# TOWARD THE STRUCTURING OF MEANINGS OF THE MEXICAN DAY OF THE DEATH RITUAL, UNDER A COMPLEX SYSTEMS APPROACH

Berna L. Valle-Canales, Oswaldo Morales-Matamoros, Isaías Badillo-Piña, Ricardo Tejeida Padilla, Ignacio Peón Escalante. [1]

## ABSTRACT

The objective of ethnographic work has among its objectives to describe human behaviour in society and the ways in which social institutions are structured. Therefore, describing the inverse processes is a fundamental part of ethnography, i.e. the effects of social institutions on the human behaviour and the consequences of social behaviour could change or remain in social institutions. The mathematical modelling of changes and continuities in social institutions is one of the issues for the hard sciences and social sciences subjects. In this paper we present to the reader a proposal to formalize the structure of one of the Mexican social institutions phenomenon called "The Mexican Day of the Death Ritual".

The Ritual of Deaths in Central and Southern Mexico has certain qualities that have been transmitted from generation to generation through Sign Systems under rules and patterns of communication-restricted interaction, these systems are called social institutions, they will be understood from the Systemic Science comparable to regular lattices and complex network. Such as the interaction of human groups in shared social spaces like public squares and cemeteries realize connectivity between individuals in the form of long-range connections or random long-range connections.

The combined use of two types of networks (local and random) to model Complex Systems of Human Activity is called small world networks. Essentially the topological connection from a logic of classes can be supplemented regularly where the probability (p) is $p = 0$, or completely random where $p = 1$. However, the threshold of interest for social topological space networks is intermediate between 0 and 1: $0 > p > 1$.

Through Ashby's Law of requisite variety, describes the qualitative-quantitative properties that are governing the internal structure of the network, and the description of network changes. The objective to observe this critical site under the Law of Requisite Variety is to test whether the postulate of Ashby can be applied to conscious systems (human acts and vital systems), i.e., testing whether the relationship that serves as the regulator (power law) acts to limit the outcome to a particular subset of variables, or to maintain some variables within certain limits, or even to hold some variables constant.

According to the proposal of K. Wilber (2000) conscious systems are quantitative and qualitative, in such a way that the most complex system includes the simplest system

[1] Address, Email: bvallec1200@alumno.ipn.mx, omoralesm@ipn.mx, ibadillop@ipn.mx, ignaciopeon@gmail.com, texpa80@yahoo.com.mx

(components, relationships and emergent properties). Based on this perspective, the qualitative dimension is an emergent property of systems that handle conscious interpretative contextual information, something that is not considered in Ashby's law.

Finally, this article will help to understand how the cultural and spiritual heritage is transmitted through time.

## INTRODUCTION

Network theory applied to social phenomenon has the aim to understand and characterize human behaviour through subject's interaction (Miritello, 2013). To accomplish this goal, the research focus is in the topological aspects of the network as well as the temporal patterns of communication. That is, the effort on the human interaction, the human behaviour, and characterizes *culture patterns* as information spreading phenomenon (Barabási & Albert 1999; Strogatz, 2001; Sahimi, 2009; Watts & Sttrogatz, 2001; Weigt & Barrat, 2000).

This proposal is a previous step to the information-spreading phenomenon. The portrayal that we suggest is grounded in a simple representation of undirected directed and mixed graphs, which allows visualising the qualitative features of a network. Afterward, to interpret the graph, possible models of mathematical depiction are presented like a power law probability distribution.

The case presented is the result of anthropological method named *ethnohistory* and was applied from a systemic approach to one of the most shared rituals of contemporary cultures in Mexico, it is The Day of the Dead. Such kinds of systems are social and technical phenomena, called by System Science *socio-technical systems,* and them can be studied and developed through Soft System Methodologies.

Therefore, the following research is structured as transdisciplinary methodology and we used the Soft System Methodology (SSM) for human activity systems (Checkland, 2000, 2012).

The first part describes the problem situation unstructured, the domain knowledge of anthropology and ethno-semiotics, and how is this encounter of systems science with anthropology. Next, the goal is to express, in brief, the problem of cultural interpretation and alternatives from the systemic view.

After identifying the problems of anthropological interpretation, the activities of Science Systems arise. First it's presented the data structure, then it's introduces the concepts: *feedback, Law of Requisite Variety, power law* and *networks* like general principles by which anthropology and science systems share common endeavours. In the third part it is presented an approach from the existing models of networks applied in social phenomenon, and then we present a particular proposal to characterizer the ritual. Finally it is presented the discussions and recommendations after application.

## PART I. SCIENCE SYSTEMS AND ANTHROPOLOGY: THE KNOWLEDGE DOMAIN

This work born in the Seminary of "Semiotics of the Image and Visual Anthropology" form the *Instituto Nacional de Antropología e Historia* (INAH). Therefor, this paper it is an accomplishment of determination from transdisciplinary group consisting in ethnographers, physical anthropologist, communicologists, engineers and scientists in complex systems, language researcher and the people from rural communities in Mexico City.

The first dare was to find a common knowledge domain. Explicitly, science systems mentioned at least three domains of knowledge than correspond to the kingdoms of evolution: (1) the domain of systems or human activity conscious, (2) the domain of living systems and (3) the domain of non-living systems (Laszlo, 1996). This occidental conceptualization comes from the philosopher Pierre Teilhard de Chardin, who talks about the complexification-conscientization of systems through the evolution.

Network models have a range of applications in these knowledge domains: random[2] and local networks[3] are used to describe behaviours in the order of non-living and living systems, random networks are employ to explain behaviours in the order of living and non-living systems, and complex networks finally combined with local and random networks correspond to the realm of human systems and conscious activity[4].

