Oxford Dictionary Of Social Work and Social Care and the graphical law

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Abstract

We study the Oxford Dictionary Of Social Work and Social Care. We draw the natural logarithm of the number of entries, normalised, starting with a letter vs the natural logarithm of the rank of the letter, normalised. We conclude that the Dictionary can be characterised by BP(4,$\beta H = 0.01$) i.e. a magnetisation curve for the Bethe-Peierls approximation of the Ising model with four nearest neighbours with $\beta H = 0.01$. β is $\frac{1}{k_B T}$ where, T is temperature, H is external magnetic field and k_B is the tiny Boltzmann constant.

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I. INTRODUCTION

We live in a society. Wherever we go, we quickly find ourselves in a society. Societal care starts from a family, goes up the ladder. Parental work and maternal care, sometimes, joins up to form a large unit called social work and social care. Wars may come and go, calamities may appear and disappear, social work and social care continue. Like the burning flame of life, these two virtuous activities go on unabated towards the future from the primordial past. These have developed with it many forms, many concepts. Herein comes the Oxford Dictionary Of Social Work and Social Care, [1], providing one with a quick look into the academic perspective of this aspect of life, we often go along without noticing.

In this article, we try to correlate this societal aspect with another side of our living existence, magnetic field. We have started considering magnetic field pattern in [2], in the languages we converse with. We have studied there, a set of natural languages, [2] and have found existence of a magnetisation curve under each language. We have termed this phenomenon as graphical law. Then, we moved on to investigate into, [3], dictionaries of five disciplines of knowledge and found existence of a curve magnetisation under each discipline. This was followed by finding of the graphical law behind the bengali language,[4] and the basque language[5]. This was pursued by finding of the graphical law behind the Romanian language, [6], five more disciplines of knowledge, [7], Onsager core of Abor-Miri, Mising languages,[8], Onsager Core of Romanised Bengali language,[9] and the graphical law behind the Little Oxford English Dictionary, [10]respectively.

We describe how a graphical law is hidden within the Oxford Dictionary of Social Work and Social Care in this article. The planning of the paper is as follows. We give an introduction to the standard curves of magnetisation of Ising model in the section II. In the section III, we describe analysis of the entries of the Oxford Dictionary of Social Work and Social Care, [1]. Sections IV, V are Acknowledgement and Bibliography respectively.

II. MAGNETISATION

A. Bragg-Williams approximation

Let us consider a coin. Let us toss it many times. Probability of getting head or, tale is half i.e. we will get head and tale equal number of times. If we attach value one to head, minus one to tale, the average value we obtain, after many tossing is zero. Instead let us consider a one-sided loaded coin, say on the head side. The probability of getting head is more than one half, getting tale is less than one-half. Average value, in this case, after many tossing we obtain is non-zero, the precise number depends on the loading. The loaded coin is like ferromagnet, the unloaded coin is like paramagnet, at zero external magnetic field. Average value we obtain is like magnetisation, loading is like coupling among the spins of the ferromagnetic units. Outcome of single coin toss is random, but average value we get after long sequence of tossing is fixed. This is long-range order. But if we take a small sequence of tossing, say, three consecutive tossing, the average value we obtain is not fixed, can be anything. There is no short-range order.

Let us consider a row of spins, one can imagine them as spears which can be vertically up or, down. Assume there is a long-range order with probability to get a spin up is two third. That would mean when we consider a long sequence of spins, two third of those are with spin up. Moreover, assign with each up spin a value one and a down spin a value minus one. Then total spin we obtain is one third. This value is referred to as the value of long-range order parameter. Now consider a short-range order existing which is identical with the long-range order. That would mean if we pick up any three consecutive spins, two will be up, one down. Bragg-Williams approximation means short-range order is identical with long-range order, applied to a lattice of spins, in general. Row of spins is a lattice of one dimension.

Now let us imagine an arbitrary lattice, with each up spin assigned a value one and a down spin a value minus one, with an unspecified long-range order parameter defined as above by $L = \frac{1}{N}\Sigma_i \sigma_i$, where σ_i is i-th spin, N being total number of spins. L can vary from minus one to one. $N = N_+ + N_-$, where N_+ is the number of up spins, N_- is the number of down spins. $L = \frac{1}{N}(N_+ - N_-)$. As a result, $N_+ = \frac{N}{2}(1+L)$ and $N_- = \frac{N}{2}(1-L)$. Magnetisation or, net magnetic moment , M is $\mu\Sigma_i\sigma_i$ or, $\mu(N_+ - N_-)$ or, $\mu N L$, $M_{max} = \mu N$. $\frac{M}{M_{max}} = L$. $\frac{M}{M_{max}}$ is referred to as reduced magnetisation. Moreover, the Ising Hamiltonian,[11], for the lattice of spins, setting μ to one, is $-\epsilon\Sigma_{n.n}\sigma_i\sigma_j - H\Sigma_i\sigma_i$, where n.n refers to nearest neighbour pairs.

