Chapter 4
Digital Ethnography Theories, Models and Case Studies

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Abstract The ethnography is a non-standard methodology utilized to study the culture and the interactions of social actors in a cultural context. With the development of the Web were born the first ethnographic applications to the cyberspace and currently this methodology has not yet defined a methodological framework and has taken different labels: Virtual Ethnography, Ethnography Network, Ethnography digital (Murthy, Sociology 42:837–855, 2008) and Netnography (Kosinets, Netnography: The Marketer's Secret Weapon. How Social Media Understanding Drives Innovation, 2010). The aim of this chapter is to define the boundaries of digital ethnography. Finally, with the help of the comparison between empirical cases we will try to understand which are critical points, limits and research prospects for digital ethnographers.

Keywords Digital ethnography · Cyberspace · Social network analysis · Fuzzy system · Big data

4.1 Background: What's Cyberspace?

The aim of this section is to understand dimension, ontological, methodological and applicative of digital ethnography. The starting point is the study of the cyberspace. The cyberspace is the space between two or more technological tools while a conversation is taking place. It began as an electric wire and evolves into a world.

However cyberspace cannot be considered a world unto itself, because it is in constant interrelation with the real world. The process of interaction between the dimension *on* and *off line* is the heart of the Network Society (Castells 2002).

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This information age has never been a technological matter. It has always been a matter of social transformation, a process of social change in which technology. And it's an element that is inseparable from social, economic, cultural and political trends.

The Network Society defined by Castells (2002) is divided according to the interaction of four dominant cultural contexts: techno-elites, virtual communities, hacker and businessmen (Castells 2001).

Tecno-elites is the culture of academia classics, within which the goodness of technological artefacts is placed as the supreme value and the relevance of the discovery evaluated in terms of its social utility.

This form of culture is essential for the birth of the web. In fact, the Internet is a product of the American scientific circles.

The hacker culture (Hošková-Mayerová and Rosická 2015) is supported by aggregate values, and is characterized by a strong sense of community is evident in the establishment of informal institutions. The community of Linux developers is one concrete example. In fact, it appears as a well-defined circle of users that, in addition to cooperate spontaneously to the Linux projects, share the system of values that constitutes the world of Free Software.

Internet entrepreneurs were the first to understand the economic potential of the Web since the early investment in dotcom to Big Data's boom. But by themselves, from the culture that distinguishes them, they could never create a basic support for networking and communication. However, their contribution was, and is essential for the many cultural dynamics that gave rise to the Internet (Castells 2006).

Social groups that generate in the network when some people take part constantly in public debates and start interpersonal relationships in the cyberspace, which is considered the theoretical space where words, human relationships, data, wealth and power are expressed through the use of Internet.

These four cultural layers are arranged hierarchically: the techno-meritocratic culture is structured as a hacker culture by building the network rules and habits of cooperation on technological projects. The virtual community culture adds a social dimension to sharing technology, making the Internet a means of social interaction and selective membership symbolic. The entrepreneurial culture works on top of the Hacker culture and community culture, to spread the use of the Internet in all areas of the company as a means to make profits.

Without the techno-meritocratic culture, hackers would simply be a counter-cultural community specific computer experts a little 'set. Without the hacker culture, community networks on the Internet would not be different from many other common alternatives. Moreover, without the hacker culture and community values, entrepreneurial culture could not be characterized as a specific Internet.

Therefore, in the case of Web-mediated communication it is necessary to make some clarifications:

(1) is an act participatory; (Rainie and Wellman 2012)
(2) gives rise to connections on the basis of related content are also called "Network of Affinity";

(3) It leads to effective mobilization of expertise in terms of new ways of social action and community projects;
(4) It generates temporary zones of consensus based on unexpected alliances between users and concepts. (Lovink 2002)

In the light of these considerations about the complexity of the system and the dynamics of cyberspace, in the following sections will be explored the methodologies, skills and applications useful for study some digital social phenomena.

4.2 Methodology: How Can We Study the Cyberspace?

This field of research methodologically lends an application to ethnographic method. The ethnographic approach is a non-standard methodology that allows you to analyse the culture and the interactions of social actors in a given context. It is based on three basic actions of the human being: to observe, question and read that are accomplished through a set of tools based on direct observation of the phenomenon, in-depth interviews and use of documents (Corbetta 1999; Baysen et al. 2016).

