Co-author pairs' frequencies distribution in journals of gender studies

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Abstract

Previous studies have presented well-ordered collaboration structures of co-author pairs. Kretschmer and Kretschmer have shown that, for high impact SCI journals, the distributions of co-author pairs' frequencies can be considered to be a reflection of a social Gestalt. This study is an extension of that work to the social sciences, namely eleven journals in women's and gender studies. After overlapping or mixing the eleven distributions of co-author pairs, the data reveal the same tendency to a social Gestalt. However the shapes of social Gestalts for gender studies differs markedly from the corresponding shapes of the high impact SCI Journals. Simulation shows that the change of the shape from the Gestalt of the mixed journals of gender studies towards the shape of the four mixed SCI journals could be continuous.

Introduction

Collaboration is increasing in science and also in social sciences since several decades (DeB. Beaver 2001, Price 1963). With increasing collaboration in science and in technology the study of the frequency of pairs or triples of co-authors is highly relevant (Morris & Goldstein 2007, Egghe, Goovaerts & Kretschmer 2008, Egghe to appear). Starting with pair distributions, well-ordered collaboration structures of co-author pairs have already been presented, i.e. the frequency of co-author pairs N_{ij} between authors with i publications per author and authors with j publications per author is a function of i and j: $N_{ij}=f(i,j)$ using the normal count procedure for counting i or j. (Kretschmer & Kretschmer 2007) The authors have assumed that the distribution of co-author pairs' frequencies can be considered to be a reflection of a social Gestalt.

The theoretical model for social Gestalts is valid for social networks in general (Kretschmer 1999, 2002). It is intended to suggest that
* social interactions between a **large number** of individuals
* can be mirrored in the form of well-ordered three-dimensional Gestalts depending
upon
* the characteristics of these individuals

Examples (types) of social interactions are collaboration, friendships, marriages, etc., while examples (types) of characteristics of these individual persons are age, labor productivity, education, professional status, etc.

The authors have shown the distribution of co-author pairs' frequencies can be considered to be a social Gestalt because co-authorships are the reflections of interactions and scientific productivity can be considered as a characteristic of persons. (Kretschmer & Kretschmer 2007)

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Social Gestalts can be visualized in the form of three-dimensional figures as follows:
Social interactions can be shown on the Z-axis and characteristics on the X and Y axes.

The model is based on both Gestalt theory and the old Chinese Yin/Yang theory. The fundamental "formula" of Gestalt theory might be expressed in this way: there are wholes, the behaviour of which is not determined by that of their individual elements, but where the part-processes are themselves determined by the intrinsic nature of the whole (Gestalt Theory by Max Wertheimer, 1924).

The intrinsic nature of the whole, i.e. here the **social Gestalt**, is explained in the present model by the Yin/Yang theory.

Yin and Yang are the opposite poles of a single whole. They are complementary tendencies interacting dynamically with each other, so that the whole system is open to change. Gestalts in social networks owe their shape and the change of their shape to the balancing interaction of these forces. All transitions occur with an uninterrupted sequence producing an infinite number of shapes. The model includes two different Yin/Yang pairs. These pairs correspond with well-known general characteristics of structures in interpersonal relations in social networks. The theoretical shapes can be produced by the mathematical function for the description of social Gestalts. The empirical shapes can be compared with the theoretical shapes (Kretschmer & Kretschmer 2007, paragraph 3.2.4). An empirical example of the changing shape of the social Gestalt of co-authorship networks - based on the influence of changing research conditions - can be shown by Ramesh Kundra and Hildrun Kretschmer from their study of the co-authorship network of Indian medicine over the course of about 30 years, (Kretschmer, Liang, Kundra 2001). See Fig. 1. But this study is not especially related to co-authorship pairs' frequencies. Therefore, other kinds of social Gestalts appear in Fig.1
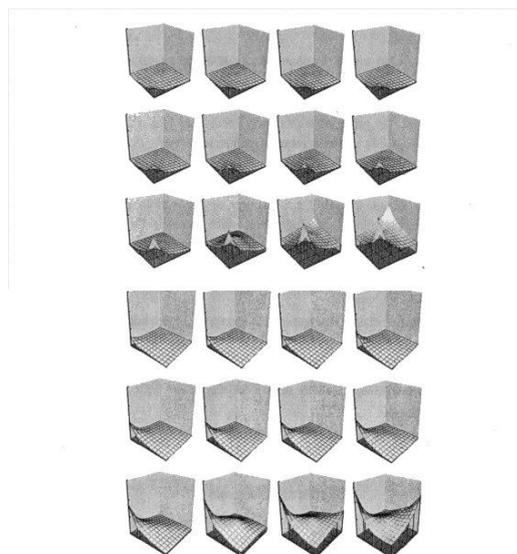