The interest in the different domains of knowledge of systems science is related to aspects of information *i, e* energy and matter *m* (Wilber, 2000). Toward the terms, which the network theory uses to define, a network, *as a set of nodes and their edges*, in social science words correspond to a set of states of the things and their process. The *object*s are actually *states of the thing* in different ways, which are according to the perspective of study as we see in next scheme.

| | **Human Systems** | **Living Systems** | **Non Living Systems** |
|---|---|---|---|
| **States** | *information* | *energy*<br>*matter* | *matter* |
| **Process** | *information* | *information* | *information*<br>*energy* |

In this way, social systems are included in the domain of human systems in which the objects of knowledge are states of information and relationships defined by information. To understand these topics we use the semiotic definition of sign that is on the *General Science of Nature of Signs* by Charles Sanders Peirce (1994).

2 The random network with N nodes linked for n edges whose probability distribution is N *(N-1)/2, were characterized first by P. Erdös & A. Rény (1959).

3 We refer to networks to characterize local events, A. Barabási and R. Albert (2002) explain: "For many real networks the nodes have a finite lifetime (for example, in social networks) or a finite edge capacity (Internet routers or nodes in the electrical power grid). Recently several groups have addressed the degree to which such constraints affect the degree distribution" (2002: 80).

4 According to Wasserman (1994) Network Theory applied to Social Sciences have tree special features: componential, relational and structural proprieties. The first one refers to graph topology, connectivity percentage and the clustering coefficient. Second one is associated to actor-agent relationship. The third feature is related to the emergence of new patterns or graph.

From this perspective, we can call the framework of the paper the *ethnosemiotic view* and it has the principle that: a conscious system increases its complexity as its objects corresponding to the growth of information states and relationships as soon as information process increase it.

This behaviour could be explained across their objects and other relationships that emerge from a mix from another objects and relationships grounded in the domain of information; Peirce named this process infinite semiosis and it is a type of feedback.

According to the semiotics of Peirce (1994), a sign is determined by an object-item and mind-power-someone through an idea in the mind called *interpretant*. So, that in the world of symbolic representations takes, at least, three entities forms: The **object** or a state of one thing, that correspond to the order to the material ***m***; the **interpretant** or the signs in someone's mind and memory based in neurochemistry functioning, it corresponds to the order of energy ***e*** and matter ***m*** at the same*;* and finally the *symbolic representations* or the **vehicle of the sign**; these symbolic world is not only in our brains, is emerging in the space of social institutions (see below Image 1), in the complex interactions between transformation of matter and energy across the information; it corresponds to the order of information ***i***.

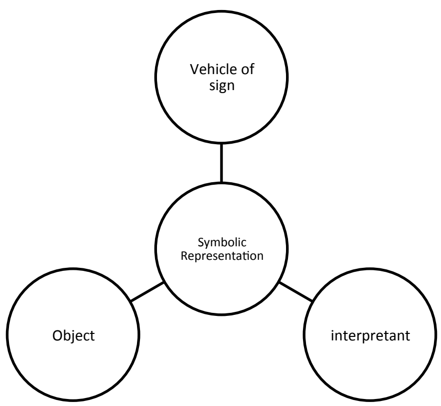



Image 1. Semiotic Triad

*The problems of cultural interpretation*

The mortuary ritual in Mexico has an origin in antiquity dating back to 1000 years ago in the archaeological record (Matos, 2009) and 500 years in colonial records (Sahagun, 1560).

In the Mestizo Cultures were created traditions, such Day of the Dead or Day of the All Souls Saints, that kind of rituals have been emerging in a multicultural context, blending into local and global characteristics. Today some traditions are unique, others remain mixed or change slowly and others become extinct gradually.

These phenomena evoke a complex field research, the elements are diverse, the process of change is dynamic and the structure of ethnographic and historic datum cannot be examined under the microscope of a formalist view as those in hard science and engineering analysis.

Mexican researchers in the field, have explored the concepts *long-lived* elements and the *continuity* of prehispanic elements in contemporary ritual, these elements are keys to understand the Mesoamerican worldview in the past and the present (López, 1999; Matos, 1999; García, 1999; Cabrera, 1999; Román & López, 1999; Malvido, 1999; Scheffler, 1999; Báez, 2011; Duverger, 1984, 1987). The features of these historical, archaeological and ethnographic researches are that they are descriptive, in some cases based on the hermeneutic induction, or deductive approaches. The essays based on a hermeneutic perspective, agree that much of the information disclosed is based on the degree of knowledge of the researchers on the topic. The consideration on prehispanic studies originates from the lack of formal structure to interpret these phenomena, as sometimes it get to complete aspects of past culture as closer to the vision of the researcher to vision of the culture in question.
The alternative of this study is the hypothesis that the universal property shared by the symbolic representations across history time -due, which it is possible, have and reliable certainty in the order of the interpretation of the data- is the statistical distribution between them. The statistical distribution of symbolic representation manifests itself through a power law as Zipf's Law. This is a heavy-tailed distribution and can be assumed to have fractal properties.

## PART II. DATA STRUCTURE

The research data correspond to the work period of November 2012 to December 2013. There are different types of ethnographic data which were collected for three teams: the first team from the *INAH* collected data in the market of Ozumba, State of Mexico on November 29 2013 (Mora et. al., 2014), the second group at *Del Mar University* from Oaxaca, collected data on the municipal market in the Oaxaca City and the town of Etla, Oaxaca (Murillo & Del Rio, 2014). Finally, the third group from the *IPN*, collected data intermittently from November 2012 to December 2013 in the village of Santiago Zapotitlan from the town of Tlahuac in Mexico City.

The method for data recollection was aimed to construct the initial lattice of the network in the form of a local cluster (Figure 1) based on the traditional scheme of structure kinship (Yanagisako & Collier, 1996) (Figure 2).

