular projection of our complex world. There is an ongoing debate about the so-called Easterlin paradox:

- Within a society, rich people tend to be much happier than poor people.
- But, rich societies tend not to be happier than poor societies (or not by much).
- As countries get richer, they do not get happier.
While the paradox is challenged, and may be not always supported by data, it is not bad to say that devote less time to making money, and more to family life and physical and mental health!

**Credit rating agencies: objective algorithms vs subjective conflict of interests**

The three famous credit rating agencies - Fitch, Moody and Standard-and-Poor rank rate countries based on their financial risk.

Some critics of the subjectivity will be shown, how rating organizations are biased. It is (not) difficult to believe that rating agencies perform consulting services, and this is an obvious source of possible bias in ratings. (Remember to woolf-boolf!).

**Corruption index**

Transparency International (TI), a non-governmental organization headquartered in Berlin, systematically monitors corruption defined as "the abuse of entrusted power for private gain" throughout the world. TI has created the “Corruption Perception Index” (CPI) and assigns a score to each countries. while it is difficult to believe that CPI is objective, TI has played an important role in shifting the attitudes of corruption from almost neutral toleration to condemnation.

**2.3. Glimpses from the world of sport ranking**

I am inclining to cancel this subsection... Of course, I know about college football ranking, etc. but nothing new could be added.

**2.4. Publish or perish? Publish!: but where?**

**2.4.1. Rating journals** As everybody knows scientists publish the results of their research in scientific journals. *Philosophical Transaction* is known to be the first journal in English devoted purely to science. The quality of the publications are controlled by the peer review system. Scientific journals, at least in the classical publication model, generally have an Editor-in-Chief, who receives first all submissions. She assigns the manuscript to one Associate Editor of the journal. The Associate Editor identifies generally two appropriate reviewers, who suggest what to do with the manuscript ("accept", "revise", "reject" are the main categories). In the overwhelming majority of cases the reviewers suggestion is accepted.

Scientific papers contain citations of the results of previous research. (As Newton famously said "If I have seen further it is by standing on the shoulders of Giants"). There are many thousands of scientific journals, of course they differ from each other both in their topics and in reputation. Eugene Garfield (1925-2017), a giant in the field of scientific communication and information created a measure to characterize the efficiency of the journals by introducing the concept of **impact factor** defined as an average number of citations to
recent articles published in that journal. Technically the "recent" means the previous two years. The impact factor is used to compare journals on the same field. "Same field" is important, mathematicians and cell biologists have very different citation culture. Researchers are competing for publishing in higher impact journals. Impact factors are considered many times as criterion for tenures, promotion, grant awards. I am just checking the details of a story about the legal debates of the tenure denial of Assistant professor Alex Johnson at University North Dakota based solely on the poor quality of the academic journals in which he published.

Sichuan Agricultural University in Ya’an awarded a group of researchers in the summer of 2017 about 2 million dollars in funding after members got a paper published in the academic journal Cell with the stellar impact factor 30,

Impact factor seems to be now a fading superstar. As it always happens, alternative measure are defined. Any such measure should characterize the prestige of a journal. This prestige depends at least on the combination of two factors. Of course, more citation implies more prestige. Similarly to the PageRank algorithm, Scimago takes into account that citations coming from more important journals provide more prestige.

Remember, Campbell law, and it is so important, I am copying here again: "The more any quantitative social indicator is used for social decision-making, the more subject it will be to corruption pressures and the more apt it will be to distort and corrupt the social processes it is intended to monitor." So, we editors manipulate the prestige measures.

An Editor-in-Chief may write to the Associate Editors something like this:

The specific requirements from the Editorial Board for each of its members are as follows:

• Contribute at least one high-quality paper to this journal per year;
• Review at least one submission per year;
• As a reviewer or editor for other journals in the same field, recommend relevant authors to cite our journal papers in their work;
• Cite at least 5 our journal papers in your own publications each year;
• Make other necessary exposure, publicity and recommendations of our journal.