The difference $\triangle E$ of energy if we flip an up spin to down spin is, [12], $2\epsilon\gamma\bar{\sigma} + 2H$, where γ is the number of nearest neighbours of a spin. According to Boltzmann principle, $\frac{N_-}{N_+}$ equals $exp(-\frac{\triangle E}{k_B T})$, [13]. In the Bragg-Williams approximation,[14], $\bar{\sigma} = L$, considered in the thermal average sense. Consequently,

$$ln\frac{1+L}{1-L} = 2\frac{\gamma\epsilon L + H}{k_B T} = 2\frac{L + \frac{H}{\gamma\epsilon}}{\frac{T}{\gamma\epsilon/k_B}} = 2\frac{L+c}{\frac{T}{T_c}} \tag{1}$$

where, $c = \frac{H}{\gamma\epsilon}$, $T_c = \gamma\epsilon/k_B$, [15]. $\frac{T}{T_c}$ is referred to as reduced temperature.
Plot of L vs $\frac{T}{T_c}$ or, reduced magentisation vs. reduced temperature is used as reference curve. In the presence of magnetic field, $c \neq 0$, the curve bulges outward. Bragg-Williams is a Mean Field approximation. This approximation holds when number of neighbours interacting with a site is very large, reducing the importance of local fluctuation or, local order, making the long-range order or, average degree of freedom as the only degree of freedom of the lattice. To have a feeling how this approximation leads to matching between experimental and Ising model prediction one can refer to FIG.12.12 of [12]. W. L. Bragg was a professor of Hans Bethe. Rudlof Peierls was a friend of Hans Bethe. At the suggestion of W. L. Bragg, Rudlof Peierls following Hans Bethe improved the approximation scheme, applying quasi-chemical method.

B. Bethe-peierls approximation in presence of four nearest neighbours, in absence of external magnetic field

In the approximation scheme which is improvement over the Bragg-Williams, [11],[12],[13],[14],[15], due to Bethe-Peierls, [16], reduced magnetisation varies with reduced temperature, for γ neighbours, in absence of external magnetic field, as

$$\frac{ln\frac{\gamma}{\gamma-2}}{ln\frac{factor-1}{factor^{\frac{\gamma-1}{\gamma}} - factor^{\frac{1}{\gamma}}}} = \frac{T}{T_c}; factor = \frac{\frac{M}{M_{max}}+1}{1-\frac{M}{M_{max}}}. \tag{2}$$

$ln\frac{\gamma}{\gamma-2}$ for four nearest neighbours i.e. for $\gamma = 4$ is 0.693. For a snapshot of different kind of magnetisation curves for magnetic materials the reader is urged to give a google search "reduced magnetisation vs reduced temperature curve". In the following, we describe datas generated from the equation(1) and the equation(2) in the table, I, and curves of magnetisation plotted on the basis of those datas. BW stands for reduced temperature in Bragg-Williams approximation, calculated from the equation(1). BP(4) represents reduced temperature in the Bethe-Peierls approximation, for four nearest neighbours, computed from the equation(2). The data set is used to plot fig.1. Empty spaces in the table, I, mean corresponding point pairs were not used for plotting a line.

BW	BW(c=0.01)	BP(4,βH = 0)	reduced magnetisation
0	0	0	1
0.435	0.439	0.563	0.978
0.439	0.443	0.568	0.977
0.491	0.495	0.624	0.961
0.501	0.507	0.630	0.957
0.514	0.519	0.648	0.952
0.559	0.566	0.654	0.931
0.566	0.573	0.7	0.927
0.584	0.590	0.7	0.917
0.601	0.607	0.722	0.907
0.607	0.613	0.729	0.903
0.653	0.661	0.770	0.869
0.659	0.668	0.773	0.865
0.669	0.676	0.784	0.856
0.679	0.688	0.792	0.847
0.701	0.710	0.807	0.828
0.723	0.731	0.828	0.805
0.732	0.743	0.832	0.796
0.756	0.766	0.845	0.772
0.779	0.788	0.864	0.740
0.838	0.853	0.911	0.651
0.850	0.861	0.911	0.628
0.870	0.885	0.923	0.592
0.883	0.895	0.928	0.564
0.899	0.918		0.527
0.904	0.926	0.941	0.513
0.946	0.968	0.965	0.400
0.967	0.998	0.965	0.300
0.987		1	0.200
0.997		1	0.100
1	1	1	0

TABLE I. Reduced magnetisation vs reduced temperature datas for Bragg-Williams approximation, in absence of and in presence of magnetic field, $c = \frac{H}{\gamma\epsilon} = 0.01$, and Bethe-Peierls approximation in absence of magnetic field, for four nearest neighbours .

