CAES Vol. 3, № 1 (March 2017)

How to estimate degree of resemblance of semiotic systems?

Alexander Akulov
independent scholar; St.Petersburg, Russia; e-mail: aynu@inbox.ru

Tresi Nonno
independent scholar; Chiba, Japan; e-mail: tresi_nonno@hotmail.com

Abstract

In order to estimate degree of resemblance of semiotic systems first of all they should be represented as structures to which formal methods can be applied. Semiotic systems should be represented as ordered pair of the following view: <A; Ω> where A is set of concepts/memes and Ω is a set of contextual distributions determined upon A. Any set of related concepts is A set; any relations determined upon this A form Ω set. Any semiotic system can be represented as set of elements with only two binary relations: subordination and similarity. Elements of Ω sets of certain particular semiotic system are relations existing between elements of corresponding A set. Degree of correlation of two semiotic systems is superposition of degrees of correlation of A sets and Ω sets. The more similar are A sets and Ω sets of compared systems the higher is the index of correlation.

Key words: semiotics; formalization of semiotics; abstract algebra; set theory

1. Problem introduction

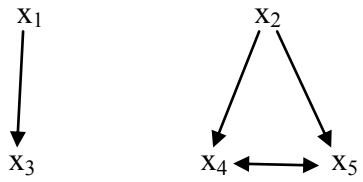
Comparison of certain cultures is usually rather speculative matter. It would be useful to be able to make precise quantitative estimations, to be able to estimate degree of resemblance of certain cultures.
In order to do it first of all culture should be represented as a structure to which formal methods can be applied.
It is rather well-known that language can be represented as ordered pair of the following view: <A; Ω> where A is a set of certain phonemes/morphemes/concepts, and Ω is a set of distributions determined upon A.
Then it is possible to say that culture is nothing else, but pragmatic level of language: when we learn pragmatic level of a language we actually learn culture and when we learn about certain culture we learn pragmatics of corresponding language. (In current text term culture means set of ideas/memes and social practices.)
As far as culture and language are congruent structures so then culture also can be represented as <A; Ω> pair where A is set of concepts/memes and Ω is a set of contextual distributions determined upon A.
It's possible to speak even not about culture, but about semiotic system: any set of related concepts is A set and any relations determined upon this A form Ω set. Fragments of culture, certain thematic semantic fields also are semiotic systems. Semiotic systems are fractal structures.
Any semiotic structure can be represented as a set of concepts organized into certain semantic fields. Any semantic field can be represented as a graph where points are concepts and

connections are relations. There are only two binary relations in any semantic field: subordination and similarity.

2. Estimation degree of resemblance of semiotic systems by sets method

2.1. Representation of semiotic systems as graphs and sets

Let's imagine an abstract scheme of structuring elements of X in certain semantic fields (scheme 1).



Scheme 1. Structure of semiotic system X

In this scheme → sign means subordination;
↔ sign means similarity/correlation/interconnection.

Elements of any semiotic system of any semantic field are in relation of similarity or/and in relation of subordination.

Subordination is irreflexive, antisymmetric and transitive.
Similarity/correlation is reflexive, symmetric and transitive.

Thus, this X semiotic system has five elements and two semantic fields. And its graph can be represented as the following:

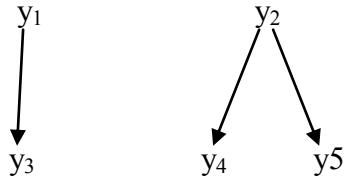
A_X $\{x_1, x_2, x_3, x_4, x_5\}$

Ω_X $\{x_1 \rightarrow x_3, x_2 \rightarrow x_4, x_2 \rightarrow x_5, x_4 \leftrightarrow x_5\}$

Each particular relation of two elements of A is element of Ω.

2.1. Comparison of X and Y semiotic systems

Now let's imagine another system, a system Y that has same number of elements as X, but their distributions are slightly different (scheme 2).



Scheme 2. Structure of Y semiotic system

The system is described by the following sets:

A_Y $\{y_1, y_2, y_3, y_4, y_5\}$;

Ω_Y $\{y_1 \rightarrow y_3, y_2 \rightarrow x_5, y_2 \rightarrow y_5\}$.

Degree of correlation of X and Y is superposition of two indexes of correlation: A_X with A_Y and Ω_X with Ω_Y.

