Rodolphe Héliot
Antoine Zimmermann (Eds.)

5th
Review of
April
Fool's day
Transactions
(RAFT 2010)

The yearly bilingual publication on nonchalant research
La publication bilingue annuelle de la recherche décontractée

Preface

The fifth edition of the Review of April Fool's day Transactions has reached an unsurpassed level of quality. This year, we had to drastically select the papers that were submitted to us. The result is an impressive *four* papers published this year. RAFT is more and more international. Three quarters of the submitted papers were in English, one was written in binary. The topics broaden too: multi-body dynamics, human emotions, numbers and 0101000001100001011101000110000101110100011011110110100101100100. This time, we had the chance to get an excellent paper by 01001000110000111010100101101100011010010110111101110100. We are proud to get support from such an important binary person! We hope you'll enjoy.

La cinquième édition de la Revue des Actes du Premier Avril a atteint un niveau de qualité inégalé. Cette année, nous avons dû sélectionner drastiquement les articles qui nous ont été soumis. Le résultat impressionant contient *quatre* papiers publiés cette année. RAFT is de plus en plus international. Les trois quarts des articles soumis étaient en anglais, l'un d'eux écrit en binaire. Les sujets s'élargissent aussi : la dynamique des corps pluriels, les émotions humaines, les nombres et les 0101000001100001011101000110000101110100011011110110100101100100. Cette fois, nous avons eu la chance de recevoir un excellent article de 01001000110000111010100101101100011010010110111101110100. Nous sommes fiers d'être soutenu par une personne binaire aussi importante ! Nous espérons que vous apprécierez.

1st April 2010

Rodolphe Héliot & Antoine Zimmermann
RAFT Editors

Organization

RAFT'2010 is organised by a committee of meta-persons.

Editors

First Editor: Rodolphe Héliot (CEA-LETI, MINATEC)
Second Editor: Antoine Zimmermann (DERI, Galway, Ireland)

Referees

G. Bordea
R. Héliot
A. Hogan

Sponsoring Institutions

Scientists of America, studies and statistics on the subject you need.
`http://www.scientistsofamerica.com/`

Acme Klein Bottles, 6270 Colby St. Oakland, CA 94618 USA.

Table of Contents

Fifth Review of April Fool's day Transactions

The Implications of Aerial Phonons Regarding Multi-body Dynamics, with Emphasis on Group Applications

Nicole Berdy and Anna Waldman-Brown

MIT Department of Physics
`nberdy@mit.edu, annawb@mit.edu`

Abstract

It has been observed that physicists as a whole fall well outside the normal distribution of aerial phonon-driven applied multibody dynamics, as demonstrated by peer institutions. In such systems, current observations [1] reveal an unprecedented number of chaotic subsystems with a non-Gaussian distribution of desirable harmonics. This study attempts to enlighten the physics community on common modes of response to phononic oscillations; an informed application of the following methodologies would minimize collisions and augment damping coefficients, while maximizing allowable symmetries and producing optimal conditions for coupling.

1 Introduction

In order to address the inability of physicists to fall within the normal distribution of a multibody system driven by aerial phonons, it is vital to comprehend the challenges faced by modern-day physicists in a group space with a high density of aerial phonons. The occurrence of such systems is periodic and almost exclusively time-dependent, brought about by the widely-recognized TGIF phenomenon. [9] A catalyzing effect may also be caused by substances with hydroxyl functional groups. [1]

When placed in this variety of multibody system, the physicist often mistakenly takes relativistic effects into account, leading to collisions and faulty dynamic considerations. [1] Improper metrics are also often used, leading to complex non-linearization and unobservable dynamics. [7] Overexcited potentials may result in energetic collisions, preventing formation of bound states. [1] Closed-form perturbative solutions to the three body problem are nonexistent in experimental trials [1], which renders further exploration of this problem impossible. Additionally, the Heisenberg uncertainty principle hinders oscillatory coordination; although the motion of dynamic physicists can only be considered on a classical scale, it must be acknowledged that such bodies do change state upon observation. [1]

This paper will examine the causes behind dynamic breakdowns [8] with respect to physicists in multibody phononic systems. [1] It will also discuss a systematic methodology that can be applied to dynamic systems to obtain results falling within the normal distribution of proper responses, with respect to other disciplines.

2 Data and Discussion

Current observations reveal a disturbing lack of coordination between phonon-space and physical space, as related to the multibody system. The subjects display an asynchronous response to phononic inputs, due to a lack of well-defined degrees of freedom. The methods employed in this paper utilize a degrees of freedom approach to normalizing physicists' responses.

Data collection is an ongoing endeavor. Further results will be published on this matter at a later time.

3 Degrees of Freedom

The Tollertanzenkraftigkeit equation, below, demonstrates the proper interplay between various degrees of freedom. It can be derived from a combination of the time-dependent Schrodinger equation [10] and Feynman's empirical samba studies. [11]

Optimal dynamic responses maximize the path integral of $G^*(x, p_s))$: this is referred to in the vernacular as "getting your groove on".

$$D_{optimal} = \lim_{x \to \infty} \left(f_s + e^{\Pi_{i=1}^{\infty} \nabla^2 \Psi_i} + i\lambda \frac{dM}{dt} + \oint G^*(x, p_s) \cdot dp_s \right) \tag{1}$$

However, direct evaluation of the Tollertanzenkraftigkeit equation (1) is ill-advised; one must take the Fourier transform of cotemporaneous phonons before extracting relevant frequencies, as shown in figure 1.

Destructive interference occurs when corpuscular oscillations undergo a phase shift with respect to the driving phonons. This phase shift often provokes a detrimental damping effect that may rapidly be propagated throughout the system.

4 The Method

Proper utilization of the Tollertanzenkraftigkeit equation involves applying standardized translational and rotational dynamics to each independent degree of freedom.

Figure 2 illustrates the degrees of freedom available for use in a multibody system driven by aerial phonons. Once the subject becomes comfortable with one degree of freedom, subsequent degrees of freedom may be added in linear combination with the first. It is important to remember that each degree of freedom is independent of all others; while dynamics of the ”hips” and ”knees” must

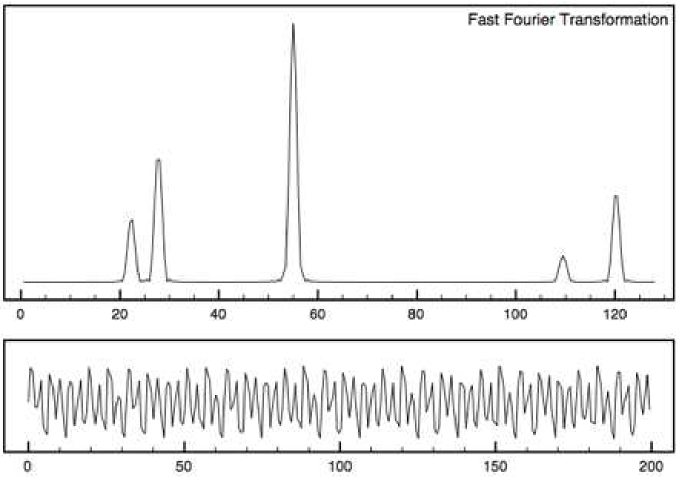


Fig. 1. The Fourier transform of a typical aerial phonon packet. [3]

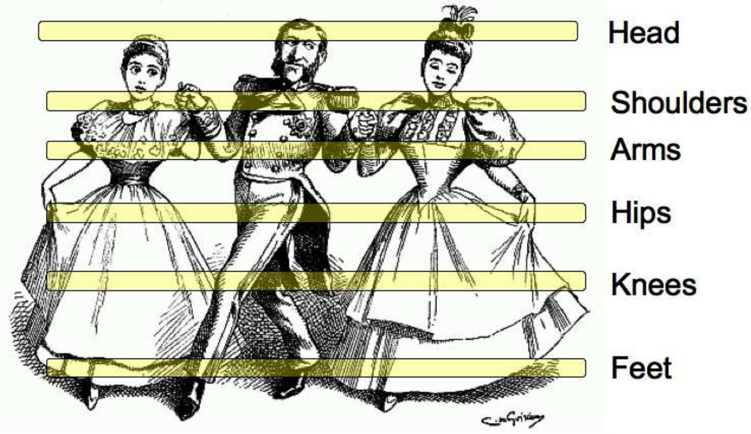


Fig. 2. Every depicted degree of freedom must be taken into account; furthermore, proper application of the Tollertanzenkraftigkeit equation requires a superposition of rotational and translational dynamics.

always undergo compatible oscillations, reasonable diversification of movement is highly advised. A lack of creative energy often results in decreased attractive potentials, and increased danger of social unacceptability.

Given the bound state of each degree of freedom to the body in question, the Tollertanzenkraftigkeit method treats any anticipated coupling as a nontrivial yet second order effect. Furthermore, the breadth of the normal distribution allows for a wide range of allowable phononic responses.

5 Spin Angular Momentum

Confusion arises from unnecessary quantization, the theoretical interpretation of which requires an advanced knowledge of string theory. Phonon-driven systems are limited to the physical dimensions of Minkowski spacetime. To minimize collisions, all neighboring bodies must be accounted for before entering an excited spin state. Quantum tunneling or teleportation is inadvisable due to the relatively trivial deBroglie wavelength of a dynamic physicist:

$$\lambda = \frac{h}{mv} \approx 10^{-36}\text{meters} \tag{2}$$

Figure 3 shows the path of motion assuming a quantum system. As shown by λ, quantum mechanics provides a very poor representation of the phonon-driven system, and thus a classical formulation should be applied. Figure 4 depics the proper path in a two-body subset of the entire multibody system.

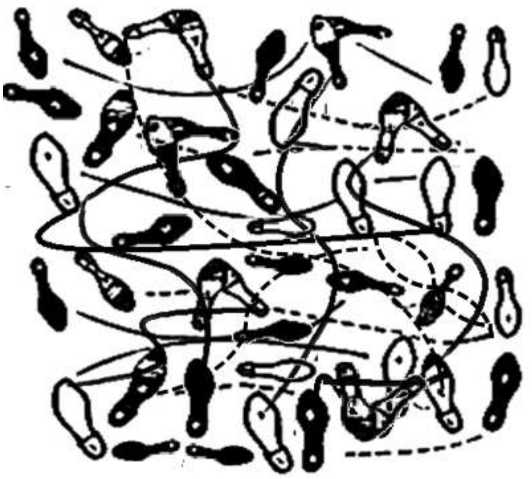


Fig. 3. The hypothetical path of two dynamic semi-closed systems in quantum motion. [2] Note that this path leads to divergence in the Tollertanzenkraftigkeit equation, and has been empirically proven an impossibility [1].

6 The Three-Body Problem

The result of asymmetrical attractive potentials may lead to undesirable semi-closed states. Several well-observed behaviors make non-attractive potentials more likely in multibody systems, and increase the probability of breaking a bound-state. The introduction of excessive hydroxyl functional groups to the system results in deceased inhibitions and a subsequent lack of coordination.