Fig.1: Change of the shapes dependent on the changing environment and men (Indian medicine during 30 years). The lower three rows show the patterns of the upper three rows, turned around 90°

As mentioned above the Kretschmers have shown that the distribution of co-author pairs' frequencies of four high impact factor SCI journals can be considered to be a social Gestalt. The shapes of the Gestalts of these four journals are very similar to each other. (Kretschmer & Kretschmer 2007) The question arises: Do there exist other kinds of shapes?

The theoretical model of social Gestalts says:
- A "force" that emanates from the well-ordered pattern of the whole (social or behavioral Gestalt) "acts" on the individual components (individual persons) of this whole.
  (In other words, cf. above: the part-processes are themselves determined by the intrinsic nature of the whole.)
- Even if this "force" fails to determine completely an individual component in terms of the predictability of this individual component:
  * this "force", nevertheless, generates a statistically balanced evenness among all

the individual components **in their totality** in the sense of a well-ordered pattern (according Gestalt theory: '*Tendency towards a good* **social** *Gestalt*')

* suggesting that this Gestalt will become predictable within a very high margin of probability (and thus mathematically describable).

Correspondingly, we can expect the tendency towards a "Good Gestalt" increases with an increasing number of individual components.

That means large sample sizes are to be preferred for empirical studies. Obtaining large sample sizes is possible in studies of large bibliographies (journals or research areas). On the other hand, the phenomenon of Gestalts could be taken into consideration originally related to morphogenetic fields or morphogenetic Gestalts: Overlapping or mixing of social Gestalts in analogy to overlapping of faces. The higher the number of mixed social Gestalts, the higher becomes the tendency towards a good social Gestalt overall (Kretschmer & Kretschmer 2007, paragraphs 3.2.3 and 7.3, and Fig. 2).
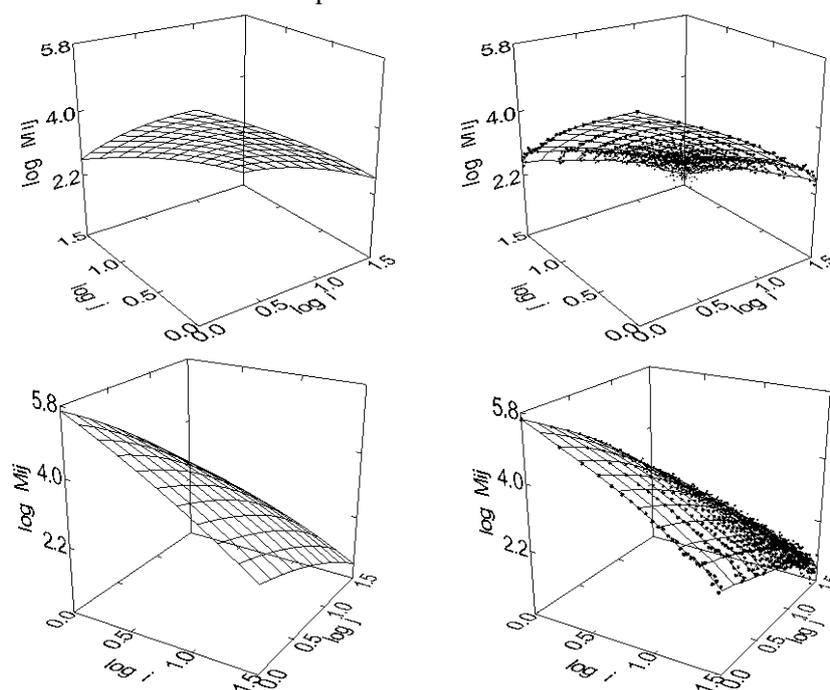

Fig. 2: Distribution of the mixed co-author pairs' frequencies M_{ij} obtained from the four single distributions of four high impact SCI Journals The patterns in the lower row are rotated by 90°. Left side: Social Gestalt, Right side: Empirical data plotted on the Gestalt. The correlation between empirical data and Gestalt is higher than those for the four single journals individually.