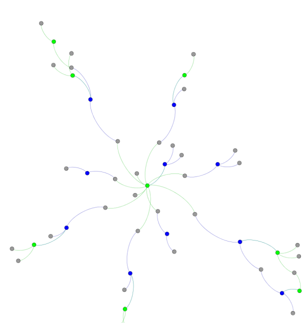


**Figure 1. On the left side, it represents a no- directed graph to outline a kinship structure. The blue and green nodes characterize relationships between persons, and grey nodes the people. Blue nodes are affinity relationship, and green nodes are consanguinity relationship.**

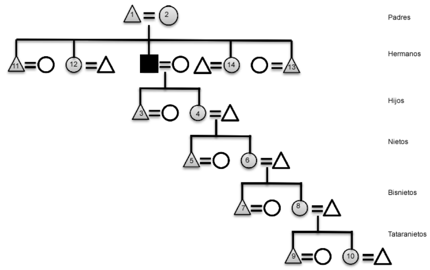



**Figure 2. On the right side, double lines symbolize affinity and consanguinity relationship. It is a traditional scheme in kinship theory.**

The vertices far away from the core cluster –a green node in Figure 1-, correspond to the current children generation i.e. those with greater cultural contact with less traditional social forms.

The decision that the structures were the *lattice start* is founded in the idea of egocentric network (Wasseman, 1994) because the source node was focused on an individual of the family called Ego. But when were started to apply the model, it was discussed in the research group than the core of kinship network is not Ego, actually is the affinity or consanguinity relationship between Ego and the other nodes (Morgan, 1871; Dziebel, 2006; Fortes, 1949), thus there are some differences between social networks analysis and this approach.

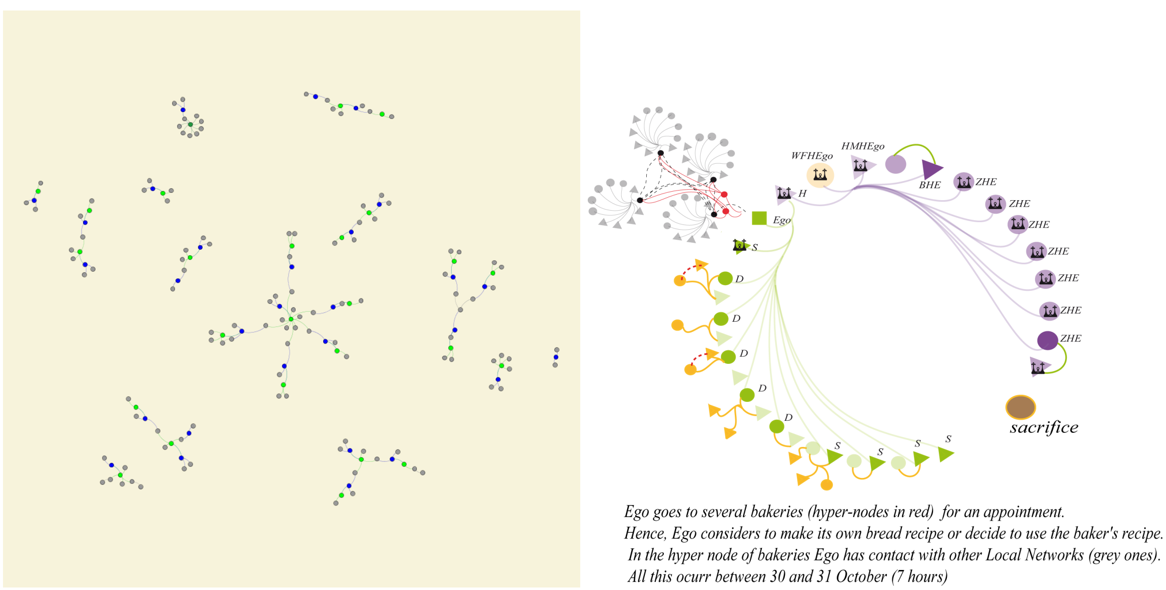



**Figure 3. In the scheme of the left they are twelve undirected graph of kinship structure from data families; on the right there is a circular layout of the kinship structure in a directed form, from Ego.**

In the social system, relationships are a class of objects and knowledge; the social phenomena are clustered in acts and objects between persons. Therefore, there were considered three clusters of nodes: agent nodes, patient nodes, and relationship nodes (Figure 4). The most important relationships in kinship are consanguinity and affinity, there were draw in green and blue reciprocally (Figure 3).

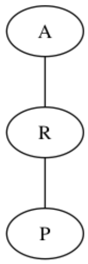



**Figure 4. The three clusters of nodes in the social system.**

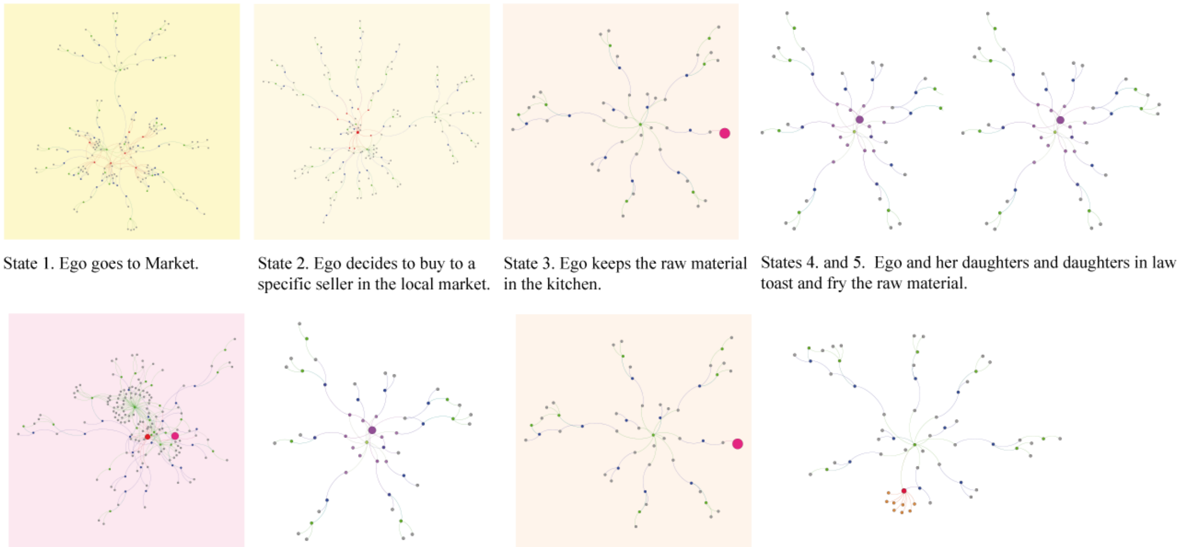
Mathematical simulation generates random nodes and links, in our case the start lattice nodes correspond to a state of social life form. The end lattice nodes correspond to the dead relatives.