It is matter of taste, it is a question of personal choice. I will write more details about the opinions which strategies are appropriate and which not? I like the Editorial of the journal Research Policy written by the Ben Martin, a British professor of Science & Technology & Policy Studies at Sussex. My own perspective is close to one of his conclusions: "where the rules are unclear or absent, the only way of determining whether particular editorial behaviour is appropriate or not is to expose it to public scrutiny".

2.4.2. Rating scientists: the objectivity-subjectivity dilemma again  Who is the most influential scientist? Maybe somebody who write many many papers. Well, it is
partially true, but what to do if the papers don’t generate any attention (one reason might be that it was published in a journal with low impact factor). So, we already guess that paper with larger number of citation matters more. But we want to take into account that a given scientist shows a consistent activity over the years. Jorge E. Hirsch’s, an Argentine American professor of physics introduced a measure of scientists activity by combining both numbers of articles published and the numbers of citations of those articles. It is called h-index. So, say, if you have ten papers which have at least ten citations, but you don’t have eleven papers with at least eleven citation you have h-index ten. Of course, ten is an arbitrary number, so a little bit more technically speaking a scientist has h-index equal to H if the top H of his/her N publications from the ranked list have at least H citations each." Of course, as we demonstrate many times in this book, an indicator is constructed, and we should ask the scope and limits of these indicators. How useful are they? Hirsch himself ten years after its introduction evaluates h-index, and I take the liberty to copy a longer comment.

"I think it plays a useful role as an "objective” element in the evaluation and comparison of different scientists, complementing other elements that may be more "subjective" such as "prestige", peers’ opinions, etc, and others that may be less indicative of individual quality, such as the institutions the scientists belong to or the journals in which they publish their work. In the past, it was easier to argue that a scientist was 'excellent’ without much solid evidence. Now, if a scientist with a low h-index is argued to be ‘excellent’ it is legitimate to ask for an explanation for why the h-index is low: there may or there may not be plausible reasons. Conversely, in the past it was easier to ignore scientists having wide and large impact but not a highly visible ‘home run’. I think that considering the h-index should result in better decisions pertaining to hiring and promotion of scientists, granting of awards, election to membership in honorary societies. and allocation of research resources by agencies that have to decide between different competing proposals. As long as this index is well used I think it should contribute positively to the progress of science and help reward those who contribute to such progress more fairly."

2.5. The Top-Ten Illusion

Many research supported the importance of round numbers as we perceive numerical information. Marketing strategists exploits for a long time our bias towards this numbers, and how our perception can be manipulated. We, consumers’ fabricate subjective categories of ranked lists. So, if you are tenth, people might feel that you are closer to the eights than to the eleventh.
2.6. Nobel and Oscar the candidates and the winners

Nobel prize  Ranked list of topics to be discussed:

- Nobel: Nomination and selection process
- Rabindranath Tagore, Sinclair Lewis, Pearl Buck, Bertrand Russell and William Faulkner are some of the authors who were awarded the Nobel Prize in Literature after being nominated in one year only
- The illusion and manipulation of objectivity: Is there any gender bias?
  - yes: Female chemists overlooked for a Nobel (based on a lecture of Magda Hargittai: https://cen.acs.org/articles/95/i36/female-scientists-should-won-Nobel.html
- "Sexism in science: did Watson and Crick really steal Rosalind Franklin’s data?"

Is Oscar racist?  Recent debates about the eventual racism of the Academy Award illustrates that the selection of the "best" reflects the attitude of the society, and Woolf-Boolf is with us.

2.7. You can choose something (somebody) if you know it (her/him): recommendation systems

2.7.1. Algorithms: friends or foes?  You have not made recently any decision without seeing the opinion of the web. As I open Amazon, I see a holiday toy list, with Star Wars Droid Inventor Kit on the top. I consulted Tripadvisor when I returned to Liverpool after decades to find a small hotel near Liverpool John Moores University where I actually talked with the same title that the present book has. I don’t really use Yelp, it might be might my fault. I have my favorite restaurants in Budapest, from Spinoza to Pozsonyi Kisvendéglő. In Manhattan, do you need recommendation? Actually I learned just this summer that some - maybe mostly Italian - restaurants don’t take cash only to save credit card transactions. Match.com leads the dating websites, and Jdates is fifteenths now. (You will not believe it, but it is true. Just I wrote one more paragraph, and had to return to here since a this moment TripAdvisor sent an email with the Subject: The United States’ #1 restaurant announced! I don’t tell you who is #1, but show a picture Fig. 8).