Hypotheses

- The tendency towards a good social Gestalt can be shown after overlaping or mixing of eleven distributions of co-author pairs' frequencies obtained from eleven different journals of gender studies.

- The shapes of social Gestalts for gender studies differs from shape of the high impact SCI Journals

- The change of the shape from the Gestalt of the journals of gender studies towards the shape of the four mixed SCI journals can be shown by simulation.

Data

Title of Journal	Abbreviation
Journal of Women and Social Work	Affilia
European Journal of Women Studies	EuJW
Feminism & Psychology	FemPsy
Feminist Economics	FemEco
Feminist Theory	FemTheo
Gender, Technology and Development	Gentechdev
Indian Journal of Gender Studies	IndGenStud
Psychology of Women Quarterly	PsyWoQ
Sexualities	Sexualities
Signs	Signs
Women's Studies International Forum	WomStu

Methods

Method for Counting N_i and N_{ij}

Given an artificial bibliography of 8 papers (names of authors: A, B, ...)

1. A		4. D, A, F		7. H,G
2. B		5. C		8. H,G,A
3. D,E		6. G, H		

The number of publications i (or j respectively) per author P (or Q respectively) is determined by resorting to the ´normal count procedure´. Each time the name of an author appears, it is counted (e.g. A three times: once in the first article, and once each in the 4th and 8th article).

Pairs P,Q are marked in the cells of the matrix under the condition of both the first authors P count (i) and the second authors Q count (j), i.e. the authors are ordered according to i or j respectively (cf. Table 1).

When the place of the authors in the by-line is not taken into consideration, a symmetrical Matrix results. For example, the pair G,A is marked two times: once under the condition G count (i) and A count (j) and once under the condition A count (i) and G count (j).

Table 1: Symmetrical matrix

i / j		1				2	3			
		B	C	E	F	D	A	G	H	Np
1	B									
	C									
	E					1				1
	F					1	1			2
2	D			1	1		1			3
3	A				1	1		1	1	4
	G						1		1	2
	H						1	1		2

<div align="right">SUM   14</div>

In the symmetrical matrix, one can determine for each author P the number of his collaborators N_P. N_P is equal to the Degree Centrality in Social Network Analysis (SNA).

The matrix of N_{ij} (derived from the symmetrical matrix) is the representation of the number of pairs N_{ij} with authors who have i publications per author, with authors who have j publications per author included in the bibliography.

For example, the pairs E,D and F,D in Table 1 are counted as $N_{12}=2$ in the matrix of N_{ij}

Table 2: Matrix of N_{ij}

i / j	1	2	3	N_i	A_i	SUM
1	0	2	1	3	4	
2	2	0	1	3	1	
3	1	1	6	8	3	
N_j	3	3	8			14
A_j	4	1	3			8
SUM				14	8	

$N_i = \Sigma_j N_{ij}$ is the number of collaborators of all authors with i publications per author.
$N_j = \Sigma_i N_{ij}$ is the number of collaborators of all authors with j publications per author.
A_i is the number of authors with i publications per author.
A_j is the number of authors with j publications per author.
$\Sigma\Sigma N_{ij}= \Sigma N_i$ – number of co-authorship pairs in total, symmetrical count
ΣB_k - number of co-authorship pairs in total ($\Sigma\Sigma N_{ij}=2* \Sigma B_k$)

Results
Verification of Hypothesis 1
Table 1: Results of regression analysis between Gestalts of the 11 journals and the corresponding empirical data as well as the mixed Gestalt and the empirical data