In the case of A_X and A_Y index of correlation is 1.

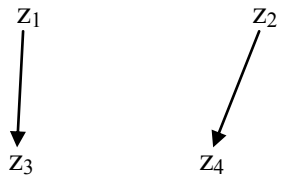
In the case of Ω_X and Ω_Y correlated elements are the following:
$x_1 \rightarrow x_3$ and $y_1 \rightarrow y_3$; $x_2 \rightarrow x_4$ and $y_2 \rightarrow y_4$; $x_2 \rightarrow x_5$ and $y_2 \rightarrow y_5$.
Thus index of correlation of Ω_X and Ω_Y is the following: $(1 + ¾)/2 = 0.875$.
And thus index of correlation of X and Y is the following: $1*0.875 = 0.875$

In order to estimate degree of correlation of two sets which are not equal should be done the following: should be found intersection of compared sets and then should be taken ratio of number of elements of intersection to the numbers of elements of each set, then should be found arithmetic mean of both ratios.

Values of correlation of A sets and Ω sets should be multiplied since sets of elements and sets of distributions should be correlated in the same time, i.e.: should be logical conjunction.

2.2. Comparison of X and Z semiotic systems

Now let's imagine a system Z which graph differs much more from that of X:



Scheme 3. Structure of Z semiotic system

Z can be described by the following sets:

A_Z $\{z_1, z_2, z_3, z_4\}$

Ω_Z $\{z_1 \rightarrow z_3; z_2 \rightarrow z_4\}$

Correlated elements of A_X and A_Z are the following: $z_1 \leftrightarrow x_1$, $z_2 \leftrightarrow x_2$, $z_3 \leftrightarrow x_3$, $z_4 \leftrightarrow x_4$, so index of correlation of A_X and A_Z is $(1/1 + 4/5)/2 = 0.9$.
Correlated elements of Ω_X and Ω_Z are the following: $x_1 \rightarrow x_3$ is correlated with $z_1 \rightarrow z_3$; $x_2 \rightarrow x_4$ is correlated with $z_2 \rightarrow z_4$.
Thus, index of correlation of Ω_X and Ω_Z is $(2/2 + 2/4)/2 = 0.75$.
And then index of correlation of X and Z is the following: $0.9*0.75 = 0.675$.

2.3. Comparison of X and W semiotic systems

Let's imagine a system that is more distant from X:

Scheme. 4. Sctructure of W semiotic system

W can be described by the following sets:

A_W $\{w_1, w_2\}$;

Ω_W $\{w_1 \rightarrow w_2\}$

Correlated elements of A_W and A_X are the following: $w_1 \leftrightarrow x_1$; $w_2 \leftrightarrow x_3$
Correlated elements of Ω_W and Ω_X are the following: $w_1 \rightarrow w_2$ is correlated with $x_1 \rightarrow x_3$.
Thus, index of correlation of A_W and A_X is $(1 + 2/5)/2 = 0.7$.
Index of correlation of Ω_W and Ω_X is the following: $(1/1 + 1/4)/2 = 0.625$.
And thus index of correlation of W and X is the following: $0.7 * 0.625 \approx 0.44$

Thus, it's rather evident that the more similar are A sets and Ω sets of compared systems the higher is the index of correlation.

3. Conclusion

Such representation of semiotic systems can help further formalization and elaboration of new methods, i.e.: sets can be considered just as normal objects of abstract algebra without any care of their origin and certain new ideas can come from abstract algebra.
We suppose that conversion of semiotic systems into certain structures of abstract algebra can be much more useful than just auxiliary use of some issues of statistics/probability theory and technical analysis that can be seen in some synergistic approaches. Statistical methods help to make some particular conclusions, however, actually they don't change general character of semiotics.
If we are going to convert semiotic and all its branches (ethnology, history and so on) into exact sciences we should convert objects of semiotics into structures of abstract algebra, but not just use statistics as auxiliary mean of belles-letters.
We suppose that situation in semiotic should be much alike the situation that exists in contemporary physics where certain phenomena are described by certain mathematical structures and then mathematical plays with these structures help to find some regularities in nature and inspire searches of certain new objects.
Moreover, we all should keep in mind that dichotomy of humanities and exact science is rather artificial: there are sciences that managed to elaborate appropriate math and those that haven't yet managed to elaborate it.