ORDER AND DISORDER IN ARTWORKS

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INTRODUCTION

The theory of complexity seeks to discover the general rules under which self-organization appears in any complex systems. In the theory of complexity deep analogy is shown in the types of behaviour between absolutely different by nature complex systems as they pass the **critical**, or **unstable**, points, when the precise details of interactions between elements play virtually no role.

Experiments and calculations on mathematical models reveal that correlations at critical points decay exponentially so long as the system is not exactly at its critical point. At critical point exponential law turns into a long-range hyperbolic law or **power law**. Systems with a such law of correlations are called "scale free" because there is no characteristic scale associated with a exponential law.

CRITICALITY IN ARTWORKS

Phenomena related to the notions of criticality or instability in art are very significant. We can declare that huge many artworks, including well-known masterpieces, exist near or at critical points or have bimodal nature and cause bistability of perception.

The circus provides good examples of mechanical unstable states: tightrope walking, acrobatics, and other feats of balance. Ability to excise control over unstable states is a basis of ballet art.

Before we consider instability in literature it is necessary to dwell on the meaning of this conception as regards the literary genre because generally it does not coincide with the mechanical meaning of instability that we deal with in the art circus and choreography.

The most adequate mathematical apparatus for the description of situation in belles-lettres may be the theory of games which is nowadays widely used in various models of behaviour basically in conditions of conflict. In the theory of games the definition of instability named "the Nash", after American mathematician John Nash. According to the Nash, some situation becomes apparently unstable, because it is about to break down , either because factors leading to that possibility exist or because one of the players obtains the best result by means of a unilateral choice of his strategy.

For example, a hare and a wolf living together is an unstable situation. Moreover, the essence of instability in the theory of games and in the mechanical models of balletic art is the same: Unstable states are momentary by their very nature and rapidly break down. But the causes of their short duration are, certainly, different.

Now let's look at instability in literature. Let us start with fiction, the literature of an entertaining genre. When in a detective story a crime is committed, the criminal according to the Nash appears to be in unstable position: because at this moment his life at large is incompatible with penal laws. The duration of the instability depends on adroitness and skill of both the criminal and organs of justice.

In general, instability in literature of an entertaining genre can be described as follows: Some value (life, honour, wealth, or power, for example) is in danger, but owing to personal traits of the heroes of the books and sometimes to favourable coincident this value is preserved.

This does not mean that instability can be met only in fiction; it is widely presented in classical literature as well. In Shakespeare's "Hamlet" the main character learns the name of his father's killer at the beginning of the first act, but he takes vengeance only at the end of the tragedy, thus, unstable state, King Claudius' life is preserved throughout the play. In "Hamlet" are instabilities in interpersonal relations that can be precisely defined with the help of the notion frustration from the theory of spin glasses. Let us consider the central characters of the play: King Claudius, Queen Gertrude, and Prince Hamlet.

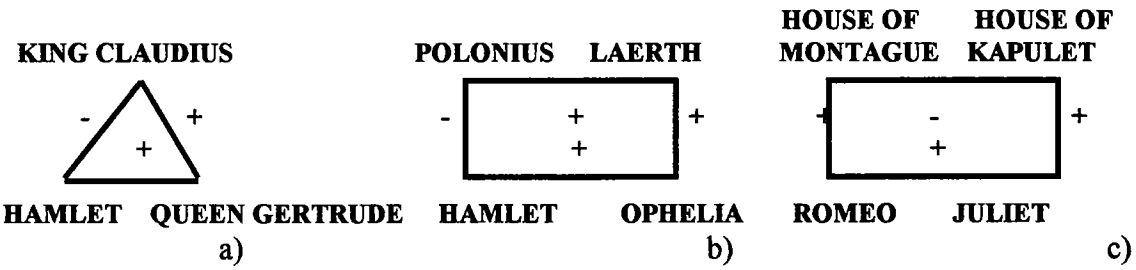

Figure 1. Frustrating bonds in plays by W. Shakespeare.

The triangle formed by the interrelations between these personages is obviously a frustration configuration (Figure 1a) and therefore this structure is metastable. Another frustrating contour is Hamlet's relations with Polonius's family (Figure 1b) at the beginning of the play. Shakespeare often brought such types of instabilities into his plays. Figure 1c is a graph of interrelations in "Romeo and Juliet" which is also frustrating configuration.