C. Bethe-peierls approximation in presence of four nearest neighbours, in presence of external magnetic field

In the Bethe-Peierls approximation scheme , [16], reduced magnetisation varies with reduced temperature, for γ neighbours, in presence of external magnetic field, as

$$\frac{ln\frac{\gamma}{\gamma-2}}{ln\frac{factor-1}{e^{\frac{2\beta H}{\gamma}}factor^{\frac{\gamma-1}{\gamma}}-e^{-\frac{2\beta H}{\gamma}}factor^{\frac{1}{\gamma}}}} = \frac{T}{T_c}; factor = \frac{\frac{M}{M_{max}}+1}{1-\frac{M}{M_{max}}}. \tag{3}$$

Derivation of this formula ala [16] is given in the appendix of [7].

$ln\frac{\gamma}{\gamma-2}$ for four nearest neighbours i.e. for $\gamma = 4$ is 0.693. For four neighbours,

$$\frac{0.693}{ln\frac{factor-1}{e^{\frac{2\beta H}{\gamma}}factor^{\frac{\gamma-1}{\gamma}}-e^{-\frac{2\beta H}{\gamma}}factor^{\frac{1}{\gamma}}}} = \frac{T}{T_c}; factor = \frac{\frac{M}{M_{max}}+1}{1-\frac{M}{M_{max}}}. \tag{4}$$

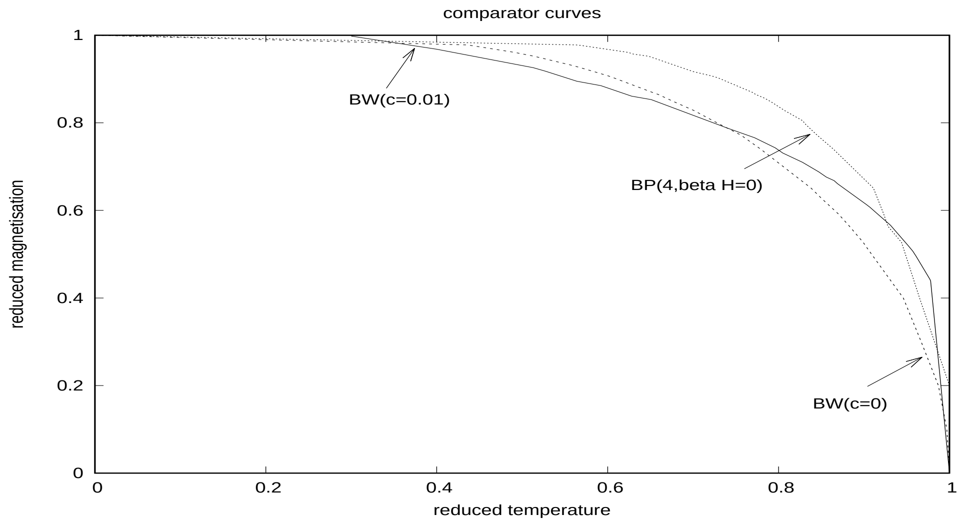

FIG. 1. Reduced magnetisation vs reduced temperature curves for Bragg-Williams approximation, in absence(dark) of and presence(inner in the top) of magnetic field, $c = \frac{H}{\gamma\epsilon} = 0.01$, and Bethe-Peierls approximation in absence of magnetic field, for four nearest neighbours (outer in the top).

In the following, we describe datas in the table, II, generated from the equation(4) and curves of magnetisation plotted on the basis of those datas. BP(m=0.03) stands for reduced temperature in Bethe-Peierls approximation, for four nearest neighbours, in presence of a variable external magnetic field, H, such that $\beta H = 0.06.$ calculated from the equation(4). BP(m=0.025) stands for reduced temperature in Bethe-Peierls approximation, for four nearest neighbours, in presence of a variable external magnetic field, H, such that $\beta H = 0.05.$ calculated from the equation(4). BP(m=0.02) stands for reduced temperature in Bethe-Peierls approximation, for four nearest neighbours, in presence of a variable external magnetic field, H, such that $\beta H = 0.04.$ calculated from the equation(4). BP(m=0.01) stands for reduced temperature in Bethe-Peierls approximation, for four nearest neighbours, in presence of a variable external magnetic field, H, such that $\beta H = 0.02.$ calculated from the equation(4). BP(m=0.005) stands for reduced temperature in Bethe-Peierls approximation, for four nearest neighbours, in presence of a variable external magnetic field, H, such that $\beta H = 0.01.$ calculated from the equation(4). The data set is used to plot fig.2. Empty spaces in the table, II, mean corresponding point pairs were not used for plotting a line.