The search field in cyberspace is suitable for application of ethnographic technique. In fact, it consists of virtual social interactions that unfold through different tools and different network but which, in fact, generate communication structures, representations of identity and culture real and shared (Murthy 2008).

In cyberspace, the search field is not clear but it must be investigated through a study of "digital tracks" of the research topic through all the structures of the Network (Social Media, Social Networks, Blogs, Wikis, web sites, search keywords)

Stages of research are divided into six phases:

- hidden observation, individuals in the community are observed and the researcher does not actively involved in the relationship dynamics of the network. This type of observation is also called *passive lurking* (Russo 2015; Russo 2016a, b, c);
- Detecting the presence of content involved;
- Crawling content: with crawling means a computer process by which you can download the contents of a computer database;
- Reconstruction of the relationship network: using open source software Gephi (Bastian et al. 2009) it's possible rebuild the network of relationships and analyse its contents;
- Analysis of "the traces of growth" (Corbetta 1999):
- Classification and ideal types.

These stages are not strictly defined but they must be designed ad hoc time after time. Besides the covert observation it's a very whole skill because it must carefully

plan and it's not possible use throughout. Indeed in some social fields the researcher needs a gatekeeper for to join in it (for example in Whatsapp's groups or in Facebook secret groups or in a closed forum). Instead in other cases the limits derives from legally protected areas and penetrable only by a legal agreement, which invalidates the observation covert.

Finally the method of passive lurking is only once of the social research tool for studying digital social realities.

The others phases of research, instead, are characterized by a multidisciplinary approach. In fact, digital ethnographic method get some skill from informatics and mathematical models. Crawling is an informatics skill that enables downloads of web contents from the Net (sites, forum, virtual communities, social network sites) to personal computer. Moreover, the network analysis needs software computer support[1] for data and graph processing.

4.2.1 Mathematical Models

From the mathematical point of view to study the relationship network use the structures and instruments of the Social Network Analysis, the theorems which make up the "Complexity Theory" and Fuzzy Systems.

The SNA is a theoretical and methodological perspective that analyzes the social reality from its reticular structure.

This method puts social relationship as a minimum unit of observation at the expense of individual attributes (e.g., gender, age, education, status, socioeconomic etc.), which are not excluded from the analysis, but traced to one of three possible levels of interdependence of social phenomena: that of the actors, the connecting relations and networks that make up the structure of the whole.

In this way it becomes possible a fundamental objective: analyze the complex system of interdependencies and multiple interconnections within society. In particular, the SNA is important for to explain the dynamics of contamination of interdependencies between systems and social behaviour of individual actors (Trobia and Milia 2011).

The structure at the base of the Social Network Analysis is the graph.

The graph, or network, is a particular type of pattern used for represent the relationships between elements, composed by points called nodes connected to each other through links (Easley and Kleinberg 2010).

Data and their graphical location within the network are described in the adjacency matrix.

[1]In this case I've been used Gephi (Bastian et al. 2009) but there are some other tools, for example Node Excel.

The adjacency matrix, also called social matrix, is a square table, composed by a number of rows and columns equal to the number network's nodes. In the matrix, actors are indicated in the same sequence both in line and in column. Each cell reports the binding information between the node of a row and the node of the others So if x_ij = 0 the link is not there; x_ij = 1 if the link is there (Trobia and Milia 2011).

The most important values for analyzing the nodes of a graph are: Centrality. Modularity and Cluster Coefficient (Chiesi 1999).

The analysis of the centrality of a node, compared to the network describes "prestige" node on the entire network and allows to detect also the weight and the level of influence within the other network elements.

The main measures of centrality are three: the centralization Freemans degree, Closeness and Betweeness.

The first indicates the degree and its distribution in the network. This value is based on the concept that the elements, which maintain a greater number of relationships with other members, enjoy a convenient location.

The Closeness measures the level of close to a node to other network. In formal terms, the closeness of a node is the function of its geodesic distance from all other network nodes.