A significant type of instability in art may be called bimodality. This type of instability means the possible existence in artwork (most often in position of main hero) of two different states, one of them may be hidden until a certain time. A commonplace example of this form of instability exists in numerous book and movie plots in which a spy or Secret Service agent is hiding his identity while maneuvering about in hostile camp. At any moment, he may be unmasked, and the agent's task is to extend his secret identity as long as possible.

It is principally important to art theory that the nature of many kinds of art is bimodal in itself.

Let us first consider an acting. Like any human being actor has in his everyday life some set of rather stable physiological and psychological parameters: sex, appearance, timbre of voice, gait, temper and so on. Acting involves an ability to create a second phase, a "role" phase, where the first one is physiological and psychological nature of the actor and which, of course, not disappear when actor play the role. In other words, a bimodal state "actor-role" is created which may be compared with well-known in psychology of perception ambiguous (or ambivalent) patterns, for instance, pattern where we see in turn "young girl" or "old lady". One can say that in this case young girl "plays the role" of old lady or vice versa. Such ambiguous patterns are also bimodal on its nature

Figure 2. Semantic ambiguity: young girl or old woman

SELF-ORGANIZATION IN ARTWORKS

Let us consider two main characters in the play by W. Shakespeare "Othello". In the beginning of the play Othello is a tranquil, self-controlled man, but by affection of Iago's lies he looses his self-controlled state and acquires jealous features. This transition by Othello state "self-control - jealousy" might be consider as phase transition and therefore as self-oraganization [2].

The plots of some works of literature are based on the idea of animated statue - that is, the phase transition "inanimate-animated" (such as "Copper Rider", "Stone Guest" by A.Pushkin).

Just as like bimodal nature of sculpture art begets plots about animated statue, bimodality of acting gives a possibility to use a phase transition called "character invasion" for plot development.

The main hero of the film "A Double Life" plays the role of Othello for so long time that it begins to affect to his psychic activity, making him more and more jealous of his beloved, and like the stage character, he strangles her and then kills himself. In the film "Jesus of Montreal" the actor playing the role of Jesus Christ becomes transformed into a Christ-like figure.

The denouement of many artworks is also a peculiar transition when the dominant (the order parameter) of the work of art breaks down. It can be compared with the phase transition when ferromagnetic bar is heated to that certain temperature when magnetization sharply falls to zero. Such is the behaviour of the dominant at the denouement of "Hamlet" when all of a sudden vengeance is committed. The disclosure of the mystery of a crime in a detective story is also the destruction of the dominant that supported its whole structure.

Generally the change of one structure by another in phase transitions is accompanied by the growth of fluctuations in the vicinity of the critical point. Let us find an example in which the change of one structure by another takes place through a state of chaos in the work of art.

In Shakespeare's "King Lear" England has reached a critical moment during a change in social structure, when the whole country is in an unstable and anxious state. No wonder that in these conditions the conflict in the family of King Lear ends in

civil war. Shakespeare emphasizes the typical nature of such conflicts in this crucial historical epoch in the drama taking place in the family of Earl of Gloucester, a betrayal by one of his children.

The state of chaos can be correlated with the civil war and with the scene of Lear's madness in Act 3, which takes place during the tempest - the chaos in nature. At the denouement of the play we observe the creation of a new social structure and new structure of power in the country.

POWER LAW IN ARTWORKS

To a power law distribution is subordinated a structural organization of a great many products of art culture. R.F.Voss recorded loudness of an acoustic signal in Bach's "First Branderburg Concerto" and found fractal distribution of loudness . But these investigations deal with an interpretation of Bach's music by a performer. In K.Hsu & A.Hsu investigations power law relation for the incident frequency (P) of interval (I) between successive notes

$$P = \frac{a}{I^d}$$ a and d are constants

was observed. This log-log inversely linear relation is more or less valid for the interval $1<I<10$ for baroque period (1600-1760) and classical period (1750-1827) of music development. A most notable feature of structure of simple music (bird songs, nursery rhymes, children's songs, folk music) is the excessive use of note repetition (I=0) and seconds (I=1,2).

The analysis of modern atonal music taking as the example "Capricorn" by Stockhausen shows the absence of fractal distribution and hence the absence of harmony in this music [3].

Some preliminary data indicate that in painting one can trace some characteristics that are subordinated to fractal law of distribution. It turned out, that in the most different pictures) the colors occupying approximately 95 per cent of pictures area and about two-thirds of its colour range can be satisfactory described by power law formula [5].

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