BP(m=0.03)	BP(m=0.025)	BP(m=0.02)	BP(m=0.01)	BP(m=0.005)	reduced magnetisation
0	0	0	0	0	1
0.583	0.580	0.577	0.572	0.569	0.978
0.587	0.584	0.581	0.575	0.572	0.977
0.647	0.643	0.639	0.632	0.628	0.961
0.657	0.653	0.649	0.641	0.637	0.957
0.671	0.667		0.654	0.650	0.952
	0.716			0.696	0.931
0.723	0.718	0.713	0.702	0.697	0.927
0.743	0.737	0.731	0.720	0.714	0.917
0.762	0.756	0.749	0.737	0.731	0.907
0.770	0.764	0.757	0.745	0.738	0.903
0.816	0.808	0.800	0.785	0.778	0.869
0.821	0.813	0.805	0.789	0.782	0.865
0.832	0.823	0.815	0.799	0.791	0.856
0.841	0.833	0.824	0.807	0.799	0.847
0.863	0.853	0.844	0.826	0.817	0.828
0.887	0.876	0.866	0.846	0.836	0.805
0.895	0.884	0.873	0.852	0.842	0.796
0.916	0.904	0.892	0.869	0.858	0.772
0.940	0.926	0.914	0.888	0.876	0.740
	0.929			0.877	0.735
	0.936			0.883	0.730
	0.944			0.889	0.720
	0.945				0.710
	0.955			0.897	0.700
	0.963			0.903	0.690
	0.973			0.910	0.680
				0.909	0.670
	0.993			0.925	0.650
		0.976	0.942		0.651
	1.00				0.640
		0.983	0.946	0.928	0.628
		1.00	0.963	0.943	0.592
			0.972	0.951	0.564
			0.990	0.967	0.527
				0.964	0.513
			1.00		0.500
				1.00	0.400
					0.300
					0.200
					0.100
					0

TABLE II. Bethe-Peierls approx. in presence of little external magnetic fields

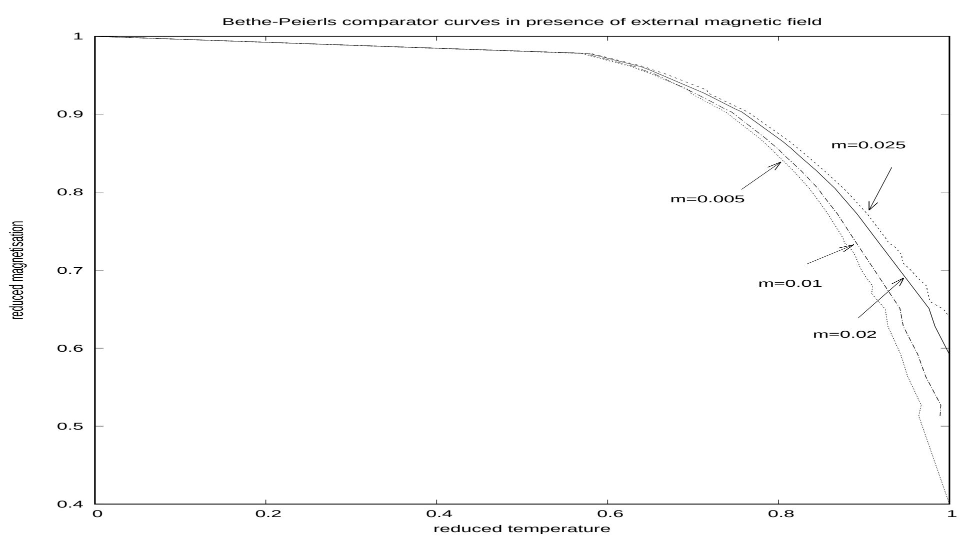

FIG. 2. Reduced magnetisation vs reduced temperature curves for Bethe-Peierls approximation in presence of little external magnetic fields, for four nearest neighbours, with $\beta H = 2m$.