The first approach -the relationships focused on Ego- allowed to observe aspects of diffusion and expansion of meaning and information from one node another in a sort of spreading phenomenon from a source. The target of this type of Data Structure is to estimate a regular lattice, but the real network is not regular, because in the natural interaction between human there is a lot of feedback, change of meaning and transformation of first idea to final idea. Essentially, the kinship structure is approximate to a regular dimension lattice.

Another difference is the timeline. A dynamic network requires a time to count discrete magnitudes in discrete scales. But social phenomenon features are not limited by a discrete numerical magnitude or geometrical magnitude; Benôit Mandelbrot (Apostel et. al., 1975) defines the observation scale in two forms: (A) The mathematical theorems like Thermodynamic issues, represent a limits by a *phase space* in Euclidian language; but (B) the natural language limits are defined by logical *trees*, today directed graphs; hence the social phenomenon like language have a logical limit, and physical phenomenon have a mathematical or geometrical limit (Apostel, 1957).

Mandelbrot's work of Zipf's law, tries to explain the nature of language across quantitative models, and the first step was to define the limit of measure scale. The limit was the text analysed. In that way the magnitude of language units are words, sentences, lines, paragraphs, chapters, or in other sense the *discourse parts*. The Zipf's law analysed the frequency between the most little of these units, that are the words, and the power law distribution remarks a probabilistic distribution with the form of harmonic number (Hn).

Consequently, with the help of semiotics, it was decided to consider the *ritual* like a unit of discourse and their parts. The social networks were associated to each of the objects in the final familiar sanctuary. In this sense, the directed relation between nodes was not relevant hence the graph changes to no-directed graph, and each of the network was defined by the states of changes of each object. By example, the "mole Network" has nine states of the network: from the seeds of raw material until it has become the ritual "*mole"* object (Figure 5).



State 1. Ego goes to Market.

State 2. Ego decides to buy to a specific seller in the local market.

State 3. Ego keeps the raw material in the kitchen.

States 4. and 5. Ego and her daughters and daughters in law toast and fry the raw material.

State 6. Ego takes the raw material to the Mill..

State 7. Ego and her daughters and daughters in law cook the mole.

State 8. Ego puts the mole in the sanctuary.

State 9. The Dead parents (in orange) come across the sanctuary objetcs.

**Figure 5. Observation scales in the ritual. The "mole Network" represents the transformation states of the network *mole*.**

It was outlined in ten *object network states (oNet)*: water, *copal (*incense*)*, fruit, *petate*, *mole*, objects of the dead, bread, salt, flower of dead and candles. It was found that the limits of relation in the *oNet* were spaces of human interactions well-defined like the local market, the mill, the kitchen, the cemetery, the family sanctuary, the bakery, and the harvest land. In this way the observation scale to measure the connectivity network was the set of activities in this spaces.

Finally, it encountered recursive behaviour in the activities.

Comparing the ten networks, we label each of the states of ritual discourse with a particular name; and those states which an identical network topology were labelled with the same name. This methodology helps understand the complex nature of social phenomena from the network structure. Based on theses network structures, there were development matrix structures, which defined the Data Structure about the ritual. This Data Structure has a sequence of basic items (in this case the activities through the ritual process), which can be combined in several ways. These combinations are the bases of the syntax in human language. Therefor, a Zipf's law can model the activities combination.

## PART III. A FORMAL EXPLANATION OF THE RITUAL

Throughout a power law distribution like Zip's law, it was tried to show that the Law of Requisite Variety of the ritual system is based on emergence patterns; these patterns are the frequency of the object network's common states.

So that the proposed model to explain in a formal way in *The Mexican Day of the Death Ritual* is the Zip's law. This model was applied as follows: At the beginning are the set of states of the network (1) and the set of their activities (2); all states and their activities are interacting in a specific ways (3), generating a great variety of possible states of the system. Despite these interactions the hub (Ego or the matriarch) most do activities if not the networks disappear.

(1) $R = \{r_1, r_2, r_3, \dots, r_{ij}\}$
(2) $D = \{d_1, d_2, d_3, \dots, d\}$
(3) $\mathrm{Z} = \{\mathrm{z}_{11}, \mathrm{z}_{12}, \mathrm{z}_{13}, \dots, \mathrm{z}_{\mathrm{ij}}\}$

Ross Ashby (1958) proposed a model to define the variety (many possible states) of a system due to external disturbances. At the Ashby's model, the inputs and outputs were characterized like "a set D of disturbances di can be met by a set R of responses $r_j$. The outcomes provide a table or matrix in which each cell shows an element $z_{ij}$ from the set Z of possible outcomes" (Ashby, 1958) (see Table 1).

In Table 1 it is show the binary matrix constructed from the non-linear interactions between the disturbances and responses of the system. In this work the Ashby model was applied to construct a metalanguage about the ritual discourse, in order to identify whose states that are repeated independently of the activities, which are combined. These states can be supposed as the emergent patterns. One way to identify these patterns is to determining the frequency of the states that are more repeated.

| | | R | | | |
|---|---|---|---|---|---|
| | | $r_1$ | $r_2$ | $r_3$ | … |
| | $d_1$ | $z_{11}$ | $z_{21}$ | $z_{31}$ | … |
| | $d_2$ | $z_{12}$ | $z_{22}$ | $z_{32}$ | … |
| D | $d_3$ | $z_{13}$ | $z_{23}$ | $z_{33}$ | … |
| | $d_4$ | $z_{14}$ | $z_{24}$ | $z_{34}$ | … |
| | … | … | … | … | … |

**Table 1. It is show the binary matrix constructed from the non-linear interactions between the disturbances and responses of the system**

In the Table 2 (Annexes 2) are shown the combination between every state in the network, with different activities, in Table 3 (Annexes 2) are shown the frequencies if the sates, activities and their combinations.