The third measure is the betweeness and detects the degree of intermediaries present between a node and the other; it indicates how often a node is located in the shortest path between two pairs of nodes in the network.

The degree of modularity, instead, determines the sub-networks (or cliques) within a larger network and the quality of their connection. Need to determine if the sub communities have many or few connections between them.

Mathematically the degree of modularity (Q) is calculated by set of connections (a_ (i, j)) between the nodes (i, j) of a less connections module (m) that would result in a random distribution. The Q value can vary from 1 to −1, and in case of modularity tending to 1, the network is composed of modules low connected, instead a degree with Q tending to -1 indicates cracks highly connected.

The clustering coefficient indicates the aggregation level of a network.

Mathematically, this value is calculated considering all actual connections of a network divided by the potential links.

Therefore, a highly structured network presents a clustering coefficient tends to 1 while, on the contrary, a DC tending to zero defines a graph characterized by a strong element of randomness and a low aggregation between the elements that compose it.

The network's studies, along with other disciplines, in a field of study called "complexity theory".

Complexity theory starts the application of the basic rules of Social Network Analysis, for analyzing complex components of network types called small worlds.

The little worlds have a hybrid form than the classical networks, and must be interpreted by using the multi-field paradigms between sociology, biology, physics and the theory of communication.

The fundamental laws that determine the study of complex systems include:

- Six Degrees of Separation; about this theorem in society individuals are separated from any other person in the world by six degrees of knowledge. In other words, society as a whole can be viewed as a huge network of about six million nodes and with a diameter equal to six.
- Strength of Weak Ties. The network structure of a social actor consists of a strongly connected group that represents the strong ties (friends and family) and a circle of acquaintances (weak ties) who have no contact with each other; but each to his acquaintance once a circle of strong and weak ties. In this context, Granovetter (1973) identifies the weak links as the most functional for the circulation of the flow of information.
- Models of small world graph; the theories of Granovetter (1973) and Buchanan (2004), argue that networks, composed of strong and weak ties have the distinction of being part of graph structured and partly random graphs. Watts and Strogatz define these networks "small world" because have some characters of a graph structure and some the characteristics of a random graph.
- Networks to scale invariance; Barabasi (2002) processes the Watt model and Strogatz (1998) and applies it to the study of the structure of digital networks detect a particular form of small world called scale-free network. The two characteristics that make the structure of the scale-free network a network Small Mode "different" from the one analyzed by Watt and Strogatz (1998), are the presence of centres of aggregation of multiple connections (hub) subjected to the Power Law. The scaling law, can be translated in the principle of "the rich who get richer", best described as a preferred combination. According to this theory hubs inside the network will naturally tend to acquire a greater extent than links to nodes with lower grade. For this reason the most popular sites are the most visited of the least popular and tend to acquire more links than others; here is because blogs with more followers are subjects to acquire more contacts than those minors. According to this principle it is built the system in Google. In fact, when you do a search on Google (beyond the sponsored link) the list of links that we get is in order to click (Barabasi 2002).

The set of laws governing the theory of complexity along with the basic techniques of social network analysis help from interpreting mathematically the dynamics of virtual communities. In fact, these types of networks reflect the structure of the model developed by Barabasi (2002) and through the parameters of the SNA are possible to study the position of the nodes and the diversity of the types of links between nodes.

Finally, for describe mathematically the quality of the ties of users within a network it need to invoke the application of fuzzy logic.

In particular Fuzzy logic is important for define varieties of the intensity of the network and the type of bond.

Previously I defined the clustering coefficient as a ranges from 0 (Random graph) to 0.5 (small Word) to 1 (graph-structured) and allows you to study the intensity of the links of a network. Through fuzzy logic, you can define additional subcategories of analysis (Fig. 4.1).

The same reasoning it is possible to apply it to the study of the types of bond. This makes it possible to detect an intermediate range of links between the strong and the weak (Fig. 4.2).