Journal	$\Sigma\Sigma N_{ij}=$ $2* \Sigma B_k$	$i_{max}=j_{max}$	Multiple R	F-Ratio	Error prob-ability P	n- number of cases in regression analysis
PsyWoQ	2100	8	0.9284	82.73	0.000000000	58
Affilia	1110	8	0.9489	40.6	0.000000009	23
WomStu	1004	8	0.9363	49.7	0.000000000	33
Signs	776	5	0.9439	26.56	0.0000038	18
FemPsy	650	21	0.8767	28.2	0.000000000	39
Fem Eco	598	7	0.8386	12.4	0.000024	26
Gentechdev	206	7	0.9351	24.37	0.00000354	19
Sexualities	204	4	0.9463	24.06	0.0000799	14
Eu JW	176	4	0.9439	26.56	0.0000037	18
IndGenStud	140	4	0.9419	15.49	0.005	10
FemTheo	40	3	/	/	/	5
Mixed	$\Sigma\Sigma M_{ij}=$ **Total Sum** $\Sigma\Sigma N_{ij}=7,004$	**21**	**0.97232**	**255.4**	**0.000000000**	**64**

Note: The 11 journals are ordered according to $\Sigma\Sigma N_{ij}$ (or ΣB_k)

The 11th journal (Fem. Theory) has no results in the regression analysis because of its small size. The correlation of the mixed journals is highest: **R=0.97232;** the F-Ratio is especially significantly higher than any of the F-ratios of the single journals. In general the size of the 11 journals is very small (7,004 co-authorship pairs in total, symmetrical count).   In comparison, the 4 SCI journals have 2,248,194 co-authorship pairs (symmetrical count) in total!

The studies of the 11 gender studies have shown the theory of the social Gestalts is also applicable on smaller samples than used in Kretschmer& Kretschmer 2007.

The social Gestalt of the mixed journals with the corresponding empirical data is presented in Fig. 3.
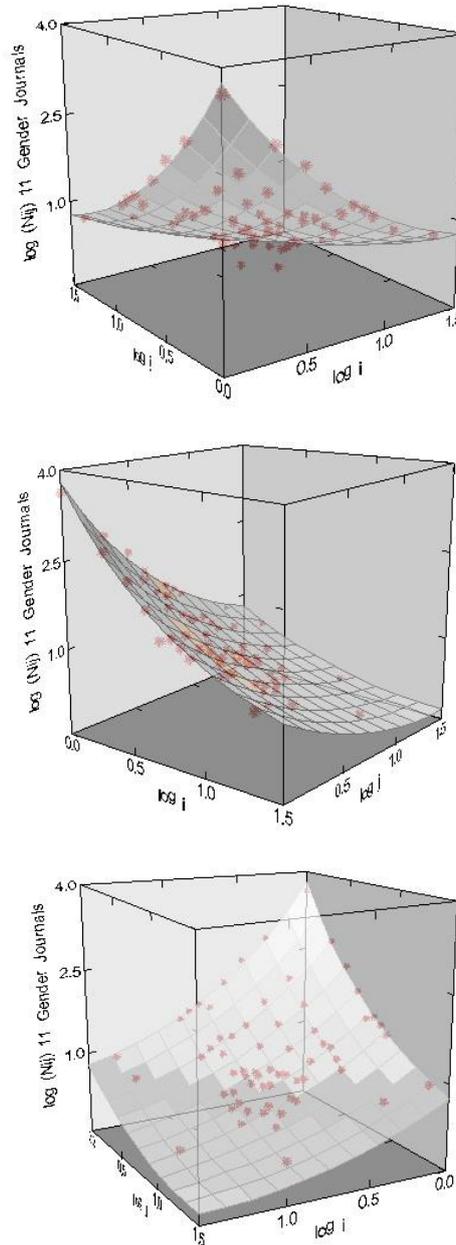

Fig. 3: Gestalts (Distributions of co-author pairs' frequencies N_{ij}) and empirical data
n=64, R=0.9723,   F-Ratio: 255.4,   P=0.000000000 (Empirical values –red)