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
129	64	267	145	101	48	44	56	102	16	8	45	71	46	38	153	12	98	141	48	28	21	29	0	11	0

TABLE III. Dictionary of Social Work and Social Care entries

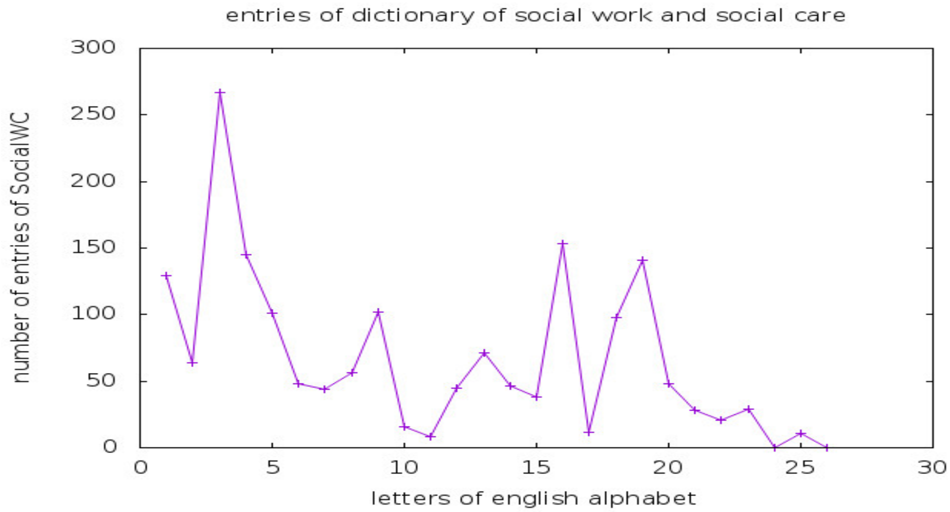

FIG. 3. Vertical axis is number of entrie of the Oxford Dictionary of Social Work and Social Care,[1]. Horizontal axis is the letters of the English alphabet. Letters are represented by the sequence number in the alphabet.

III. ANALYSIS OF THE OXFORD DICTIONARY OF SOCIAL WORK AND SOCIAL CARE

We go on analysing the Oxford Dictionary of Social Work and Social Care,[1] in the following way. We count the entries, loosely speaking words, one by one from the beginning to the end, starting with different letters. The result is the following table, III. Highest number of entries, two hundred sixty seven, starts with the letter C followed by words numbering one hundred fifty three beginning with P, one hundred forty five with the letter D etc. To visualise we plot the number of entries against the respective letters in the figure fig.3.

For the purpose of exploring graphical law, we assort the letters according to the number of words, in the descending order, denoted by f and the respective rank, [17], denoted by k. k is a positive integer starting from one. Moreover, we attach a limiting rank, k_{lim}, and a limiting number of words. The limiting rank is maximum rank plus one, here it is twenty four and the limiting number of words is one. As a result both $\frac{lnf}{lnf_{max}}$ and $\frac{lnk}{lnk_{lim}}$ varies from

k	lnk	lnk/lnk_{lim}	f	lnf	lnf/lnf_{max}	lnf/$lnf_{next-max}$	lnf/lnf_{2nmax}	lnf/lnf_{3nmax}	lnf/lnf_{4nmax}	lnf/lnf_{5nmax}
1	0	0	267	5.587	1	Blank	Blank	Blank	Blank	Blank
2	0.69	0.217	153	5.030	0.900	1	Blank	Blank	Blank	Blank
3	1.10	0.346	145	4.977	0.891	0.989	1	Blank	Blank	Blank
4	1.39	0.437	141	4.949	0.886	0.984	0.994	1	Blank	Blank
5	1.61	0.506	129	4.860	0.870	0.966	0.976	0.982	1	Blank
6	1.79	0.563	102	4.625	0.828	0.919	0.929	0.935	0.952	1
7	1.95	0.613	101	4.615	0.826	0.917	0.927	0.933	0.950	0.998
8	2.08	0.654	98	4.585	0.821	0.912	0.921	0.926	0.943	0.991
9	2.20	0.692	71	4.263	0.763	0.848	0.857	0.861	0.877	0.922
10	2.30	0.723	64	4.159	0.744	0.827	0.836	0.840	0.856	0.899
11	2.40	0.755	56	4.025	0.720	0.800	0.809	0.813	0.828	0.870
12	2.48	0.780	48	3.871	0.693	0.770	0.778	0.782	0.797	0.837
13	2.56	0.805	46	3.829	0.685	0.761	0.769	0.774	0.788	0.828
14	2.64	0.830	45	3.807	0.681	0.757	0.765	0.769	0.783	0.823
15	2.71	0.852	44	3.784	0.677	0.752	0.760	0.765	0.779	0.818
16	2.77	0.871	38	3.638	0.651	0.723	0.731	0.735	0.749	0.787
17	2.83	0.890	29	3.367	0.603	0.669	0.677	0.680	0.693	0.728
18	2.89	0.909	28	3.332	0.596	0.662	0.669	0.673	0.686	0.720
19	2.94	0.925	21	3.045	0.545	0.605	0.612	0.615	0.627	0.658
20	3.00	0.943	16	2.773	0.496	0.551	0.557	0.560	0.571	0.600
21	3.04	0.956	12	2.485	0.445	0.494	0.499	0.502	0.511	0.537
22	3.09	0.972	11	2.398	0.429	0.429	0.482	0.485	0.493	0.518
23	3.14	0.987	8	2.079	0.372	0.413	0.418	0.420	0.428	0.450
24	3.18	1	1	0	0	0	0	0	0	0

TABLE IV. Oxford Dictionary of Social Work and Social Care entries: ranking, natural logarithm, normalisations

zero to one. Then we tabulate in the adjoining table, IV, and plot $\frac{lnf}{lnf_{max}}$ against $\frac{lnk}{lnk_{lim}}$ in the figure fig.4.