The total states in the network of The Mexican Day of the Death Ritual shown in (4), the total labelled activities are in (5), the frequencies of states are in (6), the frequencies of activities (7) and the combinatory frequencies are in (8) in Annexe 2.

The rank frequency (k) of states (ks), activities (ka) and their combinations (kc) are defined in the next way (9), (10) and (11) respectively in Annexe 2.

The Zipf's law predicts that out of a population of N elements, the frequency of elements of rank $k, f(k; s, N)$ is: $f(k; s, N) = \frac{1/k^s}{\sum_{n=1}^{N}\left(\frac{1}{n^s}\right)}$

Nevertheless, the relationship founded in the data ritual is not like the harmonic series (Hn) in Zipf law. Hypothetically if Zipf's law or some like this applied in a simulated scenario with the frequency data obtained in this work and another rituals, the possible outputs of relationships in binary matrices and application of the law would be interpreted at follows: if $z_{ij}$ and $k$ is equal to cero it 0 be interpreted as non-existent qualitative activities in the ritual, if $z_{ij}$ and $k$ is equal to 1 it means that the combination of this data state (i) with data activity (j) is only for that ritual; if $z_{ij}$ tends to 0, it refers to the most frequent network state in all rituals and it is share in many rituals, i. e. we can talk about the pattern emerging in all rituals.

### *Discussion and application*

According to the scope of complex network and control, "a dynamical system is controllable if it can be driven from any initial state to any desired final state within finite time" (Jia et. al., 2013). However, the empirical data of the ritual The Mexican Day of the Death Ritual, firstly shown that social networks are not directed, most of the relationships are undirected and have a lot of feedbacks of information, and the time series are not relevant as states scenarios.

The meanings of the rituals objects have many transformations in each step, and these changes of states are the result of a personal decision. But the personal decision associated to the next link of the node is not totally random; the space of decision is a space of equiprobability with a limit, space scenarios limits, but the limit is not temporal or geometrical, but is a logical limit like the Mandelbrot's limits for language (Apostel, et. al., 1957). Accordingly, in this work is proposed to apply the Zip's law for explaining in a formal way the dynamics of rituals.

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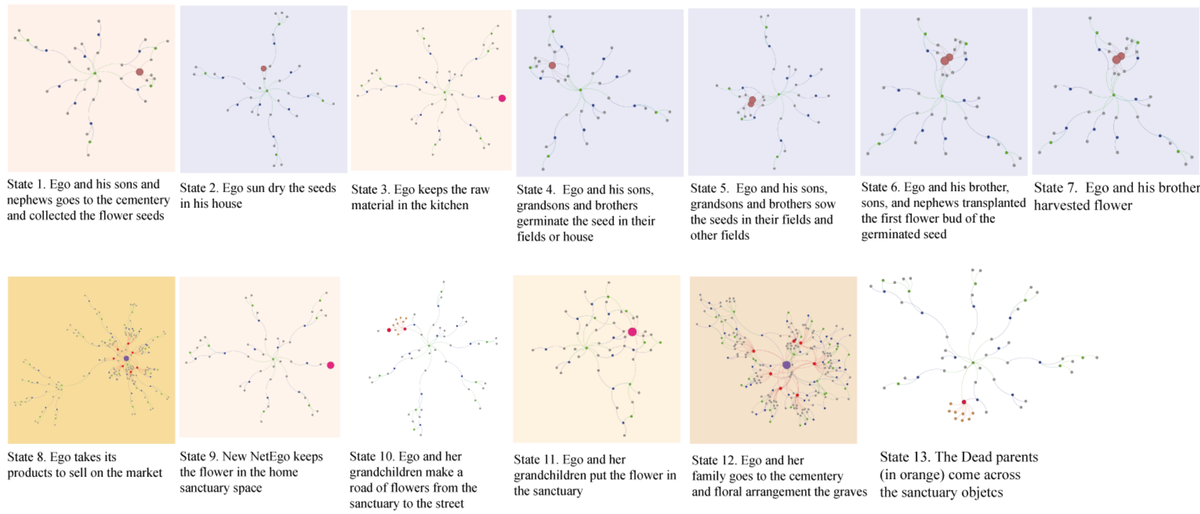
## Annexe 1 Object Network Images



State 1. Ego and his sons and nephews goes to the cementery and collected the flower seeds

State 2. Ego sun dry the seeds in his house

State 3. Ego keeps the raw material in the kitchen

State 4. Ego and his sons, grandsons and brothers germinate the seed in their fields or house

State 5. Ego and his sons, grandsons and brothers sow the seeds in their fields and other fields

State 6. Ego and his brother, sons, and nephews transplanted the first flower bud of the germinated seed