Verification of Hypothesis 2:
In Fig. 4 the shape of the mixed gender studies Gestalt (left side) is compared with the shape of the mixed SCI journals (right side). The Gestalts are turned around on the lower rows.
In Fig. 5 another version is presented, this time including the empirical data. The comparison shows that shapes of social Gestalts in gender studies are different from the kind of shape of the high impact SCI journals.
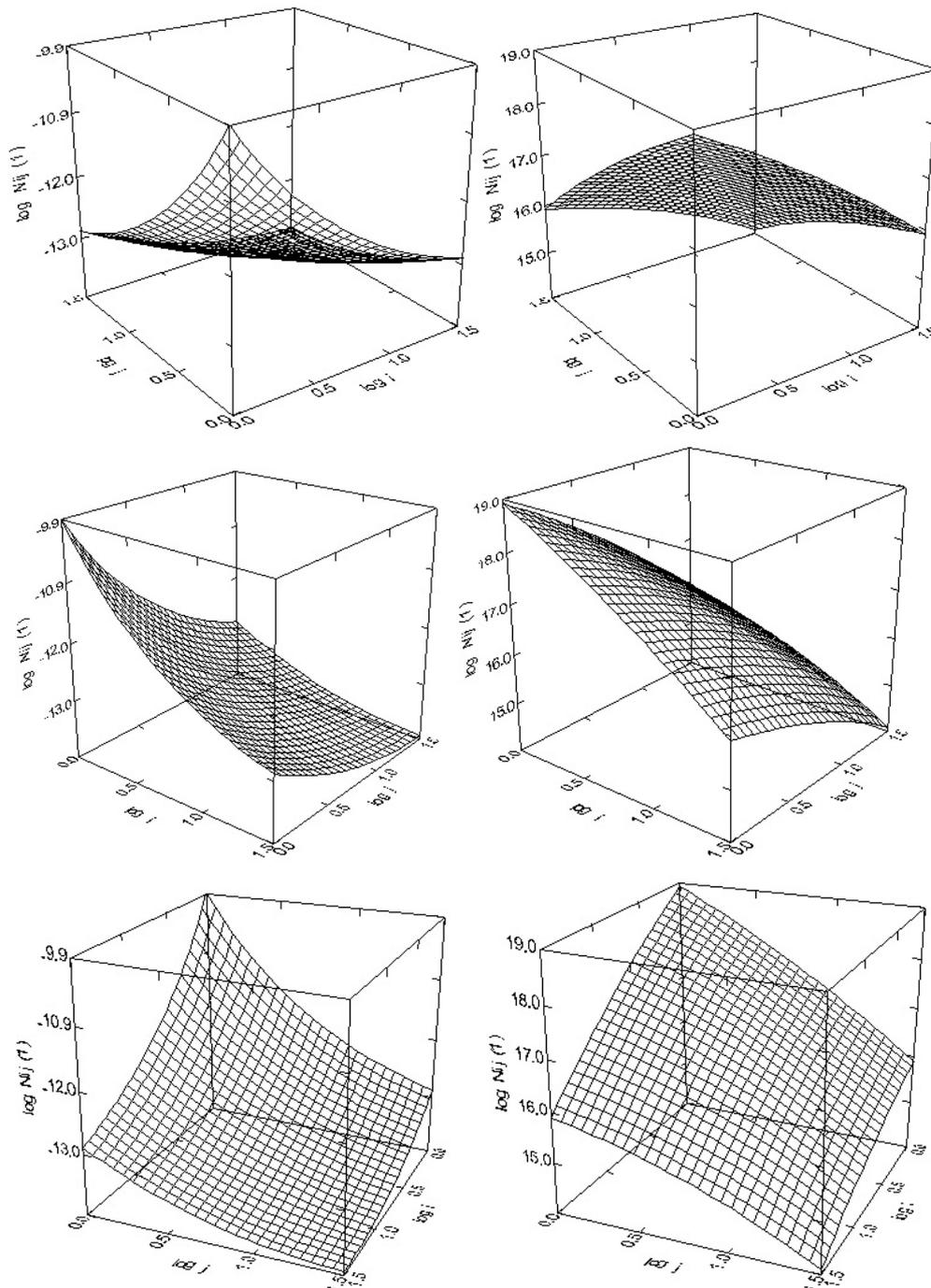