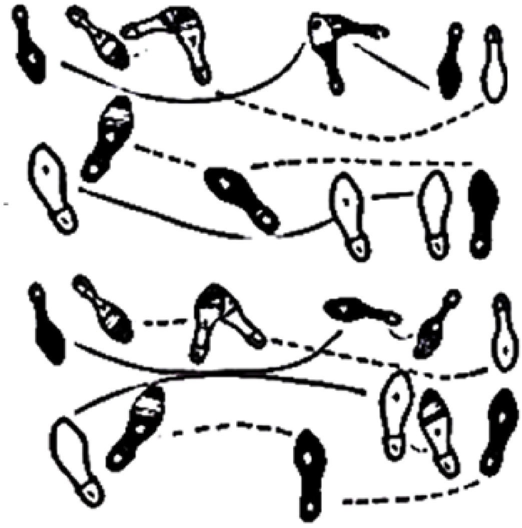


Fig. 4. The path of two dynamic semi-closed systems in classical motion. [2]. Note how much simpler it is in appearance than the quantum path.

However, it has been observed that symmetrical consumption of such fluids often heightens the probability of pair production. [1] It is helpful to depict interactions using Feynman diagrams. [11]

As demonstrated by normalized solutions to the Tollertanzenkraftigkeit equation, particularly high-amplitude forms of oscillation may lead to de-coupling by means of a repulsive potential. Additionally, excessive oscillation can cause nearest-neighbor collisions as shown in figure 5. Extreme oscillations amplify the difficulties involved in creating an optimally packed space, and are often caused by bio-chemical effects produced by the aforementioned substances.

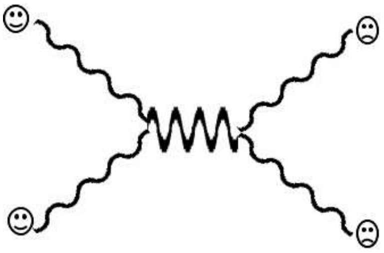


Fig. 5. Excessive oscillation interfering with neighboring bodies. As shown, resultant high-energy collisions lead to scattered states, commonly referred to as "party fouls." Such interactions provide suboptimal packing and are to be avoided.

Under certain conditions, the three-body problem can be avoided; these conditions involve carefully planned dynamical responses to avoid interaction with a third body of higher attractive potential. Such bodies are often derived from less mathematically-rigorous fields of study. Figure 6 depicts how certain suggestive oscillatory behaviors may in fact attract a third body, and break a previously-bound state. Any binding energy is then transfered to the intrusive body upon re-coupling, leaving the former partner in a solitary low-energy state.

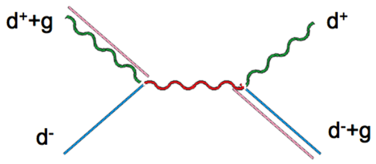


Fig. 6. The interaction of a coupled pair and a higher attractive potential. The exclusion effect produced by decoupling is often referred to as "getting served."

No closed-form solution to the perturbative three-body problem exists. Resulting perturbations can be found in both physical and emotional frames of reference. Given the present lack of a Grand Unified Field Theory of Everything, the authors decline to offer any substantial recommendations on the management of strong nonlinear attractors. Further macroscopic investigation has been ongoing. [12]

7 Conclusion

This research has attempted to explain the common obstacles facing today's dynamic physicists. While quantum mechanics provide a powerful tool for comprehension in academic settings, these findings indicate that excessive mathematical rigor hinders coupled pair production in Hilbert space. The discovery of the Higgs boson may yet contribute to advances in aerial phonon methodologies. [13] Meanwhile, research aims to explore long-term interactions within coupled pairs. [5]

Further investigation aims to extend this topic to other courses of study, such as computer science and electrical engineering. As computer scientists have been known to prefer virtual systems to quotidian Minkowski space, the authors anticipate considerable difficulty in devising appropriate methodologies. Among electrical engineers, it is well known that bodies cannot generate motion without the presence of an external field E. Given an alternating E, movement results in infinite half-circle loops, often as the "cyclotron effect." If E is constant, resulting divergence leads to loss of most the observed particles. The challenges of approaching multi-body dynamics in other fields have yet to be addressed.

Although we may not be able to locate 90% of the mass of the universe [6] or quantify the obfuscation of strong nonlinear attractors [12], dynamic phonon-driven systems can always be broken down pedagogically into a manageable series of step functions; these may be readily comprehended by any body with a background in basic physics. You have no excuse.

8 Acknowledgements

We would like to thank the following people, without whom this work would not be possible: S. Ranjan for getting jiggy with it, S. Westerdale for proposing the Grand Unified Theory of the Macarena, H. Barnard for being a grad student, our invaluable and circumspect editors R. Héliot and A. Zimmerman, and the MIT chapter of SPS for putting up with this tomfoolery.

References

1. As observed empirically throughout the campus of the Massachusetts Institute of Technology on innumerable weekend evenings.
2. Images modified from http://www.bunda.ca/, accessed 9 Feb 2010.
3. Image from http://plot.micw.eu, accessed 9 Feb 2010.
4. Audio available from `http://tinyurl.com/y8ufsnp`, accessed 7 Feb 2010.
5. i.e. “Hey baby, wanna propagate your waveform with me?”
6. Westerdale, S. (2010). Statistical Testing for Dark Matter Detectors. MIT Department of Physics.
7. Kailath, T. (1980). Linear Systems. Prentice-Hall.
8. Isidori, A. (1995). Nonlinear Control Systems. Springer.
9. ”Thank God It’s Friday.”
10. Eisberg, R. and Resnick, R. (1974). Quantum Physics of Atoms, Molecules, Solids, Nuclei, and Particles. John Wiley & Sons, Inc.
11. Feynman, R. (1985). Surely You’re Joking, Mr. Feynman! W W Norton.
12. Shakespeare, W. (1623). Comedies, Histories, and Tragedies. Heminges and Condell.
13. Aaltonen, T. et al. (2010). Combination of Tevatron Searches for the Standard Model Higgs Boson in the W+W- Decay Mode. American Physics Review.

A study of the seldomness of strong human emotions using internet metrology

Sam Jodhunt and Bernie Sormithy and Ewan Thenjabor

ELIOPE France
`[jodhunt,sormithy,thenjabor]@eliope.net`

Abstract

In this paper we expose the results of an analysis of the power of emotions expressed on the internet using textual metrology tools. We show that, to the contrary of vocal interaction, strong emotions are less often expressed. We also point out a few questionning phenomenon about similarities in the measures of different emotions.

1 Introduction

Since the dawn of time human beings have attempted to leave written traces of their emotions. From cave drawings [16, 2, 1, 5] to romantic poems [9, 14, 17], the steps of our lives which involve great emotions are the ones we make sure will not be forgotten by the pace of time. Yet, until the arrival of internet, these testimonies were restricted to intellectuals (painters, writers, sculptors), who were the only ones who would both express and observe these emotions.

With the process of illiteracy elimination, then the development of WYSIWYG[1] website production softwares and finally the invention of interactive forms of textual communications (weblogs, chat, forums), the expression of human emotions entered a new era: everybody can now easily tell the world how he/she feels.

With great power comes great responsibility [10]. The internet gave the ability to people to let their heart speak, but it must now measure the consequences of these new communication freedoms.

This article aims at beginning porting this new burden. The principle of our approach is the measure the emotions expressed on the internet using textual interfaces. In order to do this, we count the occurences of a series of expressions according to the repetitions of substrings of these expressions.

We follow the principle of the seminal work of Zimmermann [18] used for a study of a specific expression: LOL. Zimmermann introduces the notion of "degree of LOL" as the strictly positive number of "O" between two "L" forming

---

[1] What You See Is What You Get

a single word. The precise link between Zimmermann's methodology and ours will be further discussed in section 3.

The rest of this article is organized as follows: section 2 gives a formalization of the preliminary theory needed to understand our work ; section 3 explains the material we used and the methodology we adopted to use it in order to pursue our quest ; section 4 shows the results of our experiments ; section 5 analyzes said results and gives a scientific and irrefutable point of view about the emotions expressed on internet ; section 6 concludes and gives perspectives to our work.

2 Definitions

In this section, we define a few notions to ensure a good understanding of the rest of this article.

2.1 Quests and patterns

As we explain in section 3 we use internet search engines to get the number of occurences of a given expression on the internet. We call *quest* the expression looked for.

When a pattern describes several quests, it is called a *quest pattern*. A pattern describes a set of quests with varying variables. These variables may be

- repeated variables: for instance, pattern ab^*c describes all expressions made of an initial a followed by any number of b (possibly 0) and a final c: ac, abc, $abbc$ or $abbbbbbc$ are a few examples,
- substituted variables: for instance, pattern $a[b|c]d$ describes all expressions made of an initial a followed either by a b or by a c then by a final d: abd and acd are the possibilities,
- infinitely substituted variables: for instance, pattern $a{<}x{>}b$ describes all expressions made of an initial a followed by any number then by a final b: $a1b$, $a42b$, $a-378b$ are a few examples,
- hybrid variables are (infinitely) substituted repeated variables, like $a[b|c]^+d$, describing all expressions made of an initial a, followed by a b or a c then by any number of b or c in any order then by a final d: abd, acd, $abcbccd$ are a few examples.

For a pattern with repeated (possibly substituted) variables, we call *patternation degree* the number of appearances of the substring supposed to be repeated in a pattern. For instance, with pattern ab^*c, we give a few expressions matching the pattern and their patternation degree:

- ac: 0
- abc: 1
- $abbc$: 2
- $abbbbbbbc$: 7
- $abbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbc$: 42

Notice that the repeated variable can be of any length, and not only a single character or number. When there is no ambiguity about the substring to be repeated in pattern p, we note p^n the expression matching p with a patternation degree of n.

2.2 Aura

The central notion of our work is the *aura* of an expression: the aura of expression x is the number of different textual occurences of x on the internet.

We approximate the aura of an expression using the *aura heuristics*, consisting in considering the expression as a quest and counting the occurences of the quest using Google$^{\mathrm{TM}}$.

Performing a Google$^{\mathrm{TM}}$ search for an expression x in order to approximate its aura using the aura heuristics is called the *aura test* of x.

2.3 Emotion curve

We note Ω the set all the internet pages, and Ω_x the subset of Ω containing an expression x. Considering a repeated pattern p and p^i an expression of patternation degree i, Ω_{p^i} is therefore the set of all internet pages containing this expression and the set $\{\Omega_{p^i} | i \in \mathbb{N}\}$ is the set of all pages containing expressions matching p at any degree.

Since we use the aura heuristics to retrieve this set, we only access a subset of pages For an expression x and a search engine s, we note Ω_x^s the subset of pages found by the search engine. We prove that $\Omega_x^s \subseteq \Omega_x$ for any liable s, *i.e.* for any search engine which does not yield fake positive results.

Theorem 1. *Given a liable search engine s and an expression x, the set of pages found by s with quest x is a subset of (possibly equal to) the set of internet pages containing at least one occurence of x: $\Omega_x^s \subseteq \Omega_x$*

Proof. Let $c = |\Omega_x|$ be the number of internet pages containing at least one occurence of x and $c' = |\Omega_x^s|$ the number of internet pages yielded by s for quest x.

We prove the theorem by

1. *showing that, assuming s does not yield pages that are not in Ω_x, $c' \leq c$,*
2. *proving this assumption is true.*

Lemma 1 : if s does not yield pages that are not in Ω_x, $c' \leq c$

With this assumption, c' cannot be greater than c : in the best case, all pages $\omega \in \Omega_x$ are in Ω_x^s and thus $c' = c$.

It is possible that s does not yield all such pages, for instance if a page is on restricted access (intranet, password-protected page) or if s respects `norobots` instructions. Therefore, $\exists \omega \in \Omega_x, \omega \notin \Omega_x^s$.

Thus, $c' \leq c$. QED.

Lemma 2 : s does not yield pages that are not in Ω_x

Considering the assumptions of the theorem, the proof of this lemma is straightforward: we assumed s is liable. QED.