State 7. Ego and his brothers harvested flower

State 8. Ego takes its products to sell on the market

State 9. New NetEgo keeps the flower in the home sanctuary space

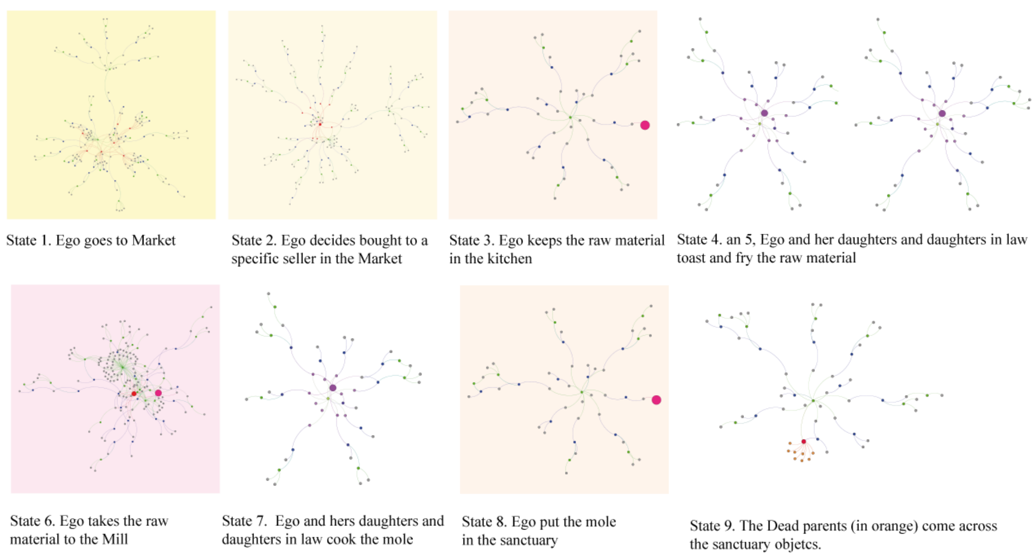
State 10. Ego and her grandchildren make a road of flowers from the sanctuary to the street

State 11. Ego and her grandchildren put the flower in the sanctuary

State 12. Ego and her family goes to the cementery and floral arrangement the graves

State 13. The Dead parents (in orange) come across the sanctuary objetcs

Image 1. oNet flower states. In this image the activity of planting *flower dead* shown, since the seed is collected in the cemetery until it is harvested and placed in the offering. This group of activities have the duration of 360 days, so it is the control group. From states network "oNet flowers" have started to label the rest of the group's activities. Red node is the physical space in which activities occur and is manifested as a Hub when carried out activities.



State 1. Ego goes to Market

State 2. Ego decides bought to a specific seller in the Market

State 3. Ego keeps the raw material in the kitchen

State 4. an 5, Ego and her daughters and daughters in law toast and fry the raw material

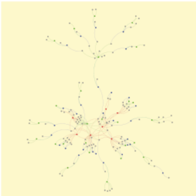
State 6. Ego takes the raw material to the Mill

State 7. Ego and hers daughters and daughters in law cook the mole

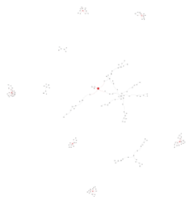
State 8. Ego put the mole in the sanctuary

State 9. The Dead parents (in orange) come across the sanctuary objetcs.

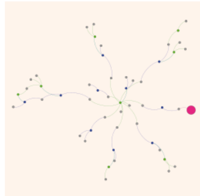
Image 2. oNet Mole states.



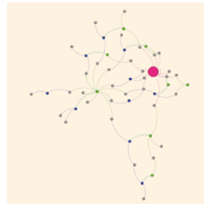
State 1. Ego goes to Market



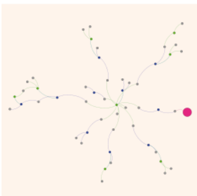
State 2. Ego decides bought to a specific seller in the Market



State 3. Ego keeps the candles in the kitchen

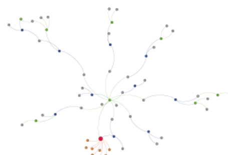


State 4. Ego and her grandchildrens put the candles in the sanctuary



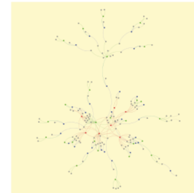
State 5. Ego lights the candles

State 6. Ego and the family waits that the dead come to home viewing the light of candles



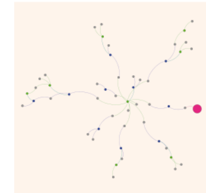
State 7. The Dead parents (in orange) come across the sanctuary objetcs

Image 3. oNet Candle states

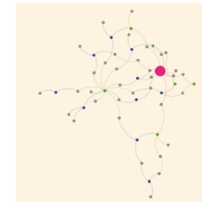


State 1. Ego goes to Market

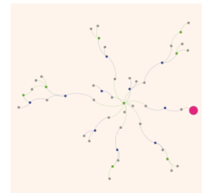
State 2. Ego decides bought to a specific seller in the Market



State 3. Ego keeps the copal in the sanctuary space



State 4. Ego and her grandchildrens put the copal in the sanctuary

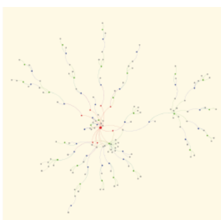


State 5. Ego lights the copal

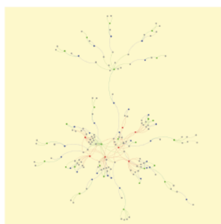
State 6. Ego and the family waits that the dead come to home smelling the copal and flowers.

State 7. The Dead parents (in orange) come across the sanctuary objetcs.

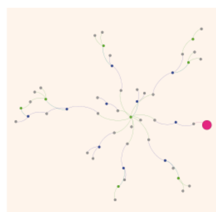
Image 4. oNet Copal states



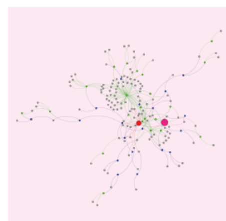
State 1. Ego makes an appointment at a village bakery



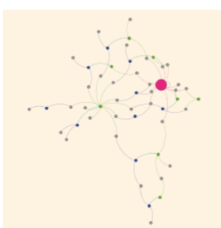
State 2. Ego goes to the local market and buy the raw material



State 3. Ego keeps the raw material in the kitchen



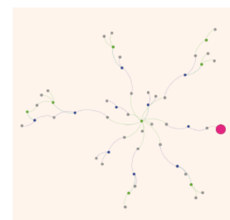
State 4. Ego takes the raw material to the bakery to be prepared "pan de muerto"