I am teaching a class this winter about the Complexity of Ranking, and plan to discuss with my students their experience with Netflix, so I suppose to collect nice stories, but I don’t know now the details. What we know already now of course that "Netflix developed and maintains an extensive personalized video-recommendation system based on ratings and reviews by its customers".

Recommendation systems use algorithms, so we do what the algorithms dictate us. The modern recommendation systems combine several strategies, by answering such kinds of
Figure 8: Fine-dining lover New Yorkers might identify the restaurant

questions:

- Show me stuffs what *my friends like* (collaborative filtering)
- Show me stuffs what *I liked in the past* (content-based filtering)
- Show me stuffs what *fits to my needs*: (knowledge-based recommendation)

A little data science will be explained, but it will not be painful. A lot of data is being collected, not only, but preferentially via social media, about consumption habits, in case of Netflix specifically about movies and TV shows, first to movies are characterized by some important features. How "similar" are two movies can be answered by analyzing the similarities between features. As Xavier Amarian, who served as Research Director for Netflix writes: "We know what you played, searched for, or rated, as well as the time, date, and device. We even track user interactions such as browsing or scrolling behavior. All that data is fed into several algorithms, each optimized for a different purpose. In a broad sense, most of our algorithms are based on the assumption that similar viewing patterns represent similar user tastes. We can use the behavior of similar users to infer your preferences." If you know the distances i.e. the dissimilarity between any two items, you can make an ordered list.

**The other side of the story: Netflix addiction** I have to admit that I am not a Netflix subscriber, so I have second-hand information only. "Binge watching" is an action to watch multiple episodes of a television series in rapid succession. While it shows some correlation to depression and loneliness, more or less we understand how our brain forces us to be addict. Episodes of series end with an exciting scene, trigger is pulled, but we don’t know the implications. Such kinds of *clickhangers* activate stress by increasing a stress-related hormone... so you push the button, look the next episode and so on... after several hours binge watching you may have a feeling, oh it was an achievement, so your brain releases more dopamine, a substance related to award, and there is a reinforcement signal creating a self-amplifying loop. So you might spend the whole weekend by looking Netflix.
2.7.2. The music what you like: Cantometrics and the Music Genome Project

As an officer of the International Neural Network Society I went to listen a workshop before my flight left from Anchorage, where the Society had its annual conference in 2017. It was on "deep learning and music". Deep learning is a hype now in the world of machine learning, data science, neural network, computational intelligence etc. I learned that there is "an attempt to analyze the structure of a song so that the system could identify similar songs that a searcher might like". Any music can be represented by a large (several hundreds) "genes". The idea came from the field of genetics, of course. As we know, genes determines traits of an organism. As organisms are closer to each other if they have more common genes, songs with larger overlap among their "genes" are more similar to each other. We already know that recommendations are based on similarities, I will tell some more stories I learned from my students.

2.8. Struggle for reputation

We cannot have thousand friends. Not even thousand closer acquaintances. The British anthropologist Robin Dunbar estimated the number with whom we can form stable social relationship. It is 150, which more precisely means that between hundred and two hundred. When I opened my aboutranking.com and run along my INBOX to decide whom I ask easily "to follow" me ... I was shocked.. their number was 149 (well, fifty of them kindly pushed the button. They are the people who know some of my characteristic features and my actions, so my reputation is based on their perception of my activities. But in a broader sense my reputation is the collective opinion of everybody else, except myself (well, too bad :-)). As it is known, to build reputation needs time. We all know that a single moment is sufficient to destroy a good reputation. Unfortunately, even malignant gossips are sufficient to smash this reputation. Well, but having a good reputation among friends might help, as they may defend you even without your knowing.