Conclusion

Lemma 1 shows that, under certain assumptions, $c' \leq c$. Lemma 2 proves these assumptions to be correct. Therefore, $c' \leq c$. QED.

We can thus study the aura of a pattern p in function of the patternation degree of the expressions by studying the function $e(i) = |\Omega_{p^i}^{\text{Google}^{\text{TM}}}|$. This function e is our emotion curve.

3 Materials and methods

The experiment implies the use of a bit of highly technological hardware. We used a computer fully equiped with a keyboard and a screen. Other user interfaces such as brain-computer interface, or telepathy were used but, for the sake of clarity, we assume in the rest of this paper that only a keyboard and a screen were used. A human with a brain (we tried unsuccessfully to use zombies) is also necessary in order to interact with the computer. The computer has to be connected to internet in a country allowing an uncensored access to Google$^{\text{TM}}$.

3.1 Experiments

We performed several experiments.

Experiment 1

The human types a selection of Google$^{\text{TM}}$ requests by increasing the number of vowels in the searched keywords. This experiment takes a really long time, and after losing 2 human beings trying to get valid results, we switched to experiment 2 (see below). However this experiment was not a loss of time, in fact we plan to make further research on human resignation while performing top level scientific experiment.

Experiment 2

We use a human to build a script which automatically retrieves Google$^{\text{TM}}$ results of a request and extract the number of results obtained. Since the human used was not very efficient, we have some limitations in our method we express later.

This script is based on a simple grammar allowing different patterns to be tested. In each word below a $^+$ indicates that the letter, or the group of letters, it applies to is present a number of times varying from 1 to infinite. Since infinite is long to reach, the script stops whenever the number of results obtained is below 10.

All auras are stored in order to be able to plot the nice graphs shown at section 4.

3.2 Considered patterns

We consider only repeated patterns, of varying lengths. For the study of the power of emotions, other kinds of patterns did not seem relevant. The reader interested in studies of other patterns may refer to the work of R. Munroe [11, 12]. The tested patterns considered in our experimental protocol are :

- a^+h, e^+h, i^+h, o^+h, u^+h
- ha^+, he^+, hi^+, ho^+, hu^+
- $(ha)^+$, $(he)^+$, $(hi)^+$, $(ho)^+$, $(hu)^+$
- a^+rgh, ar^+gh, ha^+rgh
- l^+ol, $(lo)^+l$, lo^+l, lol^+
- ro^+tfl, r^+otfl
- lma^+o, $lmao^+$
- we^+, wo^+w

With these different patterns it is possible to search for the occurences of words like : weeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeee, wooooooooooooooooooooooooooooooooooow, lololololololololololololololol or the well known aaaaaaaaaaaaaaaaaargh [4].

Notice that the experiment of Zimmermann [18] consists in an aura test for the pattern lo^+l.

4 Results

All plots are included in appendix. All expressions show a decreasing aura in correlation with the increase of their patternation degree. The link between an aura and the patternation degree seems to be an inversed exponential curve.

We also show on figure 1 an assembly of several curves. Such assemblies are interesting to be made for semantically similar patterns.

5 Analysis

Several elements demand a discussion.

First of all, a general analysis gives us this conclusion : the more intensive an emotion is, the less it appears. The general shape of the curve is always the same : high auras for expressions with a small patternation degree, small auras for expression with a high patternation degree.

However some distinct phenomena appears sporadically on some patterns. If we take for instance the pattern hu^+ (figure 11) we clearly see a sudden high aura for the degree 73. This spike of emotion is still mysterious and doesn't seem correlated to any famous quote of any kind but it yet exists.

Another strange phenomenon is the nearly systematic sudden raise of aura after the initial descent, which is not a spike since it holds for the following values. The only tested patterns which do not present this phenomenon are l^+ol (fig. 20), $(lo)^+l$ (fig. 21) and ro^+tfl (fig. 24). If it weren't for these counter-examples, we

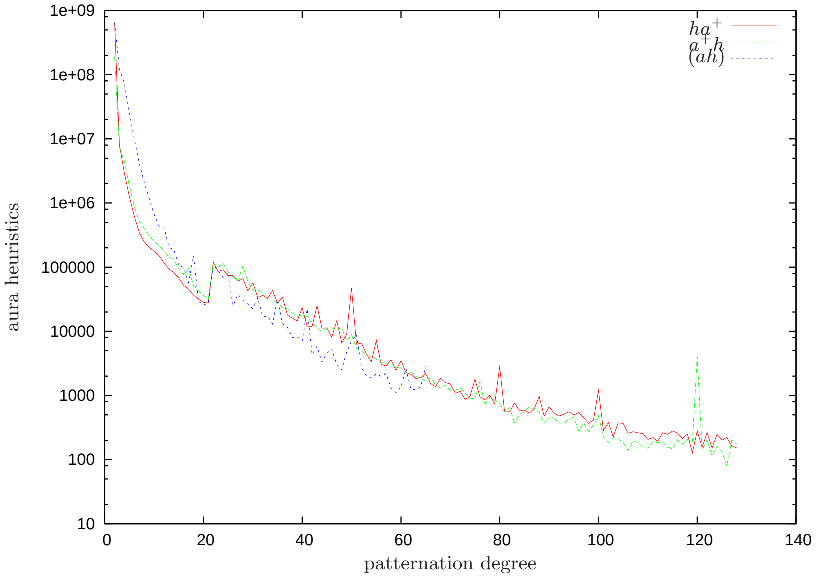


Fig. 1. Aura test results for some awe expressing patterns

would believe these higher values to be a fault of Google^{TM}'s algorithm making it non-reliable. But since there are counter-examples, it cannot be a general fault in the algorithm, hence there is definitely some important truth to be discovered about these suddenly higher values.

Last but not least, it is to be noticed that for every pattern, the emotion curve starts at the upper left corner and finishes at the bottom right corner of the graph, at similar points. We considered both extreme points of each curve and computed the distance between these points and the nearby corner. This allowed us to compute the mean value of this distance and hence the standard deviation. We were astounded to discover that the standard deviation was nearly zero ! We did the same computations on the angles between the corner and the extreme points of the curves and found the same nearly-zero standard deviation ! This means that if one were to transpose every graph so that their frames coincide, the extreme points of all curves would be nearly the same. We do not yet have a satisfying theory as to why this happens.

6 Conclusion

We showed in this paper that our hypothesis about the seldomness of human strong emotions using internet metrology has proven to be correct. All strong emotions, expressed as the repetition of one, or many, letters tend to decrease in function of their intensity ; based on the known fact : "the more the letters, the stronger the emotion".

We are now working with neuropsychiatrists specialized in communication and with linguists in order to design new experiments so as to find out why only strong emotions are expressed through oral communication forms whereas the contrary appears to be true with textual communication forms. With the same colleagues, we intend to study the reason why people tend to abandon words in favour of structured patterns when it comes to express emotions. It could either be a regression away from eloquent expression or a progression towards readable syntax.

We also intend to study the seldomness of absence of emotions, by studying patterns such as me^+h, meh^+, z^+ or $asdf^+$. One could expect an inverse relation between emotional magnitude and lack-of-emotion magnitude, where *e.g.*, z^+ should theoretically appear less often for longer patterns. We also did not test other kinds of interesting patterns, such as OW^+L or O^+WL [6].

Our method shows however some limitations: due to some slacking, the script isn't able to test more complicated pattern as $a^+r^+(gh)^+$ or $w^+t^+f^+$. A further study should correct this problem by using a more complete grammar.

Due to the fact that all aura tests were performed using Google$^{\mathrm{TM}}$, we were not able to measure the emotions of highly paranoid people who stricly refused to be referenced. Also Google$^{\mathrm{TM}}$sometimes correct the research arbitrarily (*e.g.* : with a "Did you mean aaaaaaaaaah ?"). Moreover, Facebook$^{\mathrm{TM}}$ and Twitter$^{\mathrm{TM}}$ seem to be the new emotion theaters so it will be meaningful to do a similar study on status update and tweets. Social networking is probably the future of emotion theory. We also cannot measure emotions on non-textual media, such as was the case of the experiment of [3].

Further work should also be performed over time, but will require more reflexion. Every day, auras are modified, since new occurence of the words appear while some older occurences (but not all) disappear. The use of a timestamp analysis may be able to strictly count the appearance and disappearance of webpages containing the searched pattern. This approach will also allow to identify strong emotion due to particular events : Titanic in cinema, the 9/11, the groundhog day or Michael Jackson's death.

Acknowledgments

We would like to thank the whole team of ELIOPE (Eliope is a Laboratory for Innovation and Observation of Practical Experiments) and especially the director, Gildas Macanou, for their help and advice about this research project.

We also would like to thank our anonymous reviewers for suggesting we cite their papers and for giving us very useful advice to enhance the quality of this paper.

Appendix: the nice plots

We here give all individual plots generated through our experiments.