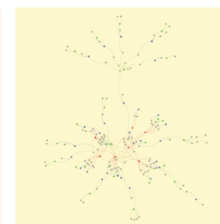
State 5. Ego and her grandchildren put the bread in the sanctuary

State 6. The Dead parents (in orange) come across the sanctuary objetcs

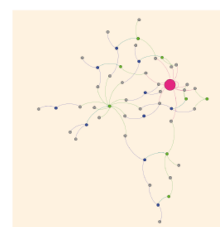
image 5. oNet Bread states



State 1. Ego clean the space for the sanctuary and the backpack



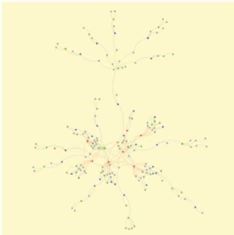
State 2. Ego goes to the market and buy a backpack



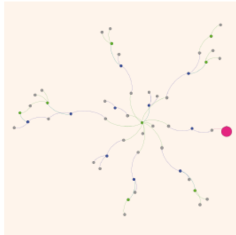
State 3. Ego and her grandchildrens put the backpack and clean the table for the family altar-oblation

State 4. The dead relatives (in orange) come across the sanctuary objetcs

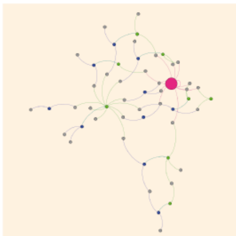
Image 6. oNet Petate



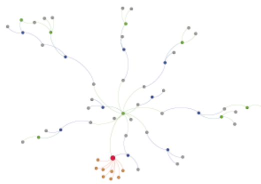
State 1. Ego goes to the market



State 2. Ego keeps the fruit in the kitchen

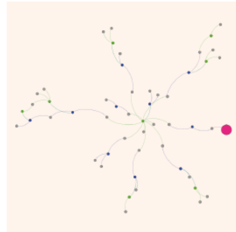


State 3. Ego and her grandchildrens put the fruit in the sanctuary

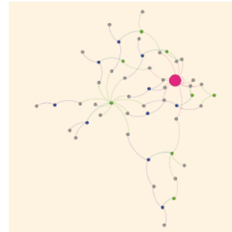


State 4. The dead relatives (in orange) come across the sanctuary objetcs

Image 7. oNet Fruit

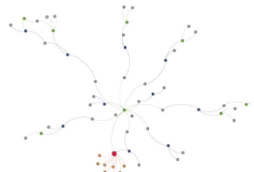


State 1. Ego takes water from the kitchen



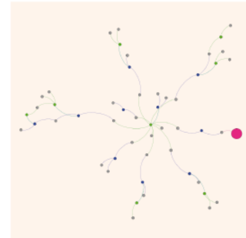
State 2. Ego and her grandchildrens put the water in the sanctuary

State 3. Ego and the family waits than the deads come and stay in home quenching his thirst.

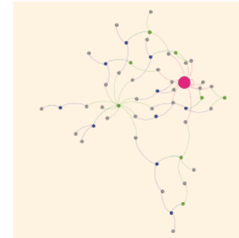


State 4. The dead relatives (in orange) come across the sanctuary objetcs

Image 8. oNet water states

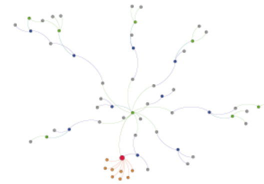


State 1. Ego takes the salt from the kitchen



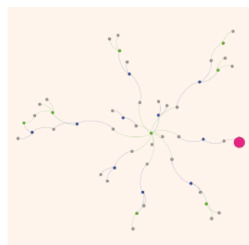
State 2. Ego and her grandchildrens put the objects in the sanctuary

State 3. Ego and the family waits than the deads come to home and use the salt

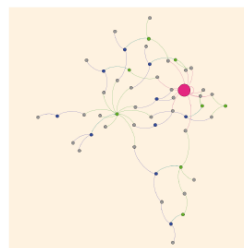


State 4. The dead relatives (in orange) come across the sanctuary objetcs

Image 9. oNet salt states



State 1. Ego keeps the object's deads parients



State 2. Ego and her grandchildrens put the objects in the sanctuary

State 3. Ego and the family waits than the deads come to home and use their things

State 4. The dead relatives (in orange) come across the sanctuary objetcs

Image 10. oNet dead object's states

Annexes 2

| *oNet* | *States of the Network* | *Activities of the ritual* |
|---|---|---|
| *1. flower* | $r = \{r_1, r_2, r_3, r_4, r_5, r_5, r_5, r_6, r_3, r_4, r_1, r_7, r_8\}$ | $d = \{d_1, d_2, d_3, d_4, d_5, d_6, d_7, d_8, d_9, d_{10}, d_{11}, d_{12}, d_{13}\}$ |
| *2. mole* | $r = \{r_6, r_9, r_3, r_{11}, r_{11}, r_{10}, r_{11}, r_3, r_8\}$ | $d = \{d_8, d_{14}, d_{15}, d_{16}, d_{17}, d_{22}, d_{17}, d_{18}, d_{13}\}$ |
| *3. Candle* | $r = \{r_6, r_9, r_3, r_1, r_3, r_4, r_8\}$ | $d = \{d_8, d_{14}, d_{15}, d_{11}, d_{18}, d_{19}, d_{13}\}$ |
| *4. copal* | $r = \{r_6, r_9, r_3, r_1, r_3, r_4, r_8\}$ | $d = \{d_8, d_{14}, d_{15}, d_{11}, d_{18}, d_{19}, d_{13}\}$ |
| *5. bread* | $r = \{r_9, r_6, r_3, r_{10}, r_1, r_8\}$ | $d = \{d_{20}, d_8, d_{15}, d_{21}, d_{11}, d_{13}\}$ |
| *6. Petate* | $r = \{r_3, r_2, r_4, r_8\}$ | $d = \{d_{18}, d_8, d_{11}, d_{13}\}$ |
| *7. Fruit* | $r = \{r_6, r_3, r_1, r_8\}$ | $d = \{d_8, d_{15}, d_{11}, d_{13}\}$ |
| *8. wáter* | $r = \{r_3, r_1, r_4, r_8\}$ | $d = \{d_{18}, d_{11}, d_{19}, d_{13}\}$ |
| *9. salt* | $r = \{r_3, r_1, r_4, r_8\}$ | $d = \{d_{18}, d_{11}, d_{19}, d_{13}\}$ |
| *10. object's dead* | $r = \{r_3, r_1, r_4, r_8\}$ | $d = \{d_{15}, d_{11}, d_{19}, d_{13}\}$ |