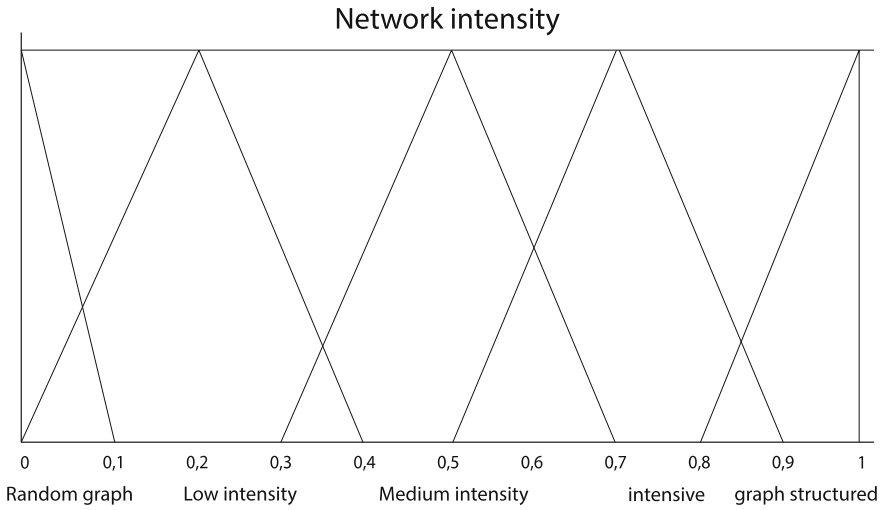

Fig. 4.1 Network intensity

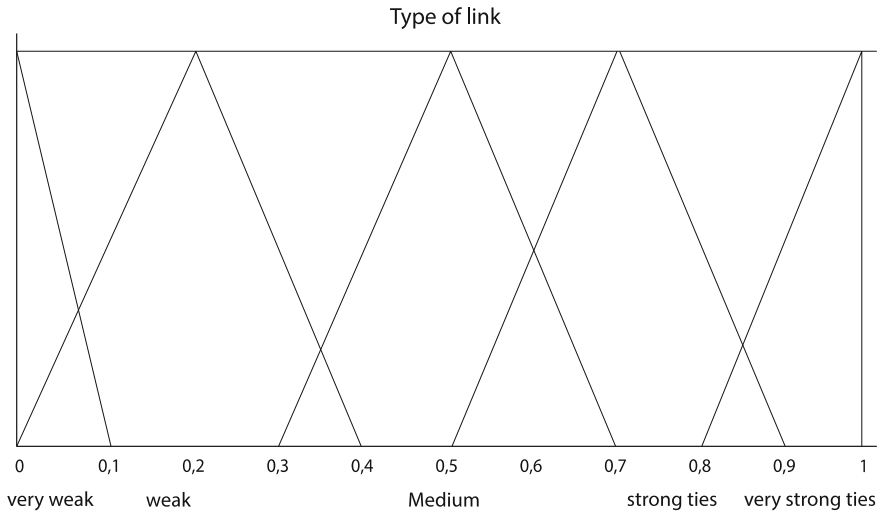

Fig. 4.2 Type of link

4.3 Applications

During my research I applied the techniques and the digital ethnography models in four empirical studies.

4.3.1 The Expression of Sexuality Through Social Network

The aim of the research was to understand how human sexuality is expressed through multimedia networks (Russo 2015).

Again, I have been taken a bearing of affinity networks arisen about sexual inclination. Finally,

I have found the social function of the various social networks about sexuality language.

In order to seek an interpretation of the collected questions, through the digital ethnography tool, the following areas were analyzed:

(1) Affinity networks for sharing a particular conception of sexuality;
(2) Uploading of content related to amateur pornography;
(3) Sharing of symbols that acquire a meaning of sexual type (for example the food, the body or the objects);
(4) The fourth, and last segment of analysis refers to the analysis of time-lapse, a photographic technique that is becoming viral in the social media and has the distinction of being used by users to tell fragments of life.

Research has revealed a universe of shared meanings among users; the Net have also detected forms of virtual community where users share values and social relations.

The analysis shows that each social platform in the field of sexuality has a specific characterization.

4.3.2 The Civic Mediactivism in the City of Chieti

The work, carried out between January 2014 and April 2015, had as its aim to visualize the networks of kinship born around the theme "City of Chieti" and understand the contents and forms of mediactivism (Russo 2016a, b, c).