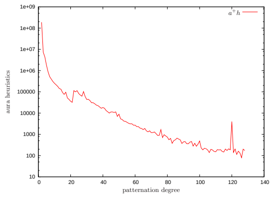


Fig. 2. Aura test results for pattern a^+h

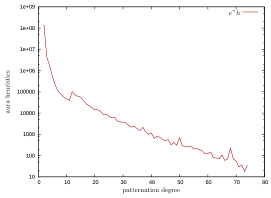


Fig. 3. Aura test results for pattern e^+h

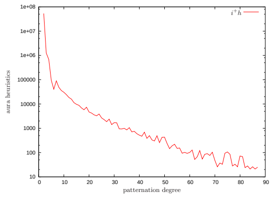


Fig. 4. Aura test results for pattern i^+h

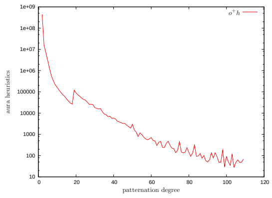


Fig. 5. Aura test results for pattern o^+h

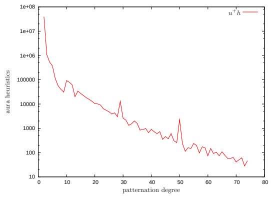


Fig. 6. Aura test results for pattern u^+h

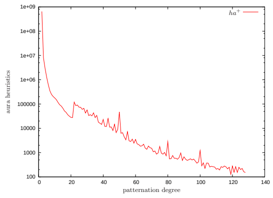


Fig. 7. Aura test results for pattern ha^+

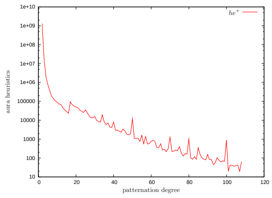


Fig. 8. Aura test results for pattern he^+

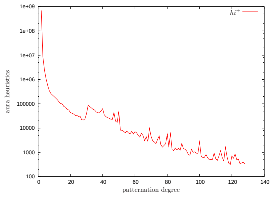


Fig. 9. Aura test results for pattern hi^+

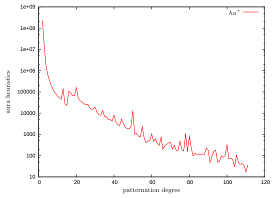


Fig. 10. Aura test results for pattern ho^+

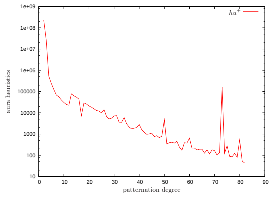


Fig. 11. Aura test results for pattern hu^+

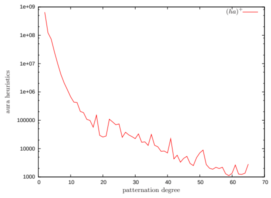


Fig. 12. Aura test results for pattern $(ha)^+$

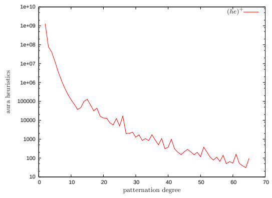


Fig. 13. Aura test results for pattern $(he)^+$

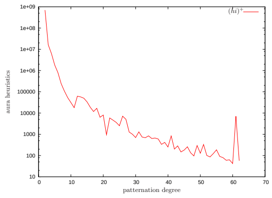


Fig. 14. Aura test results for pattern $(hi)^+$

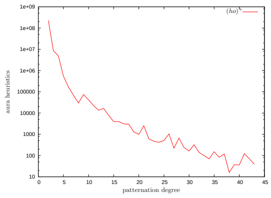


Fig. 15. Aura test results for pattern $(ho)^+$

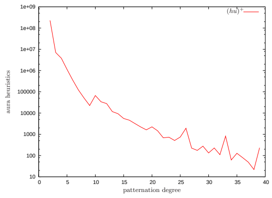


Fig. 16. Aura test results for pattern $(hu)^+$

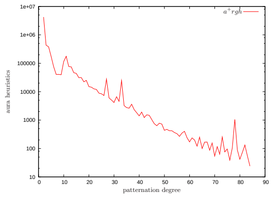


Fig. 17. Aura test results for pattern a^+rgh

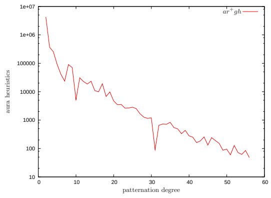


Fig. 18. Aura test results for pattern ar^+gh

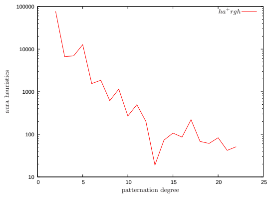


Fig. 19. Aura test results for pattern ha^+rgh

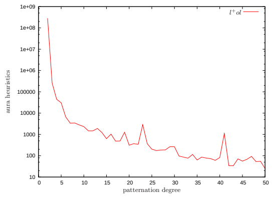


Fig. 20. Aura test results for pattern l^+ol

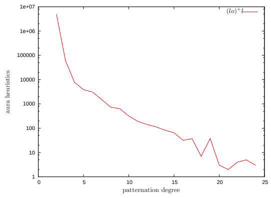


Fig. 21. Aura test results for pattern $(lo)^+l$

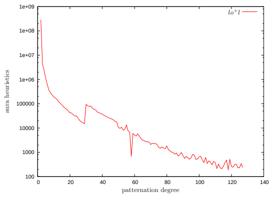


Fig. 22. Aura test results for pattern lo^+l

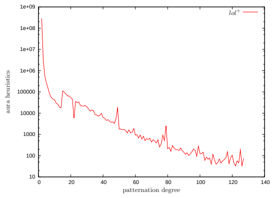


Fig. 23. Aura test results for pattern lol^+

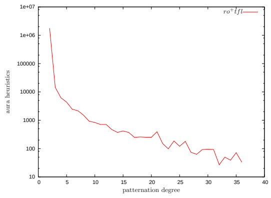


Fig. 24. Aura test results for pattern ro^+tfl

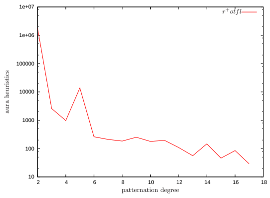


Fig. 25. Aura test results for pattern r^+otfl

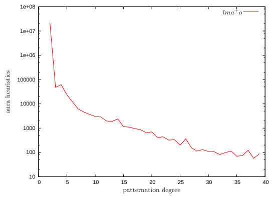


Fig. 26. Aura test results for pattern lma^+o

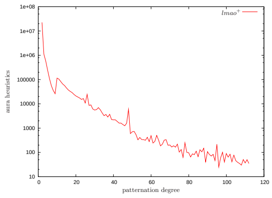


Fig. 27. Aura test results for pattern $lmao^+$

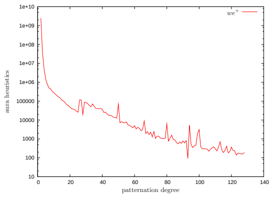


Fig. 28. Aura test results for pattern we^+

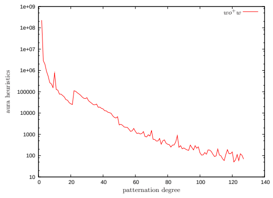


Fig. 29. Aura test results for pattern wo^+w

References

1. P. G. Bahn. *Cave art: a guide to the decorated ice age caves of Europe*. Frances Lincoln Ltd., 2007. ISBN: 0711226555.
2. G. Bataille and S. Kendall. *The cradle of humanity: prehistoric art and culture*. Zone Books, 2005. ISBN: 1890951552.
3. Z. Campbell, S. Kirby, and T. Perman. The emotion meter. `http://cybraphon.com/process/the-emotion-meter/`, 2008.
4. G. Chapman, J. Cleese, E. Idle, T. Gilliam, T. Jones, and M. Palin. *Monty Python and the Holy Grail*. Mark Forstater, John Goldstone and Michael White, 1975.
5. G. Curtis. *The cave painters: probing the mysteries of the world's first artists*. Knopf, 2006. ISBN: 1400043484.
6. A. Hogan, A. Harth, and A. Polleres. Scalable authoritative OWL reasoning for the Web. *International Journal on Semantic Web and Information Systems*, 5(2):49–90, 2009.
7. M. Höpfner, T. Blumenstock, F. Hase, A. Zimmermann, H. Flentie, and S. Fueglistaler. Mountain polar stratospheric cloud measurements by ground based FTIR solar absorption spectroscopy. *Geophysical Research Letters*, 28(11):2189–2192, 2001.
8. I. Jamnicki, J. A. Jimenez, and A. Zimmermman. Swiss/federal-german multipurpose 4600-kW C-C electrics for Renfe. *Rail Engineering International*, 12(1):29–32, 1983.
9. M. H. Liddell. *An introduction to the scientific study of poetry*. Liddell, New-York, 1912.
10. Marvel. *SpiderMan: the movie*. Columbia Pictures Industries, 2002.
11. R. Munroe. <x> girls, <y> cups. *XKCD*, 467, Aug. 2008. `http://xkcd.com/467`.
12. R. Munroe. Numbers. *XKCD*, 715, March 2010. `http://xkcd.com/715`.
13. R. Neubecker, A. Zimmermann, and O. Jakoby. Utilizing nonlinear optical pattern formation for a simple image-processing task. *Applied Physics B: Lasers and Optics*, 76(4):383–392, 2003.
14. C. Pichois and J. Ziegler. *Baudelaire*. H. Hamilton, 1989. ISBN: 0241124581.
15. G. Pisinger and A. Zimmermann. Bivariate least squares approximation with linear constraints. *BIT Numerical Mathematics*, 47(2):427–439, 2007.
16. Homo Sapiens, Homo Sapiens, Homo Sapiens, Homo Sapiens, and Homo Sapiens. The Sixtine Chapel of parietal art. *Lascaux Cave*, -18000.
17. M. Turnell. *Baudelaire: a study of his poetry*. New Directions Pub. Co., 1972.
18. A. Zimmermann. A study of LOLs on the web. *Review of April Fool's Transactions*, pages 12–16, 2007.
19. A. Zimmermann, L. Flores-De-Jacoby, P. Pan, and P. Pan. Gingivitis, plaque accumulation and plaque composition under long-term use of Meridol®. *Journal of Clinical Periodontology*, 20(5):346–351, 1993.
20. A. Zimmermann, C. Michel, and C. Stoller. Long-term effects of negative pions in female mice exposed to whole-body irradiation. *Radiation and Environmental Biophysics*, 16(3):295–298, 1979.
21. A. Zimmermann, T. Schoenberger, J. Saeckl, C. Reeps, H. Wendorff, A. Kuehnl, and H.-H. Eckstein. Eligibility for endovascular technique and results of the surgical approach to popliteal artery aneurysms at a single center. *Annals of Vascular Surgery*, 24(3):342–348, 2010.
22. A. Zimmermann and A. Sutter. β-Nerve growth factor (β NGF) receptors on glial cells. Cell-cell interaction between neurones and Schwann cells in cultures of chick sensory ganglia. *EMBO Journal*, 2(6):879–885, 1983.

Leveraging Non-Lexical Knowledge for the Linked Open Data Web

Denny Vrandečić, Markus Krötzsch, Sebastian Rudolph, Uta Lösch

Institut AIFB - Karlsruhe Institute of Technology
Karlsruhe, Germany
`{firstname.lastname}@kit.edu`

Abstract. The Linked Data paradigm introduces the possibility to share machine-readable data across numerous Web resources, thus enabling applications that are traditionally only possible in corporate intranets to be realized on a Web scale. Due to the creation of an increasing number of publicly available Linked Open Data resources, the Web of Data has become a major application area for semantic technologies. This work introduces a recently published data set LON of non-lexical entities (NLEs) that can be used for numerous tasks of quantitative modeling on the Semantic Web. The size of the published data increases the magnitude of the public Linked Data significantly, yet we show how it can be seamlessly integrated into current application architectures for the Web of Data.

A Introduction

As of today, the Semantic Web has matured to become an essential enabling factor of the ways in which we use the Web in our daily life, work, and business. Given that the principle mechanisms and architecture of the Semantic Web had already been clearly specified in 2001 [2], it may come as a surprise that the implementation of these ideas took almost a decade. Partial successes had, of course, been accomplished earlier – the most prominent example is the problem of ontological modeling which has been solved in 2004 by Smith, Welty, and McGuiness [12] – yet the main breakthrough of semantic technologies on the Web happened only more recently with the appearance of *Linked Open Data* (LOD) [3].

Linked Open Data refers to the practice of publishing structured data on the Web, and interconnecting various such data sources with links that describe their respective relationship. A more rigorous definition is provided in the section “What is Linked Data?” in [3]: “Linked Data is simply about using the Web to create typed links between data from different sources.” Many practitioners, including industry and governmental organizations, have followed this astonishingly simple paradigm for publishing data. A particularly important subset of the published resources has been grouped into the so-called *Linked Data Cloud* that is regularly updated as new resources become available.[1]

In spite of this success, there are still many areas of application for which Linked Data does not provide sufficient coverage. The contribution of this work is to extend the Linked Data Cloud with openly available information that is essential for quantitative modeling and inferencing on the Semantic Web. To this end, we provide public access to a large-scale numerical ontology that has been developed and successfully used at our institution for various years. We argue that this new data set *Linked Open Numbers* lays the foundation for hitherto unrealized applications for semantic technologies on the Web, and opens an avenue for a range of future research topics.