Fig. 4: Social Gestalts, left side: mix of 11 gender studies journals, right: mix of 4 SCI journals
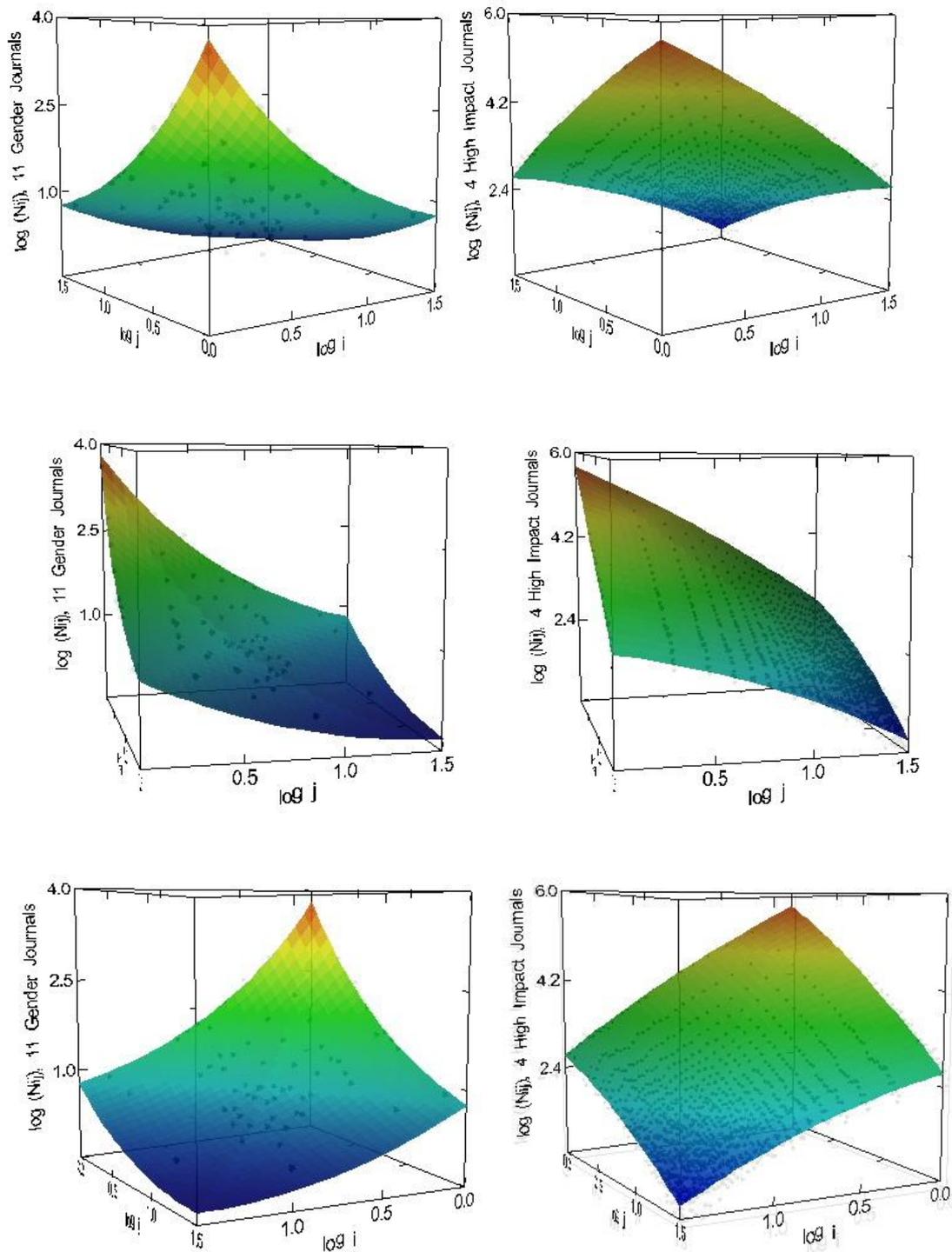
Fig. 5: Shapes of Social Gestalts (cf. paragraph 3.2.4.) and empirical data Combination with the mix of 4 SCI high impact journals (cf. Figures on the right side): Science, Nature, Proc Nat Acad Sci, Phys Rev B Condensed n=496, R=0.994, F=9,555.3 P=0.000000000

Verification of Hypothesis 3:

The change of the shape from the Gestalt of the journals of gender studies (first row) towards the shape of the four mixed SCI journals (last row) can be shown by simulation in Fig. 6.