In a preliminary step, I identified the digital frames in which the traces of the city are present. This initially made it possible to understand the organization and the contents characteristic related to the topic of research and reconstruct the reference social operating system. The second phase, more specific, aimed to the identification of tactical media discussion, in order to isolate the number of media-elements.

In this regard, it highlighted the presence of forms of civic media activism in 21 Facebook[2] virtual groups. The study of tactical networks reported on research has identified:

(1) The rules of social behavior within these communities and, in particular, the status of the group's activities;
(2) Forms of communication and social control exercised by directors and group leaders;
(3) The most frequent discussion topic, namely, the recurring themes within posts and discussions between network users;
(4) The structure; at this stage we used the mathematical models of the social network analysis. In particular, for each structure the graph consideration of relationships has been detected and has been analyzed in relation to the connection medium, in the presence of connector nodes, the diameter, the clustering coefficient and modularity;
(5) the influential social actors: this definition refers to the most active elements in the group. Fingerman and Blau (2009 in Rainie and Wellman 2012) define them consequential strangers (strangers relevant) or elements of a network with which there aren't necessarily a strong bond but acquaintances are always present.

4.3.3 *Conflict Mediation in the Institutional Forum on Line*[3]

The aim of this work was to identify the types of on line forums in the Institutional Network and related to the Abruzzo area, analyze the relational dimension and forms of conflict and, finally, define the paths of mediation made and achievable.

Specifically I have been detected:

(1) Contents of the forums and discussion groups;
(2) Conflicts and possible conciliation strategies;
(3) User behaviour in relation to situations of conflict and requests of information;

Finally, I have analyzed some interactions related to individual posts for understand: the processes of mediation and the formal and informal role of the social actors.

[2]The data were extracted by Netvizz application (Rieder 2013).

[3]This research was presented during the conference *Communication, Mediation, Evalutation and Social Intervention,* Università G. d'Annunzio Chieti—Pescara, 15 Settembre 2015.

4.3.4 Social Network Analysis as a Backup to Community Interactions Online Learning[4]

The Aim of the research project was to determine the relational dimension of a virtual learning community,[5] by applying mathematical models of Social Network Analysis (SNA) outlined in the previous paragraph.

Through the analysis of formal and informal interactions into on line forum community learning we have been detected the social dimension, formal and informal rules between the community users and signs of building links in the group.

In this case SNA became a useful tool for to identify and address the problems within a community of online learning and for facilitate the participation and collaboration among the students.

Through the analysis of graphs it was possible to identify and monitor the informal roles born in the community, some friendly able to contribute positively to the learning process and other antagonists capable of generate dissent and confusion. Also I have detected and monitored subgroups born within the community and studied the behaviour and possible forms of exclusion from the other forum members.

4.3.5 Comparative Analysis

In the four examples described in the preceding paragraphs I applied, to the methodological level, the complete digital ethnography method in all its steps. The covert observation has been implemented in all four examples, however, to get into some communities on the topic of sexuality is needed the help of a gatekeeper:

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[4]This research, in collaboration with PhD Roberta Di Risio, was presented during the conference *Fuzzy Set, Multivaluted Operations and Application to Social Science,* Università G. d'Annunzio Chieti—Pescara, 18 Settembre 2015.

[5]The learning community detected is part of the project Master ***"Koinè. Professione formatore per la didattica della comunicazione"*** (Koinè. Profession trainer for teaching communication). The Master was promoted and funded by the Ministry of Education and was activated for the academic years 2013–2014 and 2014/2015 at the "G. d'Annunzio ", with the Scientific Coordination and Teaching Prof. Giselda Antonelli. It covers four Italian universities: Università "G. d'Annunzio "of Chieti-Pescara, Università of Genoa, Università of Salerno and Università of Palermo Studies and is connected to the National Plan Logos.

The Master took two years and was disbursed in blended learning mode. The meetings held in the presence in the classrooms of the University Campus of Chieti, and for the management of on-line teaching using the training platform operated by the University Telematics "Leonardo da Vinci", based in Torrevecchia Teatina (CH). The objectives of this training event were as follows: to train the professional figure of the trainer for teaching communication and enrich their professional profile with knowledge about the use of the most advanced communication technologies in educational settings.

while the observation of the learning community online of Koinè master was not completely hidden because users knew that the course tutor had access to the contents of the forum.