In the internet age we have digital reputation. Some of the reputation is expressed by numbers, and the whole book is about discussing the reality, illusion of of objectivity. One of my peer ((one of the 149) has more than forty thousand citation. He does not need any manipulation, he has non-digital and digital reputation. When I asked him to follow my website he wrote back: "Your new project sounds very interesting. I don’t blog, twitter, facebook, etc., but if you want to send along something am happy to comment."

Well, this peer is in my age, but how about the millennials? As I learned from an article in Chronicle of Higher Education published several years ago, Eszter Hargittai (a sociologist than at Northwestern University, now in Zurich; well it happened than I met her in her parents’s house in Buda, when she was about five years old, but I have not met her later, maybe once) studied the on-line skills of millennials. Her results confirmed what many of us
sees in the classrooms, there is an obvious inhomogeneity among the students. It seems to be a correlation between the socioeconomic status of the students and their skill in building their own digital reputation, and there are many students, whose only skill is being able to post on Facebook without thinking how any post form their image. While it 's important to tell students that digital reputation is important, and it is possible to teach how to build either personal or business reputation. I hope that it is true that honesty is an essential part of building your online reputation (as I read in Susan Gunelius’ Forbes article from with the title "10 Ways To Successfully Build Your Online Reputation"), still in 2015 Amazon sued 1,114 people who were paid to publish fake five star reviews for products.

The dark side of a success story: the search engine manipulation effect and its possible impact

Actually a big industry emerged to make websites more visible, and there are SEO (search engine optimization) companies who do the job. Even Reputation Management Companies are ranked. In October 2017. As in the Western movies there are characters with white and black hats (white generally worn by heroes and black hats by villains) there are SEOs who make manipulation with "white hat" on their heads, they are called ethical hackers, and and there are manipulators with "black hat". As always, in democratic societies, first there are rules accepted by the community. Second, some people (organizations etc.) have black hats, and try to evade these rules. Third, we cannot do else just help identify and neutralize the effects of these troublemakers. Here is a warning you may find useful: Black Hat SEO can take you to the top of website ranking in a very short time. But strictly speaking, it is totally illegal. If you don’t want to get penalized and crash your Google ranking forever, it is strongly recommended to avoid black hat SEO.

There are now famous stories how rightwing hate sites managed to associate concepts, and actually Google’s human editors intervened not to suggest that Jews and black people are evil. I am in the process of finding reliable data whether or not it is true that rightwings malignant manipulations significantly outnumber of those coming from the liberal left. Again, PageRank reflects the content of the web, Google is huge resource for all of us. There are serious concerns that search engine manipulation effect (SEME) might impact on the outcomes of elections. In democratic societies people use search engines, a product of a company. Even a search engine is neutral, it might determine the outcomes of many close elections. It is a difficult to answer the question who has the responsibility to control the results. I don’t see better than to trust in the wisdom of crowds.
3. Epilogue: Ranking, rating and everything else. The mystery of the future: how to combine human and computational intelligence?

3.1. Reality, illusion, manipulation

This is what Ranking is. You can like it or not, it is with us. It is not a magic bullet which makes order in the chaos, but it is not the product of some random procedure. Like or not, parents and students will carefully studies the college ranking lists. I think if it will an accepted view that generally it is not a good idea to bring a final decision based on any formal list only, college (and I think many other) ranking systems will serve what it should be: to give some (some!) condensed, often numerical information. But as in the case of the Hungarian sport newspaper, "Let’s the objective numbers speak!"- it is an illusion. My advice to students and parents to make personalized ranking. Nobody can know, just you, what factors are important for you. (As a director of a study abroad program in Budapest, I have heard a debate between a male and a female students: "I prefer to remain in this dorm, which has excellent internet possibilities, even if there are some bugs in the building"-one of them told.). Maybe (maybe!) the algorithms are objective, the data what they evaluate are not. But they are not totally random, and reflects some view. If you don’t like your or your organization’s rank, after five minutes irritation it is a good idea to think whether the ranker is a malignant evil-doer, or... or... maybe there is a chance to improve your performance. I might be too idealistic, but this is my advice. As concerns manipulation, I do believe that in long term nothing else matters than the opinion of your community.