We then ignore the letter with the highest of words, tabulate in the adjoining table, IV, and redo the plot, normalising the lnfs with next-to-maximum $lnf_{nextmax}$, and starting from $k = 2$ in the figure fig.5. Normalising the lnfs with next-to-next-to-maximum $lnf_{nextnextmax}$, we tabulate in the adjoining table, IV, and starting from $k = 3$ we draw in the figure fig.6. Normalising the lnfs with next-to-next-to-next-to-maximum $lnf_{nextnextnextmax}$ we record in the adjoining table, IV, and plot starting from $k = 4$ in the figure fig.7. Normalising the lnfs with next-to-next-to-next-to-maximum lnf_{4n-max} we record in the adjoining table, IV, and plot starting from $k = 5$ in the figure fig.8. Normalising the lnfs with next-to-next-to-next-to-maximum lnf_{5n-max} we record in the adjoining table, IV, and plot starting from $k = 6$ in the figure fig.9.

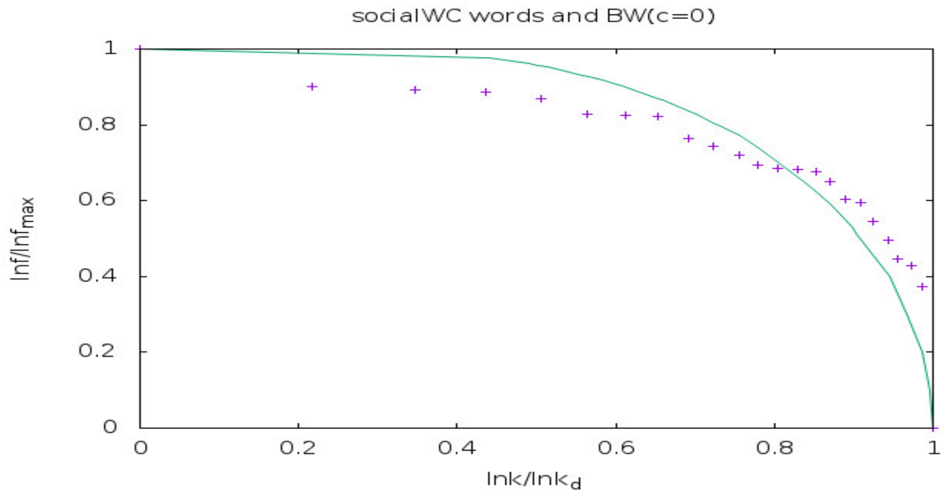

FIG. 4. Vertical axis is $\frac{lnf}{lnf_{max}}$ and horizontal axis is $\frac{lnk}{lnk_{lim}}$. The + points represent the entries of the SocialWC dictionary with the fit curve being the Bragg-Williams curve in absence of external magnetic field, $c = \frac{H}{\gamma\epsilon} = 0$.