One reason why such important information has not been published on the Semantic Web yet may be the fact that there is a persistent skepticism toward the notion of endowing numbers with an individual identity on the Web. Nonetheless, we have found that there is significant evidence that this approach is justified both on philosophical and on practical grounds. Starting from Plato, it has long been argued that mathematical objects exist in reality and renowned experts, among them Frege [5] and Goedel [6], support this view. In particular, this argument applies to mathematical entities as foundational as numbers. The least doubt about an independent existence is left about the positive integers; according to Leopold Kronecker, “God made the integers; all else is the work of man” [1]. In the light of this overwhelming evidence, the today’s Semantic Web practice of expressing numbers as literals seems highly inappropriate at best. Following [8], “URI references are used for naming all kinds of things in RDF.” Not providing URIs for numbers therefore constitutes a de-facto denial of their thingness. Therefore, our work of establishing identifiers that do justice to the nature of numbers is a significant first step towards an emancipation of numbers.[2]

Clearly, the resources to store and exhibit information about numbers are limited. This might – at the first glance – lead to the impression that a dataset about the positive integers can never be complete. However, an empirical proof of the infinity of numbers has not been established: in fact, the set of all numbers ever given explicitly turns out to be finite. Moreover, the widely acknowledged school of *ultrafinitism* (see, e.g. [14, 9, 11]) convincingly argues that there are only finitely many positive integers overall. This substantiates the hope that the desirable goal of making the positive integers available to the public in their entirety can be achieved, given adequate support by national and international research funding organizations.

The structure of this paper is as follows. In Section B, we give an overview of the modeling approach and discuss our technical realization. Section C then

---

[1] A machine-readable description (PNG) of the linked data cloud is available online at `http://linkeddata.org/`.

[2] Still, we refrain from supporting the even more radical approach “all numbers are equal”, as this might lead to some counterintuitive mathematical consequences.

explains the significance of our work in the broader context of the Semantic Web, and Section D discusses some initial application scenarios. We provide an outlook and offer our conclusions in Section E. The Linked Open Numbers data set can be publically accessed online at `http://km.aifb.kit.edu/projects/numbers/`.

B Formalizing Non-Lexical Data in RDF

Following the idea of publishing numbers as RDF, we developed an ontology for describing numbers. However, we think that a similar approach would be applicable to formalizing any other kind of non-lexical data. Therefore, in the remainder of this paper we use the term non-lexical entities (NLE) when referring to numbers, thereby reflecting the broader applicability of our approach.

After a thorough investigation of the most important and most needed information concerning non-lexical data, we identified the following requirements for the ontology:

- The integer value of a NLE should be related to its resource.
- NLEs are ordered; this order should be reflected by the formalization. It should therefore be possible to identify the *predecessor* and the *successor* of a given NLE.
- To support one of the most important paradigms of computer science, Divide-and-conquer, the *prime factorization* of each non-lexical resource should be available in the ontology.
- NLEs can either be described by a series of digits or as a word (which is language-dependent). Labels should therefore be available in digits-form and in various languages.
- For reasons of backward-compatibility, Roman literals should be supported by our approach.
- Due to its high usefulness in various domains such as biology, psychology, and music, and due to the high complexity of its computation, the natural logarithm of each non-lexical resource should be available.

These above-defined requirements are the basis for the definition of the *Numbers* ontology. The ontology defines a taxonomy of NLE types: namely, `Number` is a superclass of `Integer` which itself subsumes `NaturalNumber`, the most specific class is `Prime` as subclass of `NaturalNumber`. As the meaning should be obvious to the educated reader, we will not detail here what the semantics of each of the defined classes is.

The properties `lessThan` and `greaterThan` are defined as inverse properties relating two instances of class `Number`. The properties `next` and `previous` define the predecessor and successor relation on the class `Integer`. Additional properties where introduced for defining the prime factors of a number (`prime`) and its logarithm (`log`).

Although the ontology itself is very small (it consists of less than 100 triples), it was rather complex and hard to obtain as a number of difficult design choices had to be made: which types of NLEs should be included in the ontology? Which relations between NLEs are best suited for addressing the requirements? We believe that the formalization we propose is the best possible solution to this modeling task. This was evaluated by conducting a user study. In an expert survey, we asked a number (2) of experienced users of semantic technologies whether they saw any weak spot in the formalization. As this was denied by 100% of the participants in the study, we are confident that no further improvements are possible.

The resulting *Numbers* ontology is published adhering to all relevant Semantic Web standards, and was pedantically checked by every available validator.[3] The website is available `http://km.aifb.kit.edu/projects/numbers/`

We use the following URI scheme (as an example we take the NLE 7):

- `http://km.aifb.kit.edu/projects/numbers/n7` is the identifier for the entity, i.e. the URI identifying the abstract number 7. Since we cannot transport the actual number 7 via HTTP a GET on the URI will return a redirect to a simple, electronically transferable representation of the abstract concept, either the representation using RDF or the representation using HTML (see next two bullet points).
- `http://km.aifb.kit.edu/projects/numbers/web/n7` offers a representation of the number 7 in HTML, which most browsers are able to display for human consumption. Note that the Web page and the abstract resource are not the same and therefore have different identifiers.
- `http://km.aifb.kit.edu/projects/numbers/data/n7` is the document that contains some RDF data about the number 7. It also states the connection between the abstract number 7 and the web site describing it. The RDF resource is not meant for human consumption, but only for the machine. Its machine-understandable syntax allows the data to be repurposed and redisplayed automatically, as witnessed by the number of data browsers that are all linked from the HTML page.

We expect that this URI scheme resolves all ambiguities in this field.

C Impact on the Semantic Web and the Linked Data Cloud

Naturally, a data set of the given size has an immeasurable impact on the Linked Open Data landscape but also on the structure of the Semantic Web as a whole. Since 2007, the former has been investigated and maintained chiefly by the *Linking Open Data project* which propagates linking of existing publicly available datasets. The goal of the initiative is bootstrapping the Web of Data, and participants have identified many available datasets and converted them to Linked Data formats. Combining this approach with the skillful persuasion of stakeholders in the data hosting community, the Linked Data cloud has grown rapidly over the last years: a total of 4.7 billion published triples has been reported in May

---

[3] To the best of our knowledge.

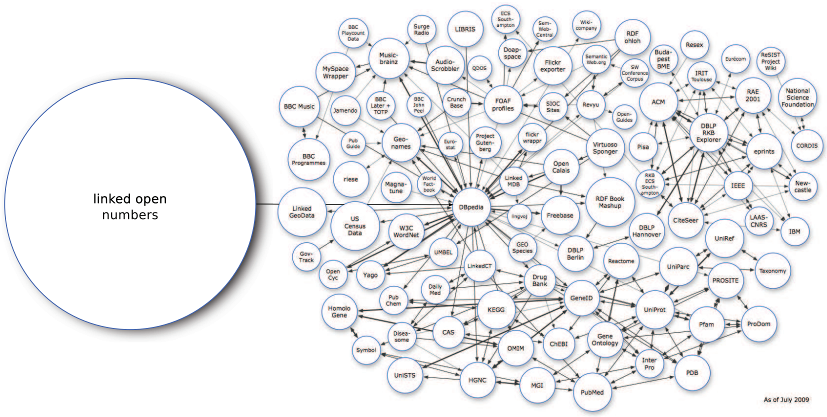


Fig. 1. Linked Open Numbers in the context of the linked open data cloud of July 2009; some sizes are estimated

2009 [3], the total was reported to have increased to 16.0 billion triples in March 2010 [13].

Our newly published RDF data set Linked Open Numbers considerably contributes to the amount of data that is available on the Web. Given the format we use to encode each NLE, a minimum of 14 RDF triples per NLE is stored in our database. Note that there are additional triples for the NLEs linking to Wikipedia, or for having the Roman encoding and the prime factorization attached. As we have encoded 1,000,000,000 NLEs, a conservative estimation of the numbers of triples we have published is 14 billion. We thereby increase the size of the Linked Data Cloud by roughly 87.5%. The significance of this increase can be seen in Fig. 1 which also visualizes the tight integration of Linked Open Numbers into the LOD cloud.

Besides this obvious impact of Linked Open Numbers on the Web of Data, the fundamental relevance of this area of application also suggests a tighter integration into the Semantic Web architecture. Indeed, it is important to ensure maximal interoperability with other semantic technology standards on a conceptual level. Due to restrictions of space, we only outline the most important aspects of this integration. A detailed architectural specification is visualized in Fig. 2 where we show how LON and NLEs are to be integrated into the W3C's Semantic Web technology stack. We point out that the combined LON/NLE module in the stack is not convex since it features two inward corners: this reflects some of the underlying design decisions of our current approach which can be seen as shortcomings in this context. The question whether a non-convex solution is possible without sacrificing practically important characteristics of our solution is left to future research.

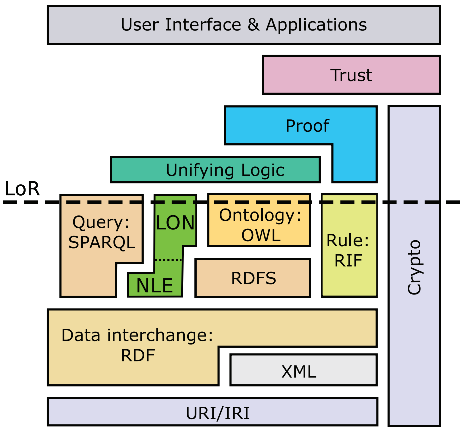


Fig. 2. Linked Open Numbers (LON) and non-lexical entities (NLE) in the context of the Semantic Web architecture where LoR represents the *line of research/realization*

Another question that is closely related to any proposed change in the Semantic Web architecture is whether downwards compatibility to existing technological standards can be ensured. It is well known that around 76% – 92% of working group activity in any W3C driven standardization effort are related to the problem that has traditionally been called *backwards compatibility*. With the advent of two-dimensional architectural diagrams, however, this problem has grown to include issues of sidewards, downwards, and, occasionally, upwards compatibility. Thus, it is important to ensure that any proposed change to the architecture imposes as little burden as possible for the users of existing technologies.

Yet, there are already a great number of Linked Open Data resources that have been created before the availability of LON as a unified resource for NLEs. Re-modeling these data sets based on the new technologies would be a tedious task that may not always be practical.[4] Fortunately, it is possible to use semantic technologies to solve this problem. Namely, the following SPARQL query creates all RDF statements that use the new approach based on the existing data:

```
CONSTRUCT ?s ?p ?nle
WHERE {?s ?p ?literal . ?nle rdf:value ?literal}
```

Using this query, it is possible to create updated linked data sets with only little human intervention. A remaining challenge is that the query can only be executed on an RDF store that contains the data that is to be transformed

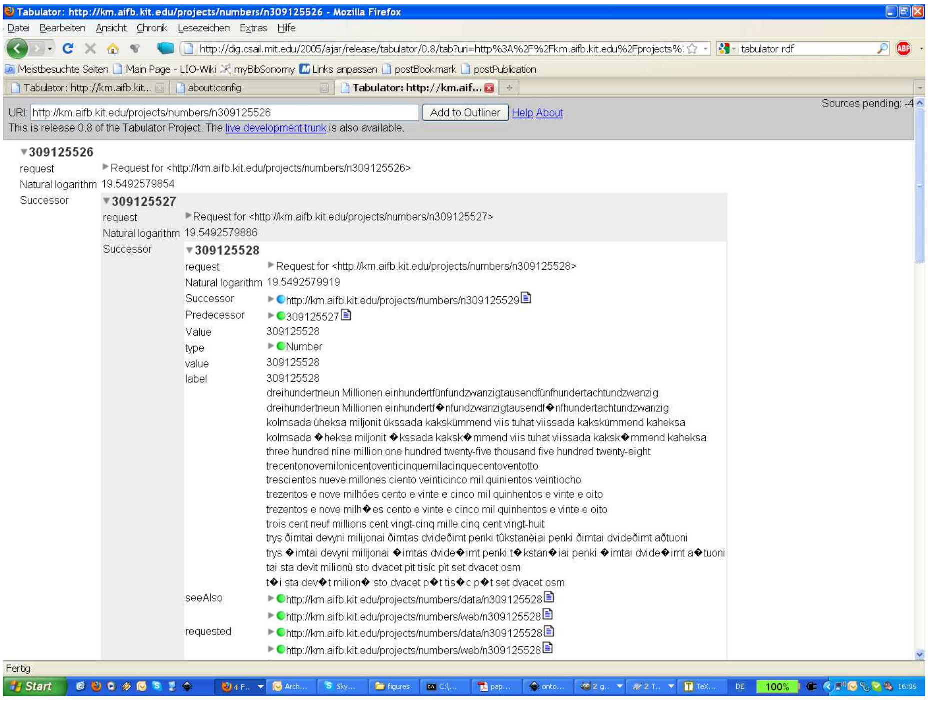
---

[4] Initial experiments on that issue have been conducted with a group of students who were asked to do the according refactoring in Protégé. Unfortunately, experiments had to be terminated without conclusive results when loading times exceeded 16 hours.

together with the complete LON data set. Initial tests with Jena[5] have not been successful, even with all additional indexing disabled.