However, in all cases it was protected the privacy and anonymity of users.

The construction of the affinity networks was carried out through Gephi software, in the case of the learning community's forum the construction of the graph was made manually through the establishment of the adjacency matrix, which has automatically generated the graph of relationships. In all other cases I used crawling tools that automatically imported all the required relational data.

In relation to the mathematical model I applied the techniques and paradigms of the SNA as described in the preceding paragraphs.

This mathematical application has been very helpful especially in research on civic mediactivism in the city of Chieti and in the intervention in the case of learning community online of Koinè master.

In the case of civic mediactivism structural analysis of the detected networks showed 18 graphs presenting the typical structure of "networks to scale invariance" (Barabasi 2002): media not equally distributed connections; among those elements were present connector nodes with a preferential amount of connections; mean diameter of the network equal to 5.12; the mean clustering coefficient equal to 0.22; in each graph they were present of the sub-components (cracks) high density and with a clustering coefficient approaches 1.

Otherwise in the case of learning community online of Koinè master view the structural characteristics of the online forum the network of relationships was presented as a graph structured. In this case the application of SNA was useful for detecting the existence of a clique of relations. This subgroup was dominant within the Network but puts in place behaviors in favor to the process of learning lessons.

4.4 Discussion and Conclusion

The digital ethnography, as new methodological syncretism, offered an useful tools for reading and understanding the digital social field.

However, the practical application reveals some critical issues that mentioning.

It is clear consider digital ethnography as an *ex novo* tool, or is a new application of an epistemological process already exists?

As claimed by Bryman and Burgess (Bryman and Burgess 1994 in Corbetta 1999) qualitative research can not be reduced to particular techniques or to a succession of stages but rather it consists of a dynamic process that ties together issues, theories and methods; accordingly the search process is not a well-defined sequence of steps that follow a clear pattern, but a confusing interaction between the conceptual world and empirical, where deduction and induction are realized at the same time (Bryman and Burgess 1994 in Corbetta 1999). Therefore—as mentioned in the previous paragraph—the Digital Ethnography remains a non-standard tool, while maintaining the epistemological structure classic ethnography, can make use

of information systems and mathematical models considered as ad hoc tools to activate the application process to a new field of research.

From a methodological point of view, however, it should be clarified what are the critical elements:

(1) the blacks numbers: there are of difficult access Web areas which make necessary the intervention of a gatekeeper thus changing the type of observation;
(2) the difficulty in not pollute, in any way, the scope of the survey, especially in the study of the structure of the network: you must not have ties to members of the group otherwise you may appear as a "hub" thus changing the structure of the network;
(3) the quality of the data, or the adhesion between the digital identity and real identity of the subjects under analysis. Moreover, the understanding of the origin of the data is fundamental to the definition of the type of communicative behavior. Is, therefore, a clear need to contextualize well the scenery of intervention;
(4) Finally, when studying a phenomenon in the network is necessary to consider some aspects that concern the real life and that may affect the search field (Sade-Beck 2004).

For this reason there is no "universal" rules for the application of the ethnographic method, but it is structured in relation to the reference context.

The last point concerns the ethics and ethical dimension. In fact, using the Big Data for the search implies, at times, the presence of sensitive data. In this regard, the AOIR Ethics Working Committee (2012) has developed a document entitled Ethical Decision-Making and Internet Research Recommendations contains some interesting guidelines for social researchers of the Network:

- The greater the vulnerability of communities/author/participant, the greater the requirement for the researcher to protect her;
- When making ethical decisions, researchers need to balance the rights of the subjects participating in the research with the social benefits of research;
- Ethical issues arise and need to be addressed during all phases of the research process, from planning, to research, to the publication and dissemination of results;
- The ethical puzzles are complex and rarely have a binary pattern: there is often a gray area that forces the researcher to self-regulate.

In conclusion, digital ethnography is a hybrid method not only quantitative, but especially qualitative. By its application for Social Research in digital fields it is possible to investigate a multitude of virtual worlds and "subworlds" that compose cyberspace defined as a system halfway between order and chaos.

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