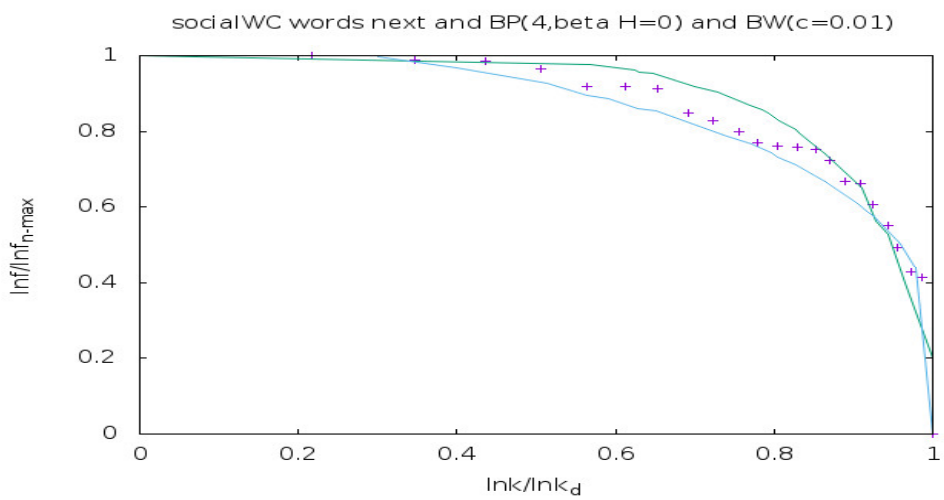

FIG. 5. Vertical axis is $\frac{lnf}{lnf_{next-max}}$ and horizontal axis is $\frac{lnk}{lnk_{lim}}$. The + points represent the entries of the SocialWC dictionary with the fit curve being in between, the Bragg-Williams curve in presence of magnetic field, $c = \frac{H}{\gamma\epsilon} = 0.01$ and the Bethe-Peierls curve in presence of four nearest neighbours in absence of external magnetic field.

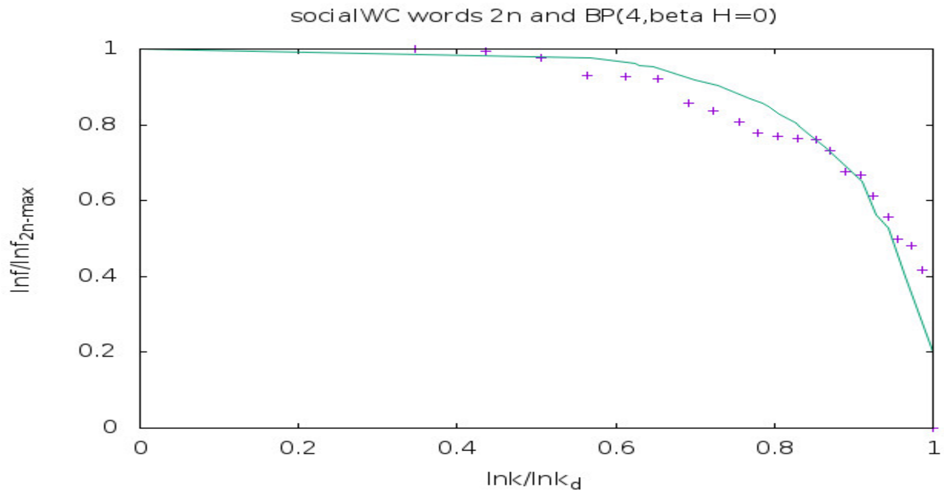

FIG. 6. Vertical axis is $\frac{lnf}{lnf_{nextnext-max}}$ and horizontal axis is $\frac{lnk}{lnk_{lim}}$. The + points represent the entries of the SocialWC dictionary with the fit curve being the Bethe-Peierls curve in presence of four nearest neighbours and in absence of external magnetic field.

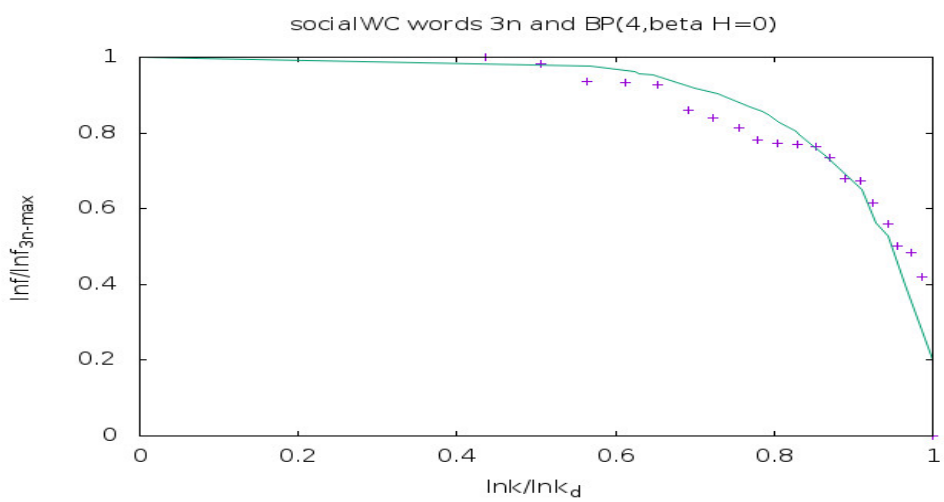

FIG. 7. Vertical axis is $\frac{lnf}{lnf_{nextnextnext-max}}$ and horizontal axis is $\frac{lnk}{lnk_{lim}}$. The + points represent the entries of the SocialWC dictionary with the fit curve being the Bethe-Peierls curve in presence of four nearest neighbours and in absence of external magnetic field.