D Application Scenarios

The added value of the paradigm shift initiated by our work cannot be underestimated. By endowing numbers with an own identity, the linked open data cloud will become treasure trove for a variety of disciplines. By using elaborate data mining techniques, groundbreaking insights about deep mathematical correspondences can be obtained. As an example, using our sample dataset, we were able to discover that there are significantly more odd primes than even ones, and – even more excitingly – a number contains 2 as a prime factor exactly if its successor does not. We conjecture these findings to also hold for numbers not yet contained in our dataset.



URI: http://km.aifb.kit.edu/projects/numbers/n309125526

This is release 0.8 of the Tabulator Project. The live development trunk is also available.

309125526
request ▸ Request for <http://km.aifb.kit.edu/projects/numbers/n309125526>
Natural logarithm 19.5492579854
Successor **309125527**
request ▸ Request for <http://km.aifb.kit.edu/projects/numbers/n309125527>
Natural logarithm 19.5492579886
Successor **309125528**
request ▸ Request for <http://km.aifb.kit.edu/projects/numbers/n309125528>
Natural logarithm 19.5492579919
Successor ▸ http://km.aifb.kit.edu/projects/numbers/n309125529
Predecessor ▸ 309125527
Value 309125528
type ▸ Number
value 309125528
label 309125528
dreihundertneun Millionen einhundertfünfundzwanzigtausendfünfhundertachtundzwanzig
dreihundertneun Millionen einhundertf�nfundzwanzigtausendf�nfhundertachtundzwanzig
kolmsada üheksa miljonit ükssada kakskümmend viis tuhat viissada kakskümmend kaheksa
kolmsada �heksa miljonit �kssada kaksk�mmend viis tuhat viissada kaksk�mmend kaheksa
three hundred nine million one hundred twenty-five thousand five hundred twenty-eight
trecentonovemilonicentoventicinquemilacinquecentoventotto
trescientos nueve millones ciento veinticinco mil quinientos veintiocho
trezentos e nove milhões cento e vinte e cinco mil quinhentos e vinte e oito
trezentos e nove milh�es cento e vinte e cinco mil quinhentos e vinte e oito
trois cent neuf millions cent vingt-cinq mille cinq cent vingt-huit
trys ðimtai devyni milijonai ðimtas dvideðimt penki tûkstanèiai penki ðimtai dvideðimt aðtuoni
trys �imtai devyni milijonai �imtas dvide�imt penki t�kstan�iai penki �imtai dvide�imt a�tuoni
tøi sta devìt milionù sto dvacet pìt tisíc pìt set dvacet osm
t�i sta dev�t milion� sto dvacet p�t tis�c p�t set dvacet osm
seeAlso ▸ http://km.aifb.kit.edu/projects/numbers/data/n309125528
▸ http://km.aifb.kit.edu/projects/numbers/web/n309125528
requested ▸ http://km.aifb.kit.edu/projects/numbers/data/n309125528
▸ http://km.aifb.kit.edu/projects/numbers/web/n309125528

Fig. 3. Browsing the LON in Tabulator

Another prominent application of our data is the use of a Linked Data browser such as Tabulator,[6] as shown in Fig. 3. The figure illustrates a typi-

---

[5] `http://jena.sourceforge.net/`

[6] `http://www.w3.org/2005/ajar/tab`

cal exploration of the data set by a human user, starting from the NLE `http://km.aifb.kit.edu/projects/numbers/n309125526`. The graphical interface of Tabulator provides a concise yet informative overview of the available data, based on which the user can refine the view according to her information need. In the given example, the user has explored entities that are related via the successor property. While this is only a very simple application scenario that does not address a particular use case, we found that many users are enthralled by the richness and depth of the LON data set. This observation hints at the huge potential of such user friendly interfaces to the Web of Data.

E Conclusion and Outlook

In this work, we have introduced a recently published data set Linked Open Numbers (LON) of non-lexical entities (NLEs) that can be used for numerous tasks of quantitative modeling on the Semantic Web. Based on the observation that quantity is an essential quality metric for resources on the Web of Data, it is expected that LON will have a major impact on the development of the Linked Open Data web and its potential applications. Yet, we have been able to show how to seamlessly integrate the LON data into the existing Web of Data, and into the Semantic Web architecture.

Considering the impact of our work on the Semantic Web as a whole, it is interesting to note the relationship to the seminal work of Fensel and van Harmelen [4]. A major insight of this work is articulated as follows: "Given that describing the natural numbers already requires countably many axioms, the Web is quite unlikely to require much less." The visionary range of this statement is certainly astonishing, yet it may also be one of the reasons why a rigorous formalization of NLEs has not been attempted until now. Another important result of this work is that "it would take 10,000 triples just to describe each human, which gives us 100 trillion." Based on this calculation of the ultimate size of the Web of Data, we can conclude that our work contributes about 0.014% of the total amount of data on the Semantic Web. While this may appear to be little, it must be kept in mind that the final magnitude of the Web of Data is not going to be reached in the near future.

In spite of the immediate benefits that LON offers to practitioners already, there are also numerous open challenges that should be addressed in future works on the topic. Maybe most obvious is the current limitation of our data set to 10^9 NLEs. While it can be argued that these entities include many of the most important non-lexical entities that are referenced in applications, they do not cover all entities of practical interest yet.[7] The limitations of our current approach mirror the fundamental trade-off between expressive power and computational demands that is typical to knowledge representation. Future technological advances will certainly allow the border to be increased, but ultimately this endeavor will also require additional funding dedicated to that task.

---

[7] See, e.g., `http://en.wikipedia.org/wiki/9814072356` for a counterexample.

Other perspectives for future research include the extension of the NLE formalism to cover decimal, rational, real, or even complex numbers. Each of these extensions requires the underlying conceptual model to be augmented with suitable constructs. For example, an ontological class for algebraic reals could be practically exploited by implementations since these entities can be stored much more memory-efficient than non-algebraic reals. Moreover, the introduction of probability and vagueness into the data set may have a large practical utility: random numbers are employed in a variety of usage scenarios but as of today are only available in traditional media formats [10].

Another type of future work concerns the export formats in which LON is made available to the public. Currently, only RDF/XML format is supported, but we consider the possibility to provide at least partial exports in formats such as JSON and OWL 2 Manchester Syntax [7]. Another possible candidate is the export of LON using Microformats[8] but it is currently open whether the `value` property of *hCard* is suitable for encoding numerical values of NLEs. An alternative would be to use the *hRecipe* microformat. Creating a new NLE microformat is also an option, but this would contradict the microformat philosophy of having a small canonical set of basic formats that cover a maximal amount of application areas with a minimal amount of vocabulary.

In summary, we consider our work to be a starting point rather than as a conclusive scientific contribution, and we are confident that it will be a suitable beginning for the next decade of Semantic Web research.

F Acknowledgements

This work would not have been possible without the great support of our colleagues: we thank Philipp Sorg for very valuable technical support, Andreas Harth for being pedantic, and Basil Ell and Irene Schick for their support in making HTML look nice.

References

1. Eric Temple Bell. *Men of Mathematics.* Simon and Schuster, New York, 1986.
2. Tim Berners-Lee, James Hendler, and Ora Lassila. The Semantic Web. *Scientific American*, pages 96–101, May 2001.
3. Chris Bizer, Tom Heath, and Tim Berners-Lee. Linked data – The story so far. *International Journal on Semantic Web & Information Systems*, 5:1–22, 2009.
4. Dieter Fensel and Frank van Harmelen. Unifying reasoning and search to web scale. *IEEE Internet Computing*, 11(2):94–96, 2007.
5. Gottlob Frege. *Die Grundlagen der Arithmetik. Eine logisch mathematische Untersuchung über den Begriff der Zahl.* Wilhelm Koebner, Breslau, 1884.
6. Kurt Gödel. What is Cantor's continuum problem? *The American Mathematical Monthly*, 54(9):515–525, 1947.

---

[8] `http://microformats.org`

7. Matthew Horridge and Peter F. Patel-Schneider, editors. *OWL 2 Web Ontology Language: Manchester Syntax*. W3C Working Group Note, 27 October 2009. Available at `http://www.w3.org/TR/owl2-manchester-syntax/`.
8. Graham Klyne and Jeremy J. Carroll, editors. *Resource Description Framework (RDF): Concepts and Abstract Syntax*. W3C Recommendation, 10 February 2004. Available at `http://www.w3.org/TR/rdf-concepts/`.
9. S Lavine. *Understanding the Infinite*. Harvard, 1994.
10. RAND Corporation. *A Million Random Digits with 100,000 Normal Deviates*. American Book Publishers, 2001.
11. P K Rashevsky. On the dogma of the natural numbers. *Russ.Math.Surveys*, 29, 1975.
12. Michael K. Smith, Christopher A. Welty, and Deborah L. McGuinness, editors. *OWL Web Ontology Language Guide*. W3C Recommendation, 10 February 2004. Available at `http://www.w3.org/TR/owl-guide/`.
13. Duc Thanh Tran. Personal communication, March 2010.
14. Petr Vopenka. *Mathematics in the Alternative Set Theory*. Teubner, 1979.