In simulation any higher number of shapes can be entered according to the principles of the Yin/Yang theory mentioned above: "All transitions occur with an uninterrupted sequence producing an infinite number of shapes." For presentation this can be used in the form of animation (as has been done previously with Kundra's Gestalts in Fig. 1).
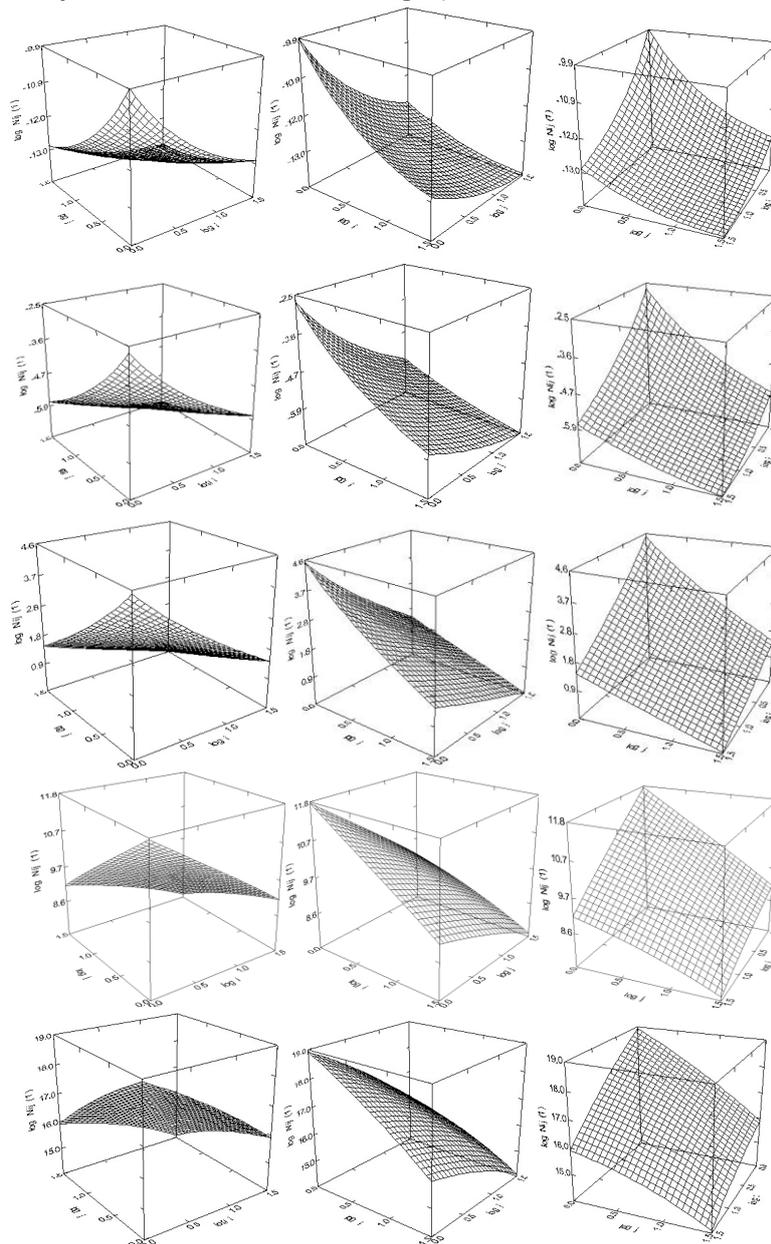

Fig. 6: Simulation (The way from Gender Studies to the 4 SCI Journals: looking from up to down)

Conclusion

On the basis of theory we expected the tendency towards a "Good Gestalt" becomes greater with an increasing number of components making up mixed Gestalts.

In the future we intend to use a different method from mixing the eleven distributions of co-author pairs frequencies obtained from the eleven different journals of gender studies.

Because the eleven journals studied belong to the same research area we expected to find a "Good Gestalt" after joining the eleven bibliographies into one large bibliography. In doing so, there is probably a shift of number of publications (i or j) per author because an author who has published i_X papers in one of the 11 journals could for example also have published i_y papers in another journal or another number of papers in two other journals, etc. Thus, the author in the example has i= i_X+ i_y papers in the large bibliography. We expect the shape of the new Gestalt is slightly different from the mixed Gestalt because we have used individual journal counts of pairs, and not adjusted them in the mixed sample by individual author's names.

We suspect male and female scientists show different collaboration behaviour. Therefore, we intend to study whether different Gestalts emerge dependent on gender.

Perhaps the collaborative gestalts in journals of the social sciences are different from those of the natural sciences because the social sciences are different from the natural sciences? Maybe future studies will show the answer regarding this question.

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