| | ***Outputs*** |
|---|---|
| *1. flower* | $z = \{z_{11}, z_{22}, z_{33}, z_{44}, z_{55}, z_{56}, z_{57}, z_{68}, z_{39}, z_{410}, z_{111}, z_{712}, z_{813}\}$ |
| *2. mole* | $z = \{z_{68}, z_{914}, z_{315}, z_{1116}, z_{1117}, z_{1022}, z_{1117}, z_{1218}, z_{813}\}$ |
| *3. Candle* | $z = \{z_{68}, z_{914}, z_{315}, z_{111}, z_{318}, z_{419}, z_{813}\}$ |
| *4. copal* | $z = \{z_{68}, z_{914}, z_{315}, z_{111}, z_{318}, z_{419}, z_{813}\}$ |
| *5. bread* | $z = \{z_{920}, z_{68}, z_{315}, z_{1021}, z_{111}, z_{813},\}$ |
| *6. Petate* | $z = \{z_{318}, z_{28}, z_{411}, z_{813}\}$ |
| *7. Fruit* | $z = \{z_{68}, z_{315}, z_{111}, z_{813}\}$ |
| *8. wáter* | $z = \{z_{318}, z_{111}, z_{419}, z_{813}\}$ |
| *9. salt* | $z = \{z_{318}, z_{111}, z_{419}, z_{813}\}$ |
| *10. object's dead* | $z = \{z_{315}, z_{111}, z_{419}, z_{813}\}$ |

Table 2. It is shown the combination between every state in the network, with different activities and their outputs.

Frequencies of states (r), activities (d) and their combinations (z)

| | $r_1$ | $r_2$ | $r_3$ | $r_4$ | $r_5$ | $r_6$ | $r_7$ | $r_8$ | $r_9$ | $r_{10}$ | $r_{11}$ | $r_{12}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fq | 9 | 2 | 12 | 8 | 3 | 6 | 1 | 10 | 4 | 2 | 3 | 1 |

| | $d_1$ | $d_2$ | $d_3$ | $d_4$ | $d_5$ | $d_6$ | $d_7$ | $d_8$ | $d_9$ | $d_{10}$ | $d_{11}$ | $d_{12}$ | $d_{13}$ | $d_{14}$ | $d_{15}$ | $d_{16}$ | $d_{17}$ | $d_{18}$ | $d_{19}$ | $d_{20}$ | $d_{21}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fq | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 7 | 1 | 1 | 9 | 1 | 10 | 3 | 6 | 1 | 1 | 6 | 5 | 1 | 1 |

| | $z_{11}$ | $z_{22}$ | $z_{28}$ | $z_{33}$ | $z_{44}$ | $z_{55}$ | $z_{56}$ | $z_{57}$ | $z_{68}$ | $z_{39}$ | $z_{410}$ | $z_{411}$ | $z_{111}$ | $z_{712}$ | $z_{813}$ | $z_{914}$ | $z_{315}$ | $z_{1116}$ | $z_{1117}$ | $z_{1218}$ | $z_{318}$ | $z_{419}$ | $z_{920}$ | $z_{1021}$ | $z_{1022}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fq | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 6 | 1 | 1 | 1 | 8 | 1 | 10 | 3 | 6 | 1 | 2 | 1 | 5 | 5 | 1 | 1 | 1 |

Table 3. It is shown the frequencies (Fq) of states of the network, activities of the ritual and their combinations.

(4) $\mathrm{R} = \{\mathrm{r}_1, \mathrm{r}_2, \mathrm{r}_3, \mathrm{r}_4, \mathrm{r}_5, , \mathrm{r}_6, \mathrm{r}_7, \mathrm{r}_8, \mathrm{r}_9, \mathrm{r}_{10}, \mathrm{r}_{11}, \mathrm{r}_{12}\}$

(5) $D = \{d_1, d_2, d_3, d_4, d_5, d_6, d_7, d_8, d_9, d_{10}, d_{11}, d_{12}, d_{13}, d_{14}, d_{15}, d_{16}, d_{17}, d_{18}, d_{19}, d_{20}, d_{21}, d_{22}\}$

(6) $R_{fq} = 12,10,9,8,6,4,3,2,1$

(7) $D_{fq} = 10,9,6,5,1$

(8) $Z_{fq} = 10,8,6,5,3,2,$

(9)

$$ks = \left(12 - \left(1 - \frac{n}{n}\right)\right) - \sum_{n=2}^{n=9} 2\frac{n}{n} - \sum_{n=3}^{n=9} \frac{n}{n} - \sum_{n=5}^{n=9} 2\frac{n}{n} - \sum_{n=7}^{n=9} \frac{n}{n}$$

(10)

$$ka = \left(10 - \left(1 - \frac{n}{n}\right)\right) - \sum_{n=2}^{n=5} \frac{n}{n} - \sum_{n=3}^{n=5} 3\frac{n}{n} - \sum_{n=4}^{n=5} \frac{n}{n} - \sum_{n=5}^{n=5} 4\frac{n}{n}$$

(11)

$$kc = \left(10 - \left(1 - \frac{n}{n}\right)\right) - \sum_{n=2}^{n=7} 2\frac{n}{n} - \sum_{n=3}^{n=7} \frac{n}{n} - \sum_{n=4}^{n=7} 2\frac{n}{n} - \sum_{n=5}^{n=7} \frac{n}{n}$$