010000010010000001000111011001010110111001100101011100100110000101101100001000000101000001110101011100100111000001101111011100110110010101 0101000001100001011101000110000101110100011011110110100101100100 01000111011001010110111001100101011100100110000101110100011011110111001000111010001000000101010001101000011001010110111101110010011110010010000001100001011011100110010000100000010000010111000001110000011011000110100101100011011000010111010001101001011011110110111001110011

0101001001101111011001000110111101101100011100000110100001100101
01001000110000111010100101101100011010010110111101110100[1]

01000011010001010100000100101101010011000100010101010100010010010010000001001101010010010100111001000001010101000100010101000011

`0111001001101111011001000110111101101100011100000110100001100101001011100110100001100101011011000110100101101111011101000100000001100011011001010110000100101110011001100111001001110010`

Abstract

01000001011100110010000001110100011010000110010101110010011001010010000001101001011100110010000001100001001000000110001101101111011011100111001101110100011000010110111001110100001000000110111001100101011001010110010000100000011010010110111000100000011101000110100001100101001000000111001101100011011010010110010101101110011101000110100101100110011010010110001100100000011000110110111101101101011011010111010101101110011010010111010001111001001011000010000001110111011001010010000001110000011100100110010101110011011001010110111001110100001000000110100101101110001000000111010001101000011010010111001100100000011100000110000101110000011001010111001000100000011000010010000001101110011011110110111000101101011100000110000101110010011101000110100101100011011101010110110001100001011100100010000001100110011010010110011101110101011100100110010100100000011001110110010101101110011001010111-

00100110000101110100011011110111001000101100001000000110001001100001011100110110010101100100001000000110111101101110001000000110000100100000010100110100011000101101010000010100110101010000010001110010000001101101011001010111010001101000011011110110010000101110001000000101010001101000011001010010000001110011011010000110000101110000011001010111001100100000011101110110100001101001011000110110100000100000011000010111001001100101001000000110001001110101011010010110110001110100001000000111011101101001011101000110100000100000011101000110100001101001011100110010000001100001011011000110011101101111011100100110100101110100011010000110110100100000011000010111001001100101001000000110001101101111011011100111011001101001011011100110100101100101011011100111010000100000011001100110111101110010001000000110110101101111011100110111010000100000011000010111000001110000011011000110100101100011011000010111010001101001011011110110111001110011001011110

A 0100100101101110011101000111001001101111011001000111010101100011011101000110100101101111011011110

01010000011001010110111101110000011011000110010100100000011101110111001001101001011101000110100101101110011001110010000001100001011100100111010001101001011000110110110001100101011100110010110000100000011011110110011001110100011001010110111000100000011001010111100001110000011011000110000101101001011011100110100101101110011001110010000001100111011001010110111001100101011100100110000101101100001000000010100001101110011011110110111001110000011000010111001001110100011010010110001101110101011011000110000101110010001010010010000001110011011010010111010001110101011000010111010001101001011011110110111001110011001011000010000001100001011011000111011101100001011110010111001100100000011001100110000101100011011001010010000001100001001000000110110001100001011000110110101100100000011011110110011000100000011001100110100101100111011101010111001001100101011100110010000001110111011010010111010001101000001000000110111001101111001000000111000001100001011100100111010001101001011000110111010101101100011000010111001000100000011100110110100001100001011100000110010101110011001011000010000001101001001011100110010100101110001000000111011101101000011010010110001101101000001000000110000101110010011001010010000**011011100110111101110100**00100000011001010110100101110100011010000110010101110010001000000110000100100000011100000110010101110010011001100110010101100011011101000010000001110011011100010111010101100001011100100110010100101100001000000111010001110010011010010110000101101110011001110110110001100101001011000010000001100011011010010111001001100011011011000110010100100000011011110111001000100000011001010110110001101100011010010111000001110011011001010010111000100000001011100010000000101110010101110110010100100000011001100110111101100011011101010111001100100000001101-

0000110010101110010011001010010000001101111011011100010000001110100011010000110010100100000011010010111001101110011011101010110010100100000011011110110011000100000011001000111001001100001011101110110100101101110011001110010000001100001001000000111000000110010101110010011001100110010101100011011101000010000001101110011011110110111000101101011100000110000101110010011101000110100101100011011101010110110001100100010111001000100000011100110110110101101111011011110111010001101000001000000110011001101001011001110111010101110010011001010010000000101000011011100110111101110100001000000110000100100000001110000001101111011011000111100101100111011011110110111000101001001011000010000001110100011100100111100101101001011011100110011100100000011101000110111100100000011100000011100100110111101110110011010010110010001100101011101110110100101110100011010000001000000111001001100101011100110111010101101100011101000110000110000101110100001000000001110111011011110111010101101100011001000010000001101110011011110111010000100000011011000110111101101111011010110010000001101100011011010110110010100100000011000010110111000100000011001010110110001101100011010010111000000111001101100101001011110

0101011101100101001000000111000000111001001101111011100000011011110111001101100101001000000110000100100000011011010110010101110100011010000110111101100100001000000111010001101111001000000111001101101111011011000111011001100101001000000111010001101000011010010111001100100000011100000011100100110111101100010011011000110010101101101001000000011101000100000011000010110011001110100011001010111001000100000011100100100110010101110110011010010110010101110111011010010110111001100111001000000111001101101111011011010110010100100000011101000110100001100101011011110111001001100101011101000110100101100011011000010110110000100000011100000110111101101001011011100111010001110011001000000101000011100110110010101100011011101000110100101101111011011100010000001001001010010010010100100101100001000000111011101100101001000000111000011100100110111101110000001101111011100110110010100100000011000010110111000100000011010010110110101110000011011000110010101101101011001010110111001110100011000010111010001101001011011110110111000100000010100001110011011001010110001101110100011010010110111101101110001000000001001001010010010100100100101001001011000010000001100001011011100110010000100000011001100110100101101110011000010110110001101100011110010010000001110000011100100110010101110011011001010110111001110100010000001110011011011110110110101100101001000000111001001100101011100110111010101101100011101000111001100100000001010000111001101100101011000110111010001101001011011110110111000100000010010010101011000101001001011100010000001010100011010000110100101110011001000000111011101101001011011000110110000100000011000100110010100100000011001100110111101101100011011000110111101110111011001010110010000100000011000100111100100100000011000010010000001100100011010010111001101100011011101010111001101110011011010010110111101101110001000000101000011100110-

11001010110001101110100011010010110111101101110001000000101011000101 00100101110

B 010101000100100001000101010011110101001001011001

01010111011001010010000001100100011001010110001101101001011001000110010101100100001000000111010001101111001000000111010101110011011001010010000001100001001000000111001101110000001101100011010010110111001100101010010110101100010011000010111001101100101011001000001000000110000101110000001110000001110010011011110110000101100011011010000001000000011101100100000011001100110111101110010001000000110000100100000011000110110111101101101011100000011011000110010101110100011001010010000000111001001100101011101100110100101100101011101110010000001101111011001100010000001110011011100000011011000110100101101110011001010111001100100000011101000110100001100101011011110111001001111001001011000010000001101111011011100110010100100000011000110110000101101110001000000111001001100101011000010110010000100000 [1]0101101100110001010111010010111000100000001010100011010000110010100100000001100001011011000110011101101111011100100110100101110100011010000110110100101100001000000110001101100001011011000110110001100101011001000010000001010011010001100010110101000000101001101010100000100011100100000000101000011101101101000011010010110001101101000000100000011100110111010001100001011011100110010001000111001100100000001100110011011110111001000100000001010011011010000110000101110000001100101001000000010001100111001001100101011001010010000000101101001000000010000010110111001100011011010000110111101110010011010010110111001100111001000000010011010110111101100100011001010110110000100000001010000011000010111010001100001011101000110111101101001011001000010000000100011101100101011011100110010101110010011000010111010001101111011100100010100100101100001000000111011101101111011100100110101101110011001000000011000010111001100100000011001100110111101101011000110110001101111011101110111001100111010

[1] 01010111011001010010000001100110011010010111001001110011011101000100000011001000110010101100110011010010110111001100101001000000011000010010000000111001001100101011000110111010001100001011011100110011100111011110101011011000110000101110010001000000110001001101111011101110101011011100110010001000110100101101110011001110100000011000100110111011111011100000100000001100110011011110111001000100000001110100011010100011001010010000000110011001101001011100111011101010111001001101011100100110010100101100000010000000110000010110111001100100000001000000011000110110101000011011110111001001101001011101000110100001101101001000000011011110111011011001110110010101110010001000000110011001101001011011100110100101110100011001010010000001100100011011110110110101100001011010010110111001110011001011000010000001110111011001010010000001101111011000100111010001100001011010010110111000100000011000100110100101101110011000010111001001111001001000000111001101110100011100100110100101101110011001110111001100101110001000000101010001101000011001010010000001100011011011110110111001110011011101000111001001110101011000110111010001101001011011110110111000100000011011110110011000100000011101000110100001100101001000000111001101100101011100010111010101100101011011100110001101100101001000000110100101110011001000000110000101110011001000000110011001101111011011000110110001101111011101110111001100111010-

01011011100110011100100000**0111000001101111011010010110111001110100**00101100

10 0111010001101000011001010110111000101100001000000111011101100101001000000110001101101111011011010111000001110101011101000110010100100000011101000110100001100101001000000110011001101111011101010111001000100000011011000110010101101110011001110111010001101000011100110010000001100010011001010111010001110111011001010110010101101110001000000111010001101000011001010111001101100101001000000110011001101111011101010111001000100000011000010110111001100011011010000110111101110010011010010110111001100111001000000111000001101111011010010110111001110100011100110010000001100001011011100110010000100000011100000110110001100001011000110110010100100000011000010010000001100110011010010110011001110100011010000010000001100001011011100110001101101000011011110111001001101001011011100110011100100000011100000110111101101001011011100111010000100000011011110110111000100000011101000110100001100101001000000110110001101111011011100110011101100101011100110111010000100000011100110110010101100111011011010110010101101110011101000010110000101100

11 0110011001101001011011100110000101101100011011000111100100101100001000000111011101100101001000000110001001110101011010010110110001100100001000000110000100100000011100110111000001101100011010010110111001100101001000000110001101110101011100100111011001100101001000000110001101110010011011110111001101110011011010010110111001100111001000000111010001101000011001010111001101100101001000000110011001101001011101100110010100100000011000010110111001100011011010000110111101110010011010010110111001100111001000000111000001101111011010010110111001110100011100110010111000101110

C 0100100101001101010100000100110001000101010011010100010101001110010101000100000101010100010010010100111101001110

0101011101100101001000000110100101101101011100000110110001100101011011010110010101101110011101000110010101100100001000000111010001101000011010010111001100100000011000010110110001100111011011110111001001101001011101000110100001101101001000000111011101101001011101000110100000100000010100110110001101101001011011000110000101100010[1]00101100001000000110000100100000011001100111001001100101011001010010000001110011011000110110100101100101011011100111010001101001011001100110100101100011001000000111001101101111011001100111010001110111011000010111001-

---

[1] 0101010001101000011001010010000001010011011000110110100101101100011000010110001000100000010000110110111101101110011100110110111101110010011101000110100101110101011011010011101100100000011101110111011101110111001011100111001101100011011010010110110001100001011000100010111001101111011100100110011100100111

0011001010010000000111000000110000101100011011010110110000101100111011001010010111000100000010101110110010100100000001110010011001010111100000110111101110010011101000010000001110011011000110111001001101001011100000011101000010000001100011011011110110010001100101001000000011001100110111101110010001000000110111101110000001100101011011100010000000110010001101001011100110111010001110010011010010110001001110101011101000110100101101111011011100010111000100000

001011110010111100100000011101010111001101100101011100100010000001100100011001010110011001101001011011100110010101110011001000000110001001101111011101010110111001100100011010010110111001100111001000000110001001101111101111000
01101100011000010111001001100111011001010111010101110010001111010110100101101110011100000011101010111010000101000111000101000000010011001010100000011000010111010001100001011101000110111101101001011001000001000000111011101101001011001000111010001101000000100000001111111110001010000000010011001001010010011 1011
01101000011000010111010101110100011001010111010101110010001111010110100101101110011100000011101010111010000101000111000101000000010011001010100000011000010111010001100001011101000110111101101001011001000001000000110100001100101011010010110011101101000011101000010000000111111111000101000000001001100100101001001110 11