3.2. How (not) to rig an election?

Electoral systems are means of collective decision making, i.e to rank candidates. Sometimes only the winner matters (president, prime minister), in other cases everybody, who is on a ranked list higher than a threshold is "winner" (say, becomes the member of a parliament of a board etc.). We don’t have a single best electoral system, and a legendary economist, Kenneth Arrow published his famous impossibility theorem in 1950 (Nobel prize: 1972), which showed that when voters rank candidates, some failures may occur. There are debates and comparative mathematical analyses about the voting systems. The only thing we know from Churchill (and he also inherited from the past): "Many forms of Government have been tried, and will be tried in this world of sin and woe. No one pretends that democracy is perfect or all-wise. Indeed it has been said that democracy is the worst form of Government except for all those other forms that have been tried from time to time."
3.3. Rank reversals

Several paragraphs earlier I mentioned that algorithms are *maybe* objective. A famous example now known how PageRank gives different results by changing the numerical value of what is called the "damping factor". PageRank is based on an assumption how a web-surfer behaves. For a while the surfer will click to links she is seeing in a certain page, but get bored with the actual page she visits, and then jump to another page randomly (as with directly typing in a new URL rather than following a link on the current page). The original algorithm assumed that the probability of being bored is 0.15, so the numerical value of the damping factor was set as $1 - 0.15 = 0.85$. So, setting the damping factor for other numbers we may get different ranking. The phenomenon is called rank reversal. Rank reversal is a change in the rank ordering depending on some not important, or many times irrelevant factors.

It is reasonable to expect that the ranking of any two candidates, A and B, should be preserved even if one more candidate C enters the race. This is the "rank reversal rule". This rule was infamously violated in the US election in 2000, when Ralph Nader captured a few per cent of the vote in Florida, giving the election to George W. Bush (over Al Gore). As all we know Gore would have won if Nader was not in the race.

3.4. Algorithms humans use and create/control

**Algorithms what we humans use**  Cognitive science is the interdisciplinary study of the mind. Its classical paradigm states or uses as an analogy that the mental activity can be simulated by computational algorithms. While there are debates for decades how good/bad the analogy is, nobody denies that the analogy helps to understand our thinking. Comparison and ranking are indispensable elements of human planning and decision making. We need a two-stage plan. First, we should uncover how our brain implements, say, social comparison. There are initial results in the field called social neuroscience to find out the underlying brain regions and neural mechanisms behind social comparison. Second, I cannot tell anything else, we understand our brain, if we are able to assign our ideas about a neural mechanisms a computational algorithm. If we are able to reproduce previous facts and predict future behavior, we may say: "Aha, I understand it". Okay, maybe it was too much science.

**Who has the last word; the human or the computer?** Computer scientists design ranking algorithms, and of course, computers can process now huge datasets by theses algorithms. As we have seen, we are not always happy with the results, so we might ask whether when and how the results of the a ranking algorithm should be controlled by *content curators*. Classically museums have curators to select artworks for display in a specific exhibition. Whether or not and if yes how ranking produced by soulless algorithms should be controlled,
will be a battlefield in the coming decade.

Cathy O’Neil, a mathematician and blogger, the author of *Weapons on Math Destruction* believes Google would ultimately have to hire human editors. In addition to the "What came first: the chicken or the egg?" we have now a new question: "Who has the last word; the human or the computer?"

**3.5. From ranking to feedback**

It is very important to understand that ranking gives an evaluation of the performance of an agent (person, organization etc.), combining objective and subjective elements. We, agents evaluate this evaluation with our expectation, and we react to get better result next time. So, there is a feedback mechanism, which connects past and future.

My next book will have the title: Feedback: How negative and positive loops create and control nature and society. But this will be an other story.