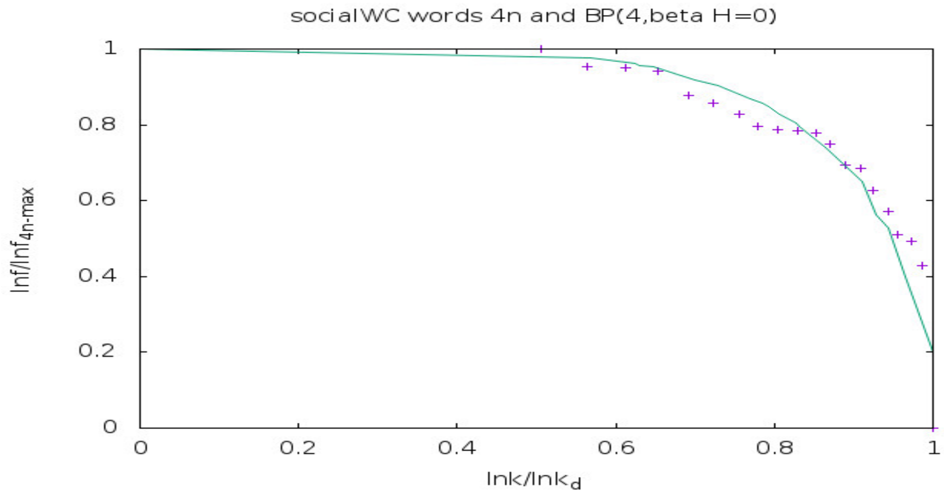

FIG. 8. Vertical axis is $\frac{lnf}{lnf_{4n-max}}$ and horizontal axis is $\frac{lnk}{lnk_{lim}}$. The + points represent the entries of the SocialWC dictionary with the fit curve being the Bethe-Peierls curve in presence of four nearest neighbours and in absence of external magnetic field.

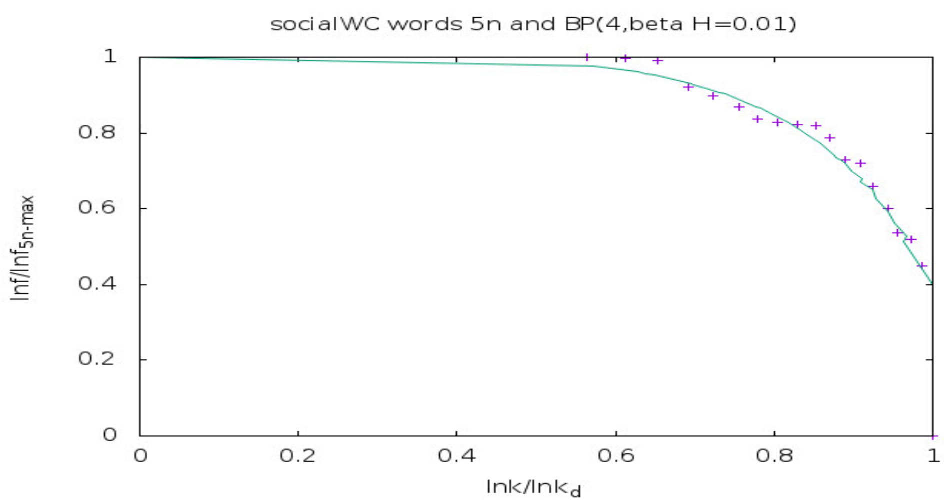

FIG. 9. Vertical axis is $\frac{lnf}{lnf_{5n-max}}$ and horizontal axis is $\frac{lnk}{lnk_{lim}}$. The + points represent the entries of the SocialWC dictionary with the fit curve being the Bethe-Peierls curve in presence of four nearest neighbours and little external magnetic field, $m = 0.005$ or, $\beta H = 0.01$.

A. conclusion

From the figures (fig.4-fig.9), we observe that there is a curve of magnetisation, behind the entries of the Oxford Dictionary of Social Work and Social Care. This is magnetisation curve in the Bethe-Peierls approximation with four nearest neighbours and little external magnetic field, $m = 0.005$ or, $\beta H = 0.01$. Moreover, the associated correspondance is,

$$\frac{lnf}{lnf_{5n-max}} \longleftrightarrow \frac{M}{M_{max}}, \quad lnk \longleftrightarrow T.$$

k corresponds to temperature in an exponential scale, [18]. As temperature decreases, i.e. lnk decreases, f increases. The letters which are recording higher entries compared to those which have lesser entries are at lower temperature. As the subject of Social Work and Social Care expands, the letters like ...,D,P,C which get enriched more and more, fall at lower and lower temperatures. This is a manifestation of cooling effect, as was first observed in [19], in another way.

IV. ACKNOWLEDGEMENT

We have used gnuplot for plotting the figures in this paper.

V. BIBLIOGRAPHY

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