001011110010111100100000011100100110000101101110011001000110111101101101001000000110001101101000011011110110100101100011011001010010000001101111011001100010000000011010000100000011000010110111001100011011010000110111101110010011010010110111001100111001000000111000001101111011010010110111001110100011100 11
0101001001100001011011100110010000100000000111101001000000011100100110000101101110011001000010100000011000100101100001101010010100100111011
0101001001100001011011100110010000101000000110101001010010010000000011110100100000001100000010111000110101001010110011000000010111000110010001010100010100001010010011000010110111001100100001010000011010100101001001011010011000000101110001101010010100100111011
0111100000010000000111101001000000010110110101001001100001011011100110010000101000000110001001010010010101001101100011000010111001001100111011001010111010101110010001011000010000000110110001100001011100100110011101100101011101010111001000101100001000000010100100110000101101110011001000010100000011001000101001001010100110110001100001011100100110011101100101011101010111001000101100001000000011000001011110100111011
011110010010000000011110100100000001011011001100000001011000010000001010010011000010110111001100100001010000001100110010100100101010011010000110000101110101011101000110010101110101011100100010110000100000011010000110000101110101011101000110010101110101011100100010110000100000001010010011000010110111001100100001010000001101000010 1-

00100101010011010000110000101110101011101000110010101110101011100100101110100111011

0010111110010111110010000001100011011011110110110101110000011101010111010001100001011101000110100101101111011011100010000001101111011001100010000000111010001101000011001010010000001100110011010010110011001110100011010000010000001100001011011100110001101101000011011110111001001101001011011100110011100100000011100000110111101101001011011100111010 0
0110011001101111011100100010000001101001001111010011000100111010001101 00
011001000110100101110011011101000010100001101001001010010011110101110011011100010111001001110100001010000010000000010100001111000001010000110110101101111011001000111010101101100011011110010100001101001001011000011010000101001001010110011000100101001001011010111100000101000011010010010100100101001110010111000011000110010001000000010101100100000000101000011110010010100001101101011011101100100011101010110110001101111001010000110100100101100001101000010100100101011001100010010100100101101011110010010100001101001001010010010100111001011100001100011001000100000000101001001110 11
011001010110111001100100
010110110110110100101100011010010110111001100100011001010111100001011101001111010110110101100001011110000010100001100100011010010111001101110100001010010011101 1

00101111100101111100100000011000110111001001100101011000010111010001101001011011111011011100010000001101111011001100010000000110001001100001011100110110010100100000011101100110010101100011011101000110111110111001001110011
01111000011011010110111101110010011001010010000000111101001000000111100000101000011010010110111001100100011001010111100000101001001010100101001001100001011011100110010000101000001101010010100100101011011110000010100001101101011011110110010001110101011011000110111100101000011010010110111001100100011001010111100000101100001101000010100100101011001100010010100100101010001010000011000100101101010100100110000101101110011001000010100000110101001010010010100100111011
011110010110110101101111011100100110010100100000001111010010000001111001001010000110100101101110011001000110010101111000001010010010101001010010011000010110111001100100001010000011010100101001001010110111100100101000011011010110111101100100011101010110110001101111001010000110100101101110011001000110010101111000001011000011010000101001001010110011000100101001001010100010100000110001001011010101001001100001011011100110010000101000001101010010100100101001 00111011
0111100001101110011001010111011100100000001111010010000001011011011110000010100000110001001110100110100101101110011001000110010101-

1110000010100100101100001000000011110000110110101101111011100100110010100101100001000000011110000010100001101001011011100110010001100101011111000001010110011000100111010011011000110010101101110011001110111101000110100000101000011110000010100100101001001011000010000001111000000101000000110001001010010101110100111011

0111100101101110011001010111011100100000001111010010000000101101101111001001010000011000100111010011010010110111001100100011001010111100000101001001011000010000000111100101101101011011110111001001100101001011000010000000111100100101000011010010110111001100100011001010111110000010101100110001001110100110110001100101011011100110011101111010001101000001010000111100100101001001010010010110000100000011110010010100000011000100101001010111101001110 11

0111010000100000001111010010000000110001001110100110110001100101011011100110011101111010001101000000101000011110000110111001100101011101110010100100111011

011001000110010101110010001010000011000100101001001111010011000000111011

0110010001100101011100100010100000110010001010010011110101100100011001010111001000101000001100010010100100111011

0010111100101111001000000111000001100101011100100110100101101111011001000110100101100011001000000110001101110101011000100110100101100011001000000111001101110000011011000110100101101110011001010010010000000110100101101110011101000110010101110010011100000110111101101100011000010111010001101001011011110110111001110

0111100001111000000111101011011000110100101101110011100110111000001100001011000110110010100101000001100010010110001101100011001010110111001100111011110100011010000001010000111100001101110011001010111011100101001001011000011000100110000001100000011000000110000001010010011101 1

0111100001101001001000000011110100100000011010010110111001110100011001010111001001110000000101000011110000111100000101100001000000111010000010110000100000001111000011011100110010101110111001011000010000001110011011100000011011000110100101101110001010000111010000101100001000000111100001101110011001010111011100100000001011000111000001100101011100100110100101101111011001000110100101100011001010010010100100111011

0111100101101001001000000011110100100000011010010110111001110100011001010111001001110000000101000011110000111100000101100001000000111010000010110000100000001111001011011100110010101110111001011000010000001110011011100000011011000110100101101110001010000111010000101100001000000111100101101110011001010111011100100000001011000111000001100101011100100110100101101111011001000110100101100011001010010010100100111011

```
0000000000000000000000011110000
0000000000000000000000110001000
0000000000000000000001100001000
0000000000000000000011000001100
0000000000000000000110000000100
0000000000000000001100000000100
0000000000000000001000000000110
0000000000000000011000000000010
0000000000000000110000000000010
0000000000000001100000000000010
0000000000000001000000000000010
0000000000000011000000000000010
0000000000000110000000000000010
0000000000001100000000000000010
0000000000011000000000000000011
0000000000110000000000000000001
0000000001100000000000000000001
0000000011000000000000000000001
0000000110000000000000000000001
0000011100000000000000000000001
0001110000000000000000000000001
0011000000000000000000000000001
1110000000000000000000000000001
1000000000000000000000000000001
1000000000000000000000000000001
1000000000000000000000000000001
1100000000000000000000000000001
0110000000000000000000000000001
0011000000000000000000000000001
0001100000000000000000000000001
0000110000000000000000000000001
0000011100000000000000000000001
0000000110000000000000000000001
0000000011100000000000000000001
0000000000110000000000000000001
0000000000011100000000000000001
0000000000000110000000000000001
0000000000000011100000000000001
0000000000000000110000000000001
0000000000000000011100000000011
0000000000000000000111000000010
0000000000000000000001110000010
0000000000000000000000011101110
0000000000000000000000000111000
```

Fig. 1. 010001010111100001100001011011010111000001101100011001010010000001101111011001100010000001110011011010000110000101110000011001010010000001100111011010010111011001100101011011100010000001100010011110010010000001110100011010000110010100100000010100110100011000101101010100000101001101010100010001111

D 01010010010001010101001101010101010011000101010001010011

010000010110110001101100001000000110011001101001011001110111010101110010011001010111001100100000011000110110111101101101011100000111010101110100011001010110010000100000011000100111100100100000011011110111010101110010001000000101000001100001011101000110000101110100011011110110100101100100001000000100011101100101011011100110010101110010011000010111010001101111011100100010000001100001011100100110010100100000011101100110010101110010011110010010000001100011011011110110111001110110011010010110111001101001011001010110111001110100001000000110011001101111011100100010000001100001011011000110110000100000011100000111-

01010111001001110000011011110111001101100101011100110010111000100000010101110110010100100000011100110110100001101111011101110010000001101001011011100010000001000110011010010110011100101110001000000011000100100000011000010110111000100000011001010111100001100101011011010111000001101100011001010010111000101110

E 01000100010010010101001101000011010101010101001101010011010010010100111101001110

01010111011001010010000001110000011100100110010101110011011001010110111001110100011001010110010000100000011010000110010101110010011001010010000001100001001000000101000001100001011101000110000101110100011011110110100101100100001000000100011101100101011011100110010101110010011000010111010001101111011100100010000001100010011000010111001101100101011001000010000001101111011011100010000001100001001000000101001101000110001011010100000101001101010100000100011100100000011000010110110001100111011011110111001001101001011101000110100001101101001011000010000001100001011000100110110001100101001000000111010001101111001000000111000001110010011011110111011001101001011001000110010100100000011101110110100101110100011010000010000001110011011011010110000101110010011101000010000001101110011011110110111000101101011100100110010101100111011101010110110001100001011100100010000001110011011010000110000101110000011001010111001100101100001000000111010101110011011001010110011001110101011011000110110000100000011101110110100001100101011011100010000001100100011001010110000101101100011010010110111001100111001000000111011101101001011101000110100000100000011000010010000001100111011001010110111001100101011100100110000101101100001000000110001101100001011100110110010100100000001010000110100101101110011100110111010001100101011000010110010000100000011011110110011000100000011000010010000001110000011000010111001001110100011010010110001101110101011011000110000101110010001000000110011001101001011001110111010101110010011001010010100100101110001000000101010001101000011010010111001100100000011010010110010001100101011000010010000001100011011011110111010101101100011001000010000001100010011001010010000001100101011110000111010001100101011011100110010001100101011001000010000001110100011011110010000001101101011000010110111001111001001000000110111101110100011010000110010101110010001000000111001101101001011011010110100101101100011000010111001000100000011001110110010101101110011001010111001001100001011101000110111101110010011100110010000001110100001000000111010001101000011001010111001001100101001000000110100101110011001000000110000101101100011100110110111100100000011000010110111000100000011010010110110101110000011011110111001001110100011000010110111001110100001000000110111001100101011001010110010000100000011001100110111101110010001000000111010101101110011100110111000001100101011000110110100101100110

01011001100110100101100101011001000010000001110100011100100110100101100001011011100110011101101100011001010111001100101110

F 01000001011000110110101101101110011011110111011101101100011001010110010001100111011001010110110101100101011011100111010001110011

0101010001101000011001010010000001100001011101010111010001101000011011110111001000100000011101110110111101110101011011000110010000100000011011000110100101101011011001010010000001110100011011110010000001110100011010000110000101101110011010110010000001100001011011000110110000100000011100000110010101101111011100000110110001100101001000000111010001101000011000010111010000100000011011010110111101110100011010010111011001100001011101000110010101100100001000000111010001101000011001010111001101100101001000000111011101101111011100100110101101110011001011000010000001100001011011100110010000100000011001010111001101110000011001010110001101101001011000010110110001101100011110010010000001010011001011100010000001000011011010000110000101110010011001010111100101110010011011110110111000100000011001100110111101110010001000000110100001100101011100100010000001101001011011100110100101110100011010010110000101101100001000000110100101101101011100000111010101101100011100110110010100101110

References

1. 01000010011000010111001001110100011001010110110001110011, 010000100110010101100001011101000111010001111001, and 010000100110000101110010011100110110101101111001. *0100000101101110001000000100100101101110011101000111001001101111011001000111010101100011011101000110100101101111011011100010000001110100011011110010000001010011011100000110110001101001011011100110010101110011001000000110011001101111011100100010000001010101011100110110010100100000011010010110111000100000010000110110111101101101011100000111010101110100011001010111001000100000010001110111001001100001011100000110100001101001011000110111001100100000011000010110111001100100001000000100011101100101011011110110110101100101011101000111001001101001011000110010000001001101011011110110010001100101011011000110110001101001011011100110011101100111* 01001101011011110111001001100111011000010110111000100000010010110110000101110101011001100110110101100001011011100010110000100000010011000110111101110011001000000100000101101100011101000110111101110011001011000010000001000011010000010001, 00110001001110010011100000110111.

Author Index