HUB

Human Ecosystems Bologna

REPORT 2015

INTRODUCTION

On *October 2015* we officially started **HUB, Human Ecosystems Bologna**, the system which allows

- observing and capturing the online expressions of the people living in Bologna about **collaboration** and participation to the civic life of the city,

- creating a source of **Open Data** which results from the observation, and

- creating a public visual experience which enables people (whether they are living in Bologna, visiting as tourists, students studying in town, or people anywhere in the world) to observe the *real-time collaborative life of the city*.

Bringing up the system and its elements was a complex process, which required the full engagement of the public administration of the City of Bologna, of the city's Urban Center, of organizations such as LabGov, Co-Cities, ANCI, Robot Festival, Working Capital and the University of Bologna, all dedicated to making it possible, sustainable and, most important of all, to enable it to be recognized as it is: the possibility to reclaim the digital public space of the city to make it accessible, transparent, observable and, in projection, more inclusive and usable for research and for collaborative, participative action.

In fact, every day of our lives, each of us generates progressively *growing amounts of digital data*, by shopping, expressing on social networks, exchanging messages, and even by traversing the spaces of the city, using our mobile phones and using our appliances and devices in our homes, offices and schools.

This information has started to constitute a large part of our public, private and intimate expressions. It is not anymore a mere "addition" to our daily life, it is an integral part of it, and it is progressively becoming impossible to discern what is "digital" from what it is not.

The fact is that, currently, a very small and controlled part of this data and information is available and accessible.

This fact affects: individuals desiring to interpret the data they generate to gain better understandings about their public, private and intimate lives; communities wishing to use the public data generated in people's daily lives to shape their agendas and to collaborate towards common goals; administrations needing the public data to shape their policies, monitor impacts and establish wide, inclusive communication channels.

All of these opportunities – and more, including researchers, students, companies – are currently possible only to a very limited degree. All of this data and information, in fact, is fully available only to a limited number of service providers and private operators. Thus, in this situation, these few operators are the only ones who can benefit from the availability of the data regarding our public, private and intimate lives, spaces and times.

With *HUB (Human Ecosystems Bologna)* we have begun addressing this issue, starting from the public sphere.

In the current phase of the project we have set the preconditions and a powerful and significant part of the implementation of the process according to which, on the one hand, the public data about the life of the city becomes a commons and, on the other hand, individuals will be able to reclaim all of their data (public, private and intimate) to use it on their own, or to share it with their community, the city, researchers, scientists, companies, or whomever they wish, according to their desires, values, relationships.

We have started this process from capturing the life of the city for everything that revolves around the theme of "collaboration".

In this report we will explore HUB, describing:

- the methodology used for HUB, including the technologies used and the critical issues faced (privacy, for example) and how they were solved (also by establishing the ethical code for the initiative, and ensuring that all the processes involved respect it);

- an overview of social networking in the city of Bologna, to provide a context in which to frame the observations of the following sections;

- the collaboration in the City of Bologna, as observed during the capture process;

- the Open Data and Toolkits released for the city and its administrators;

- some conclusions and final remarks, synthesizing the findings and exploring possible next steps and opportunities.

METHOD

In this section of the report we will explain how the observation of the expressions of collaboration and participation in the city of Bologna has been set up.

We will explore:

• the overall process;

• the technologies and techniques involved;

• the critical issues;

• the adopted ethical code and its implications.

The Process

Figure 1 describes the process used for HUB.

We will describe it in its flow, from the top to the bottom of the diagram.

The first step is a **harvesting process**, in which major social networks (Facebook, Twitter, Instagram) and relevant websites are monitored in order to detect public content generated in Bologna or about Bologna and dealing with collaboration, participation and the commons, as expressed by internet users and as relevant to urban contexts.

Let's explore each part.

Capturing content from the various sources (social networks and websites) requires different techniques.

For example, services like Twitter and Instagram provide APIs (Application Programming Interfaces) which allow searching for certain keywords, hashtags, geographic locations and timeframes, and, thus, to obtain the public content which was generated by users about certain topics and in relevant locations. There are limits for the usage of such APIs (for example on the number of contents which can be harvested, on the geographic area
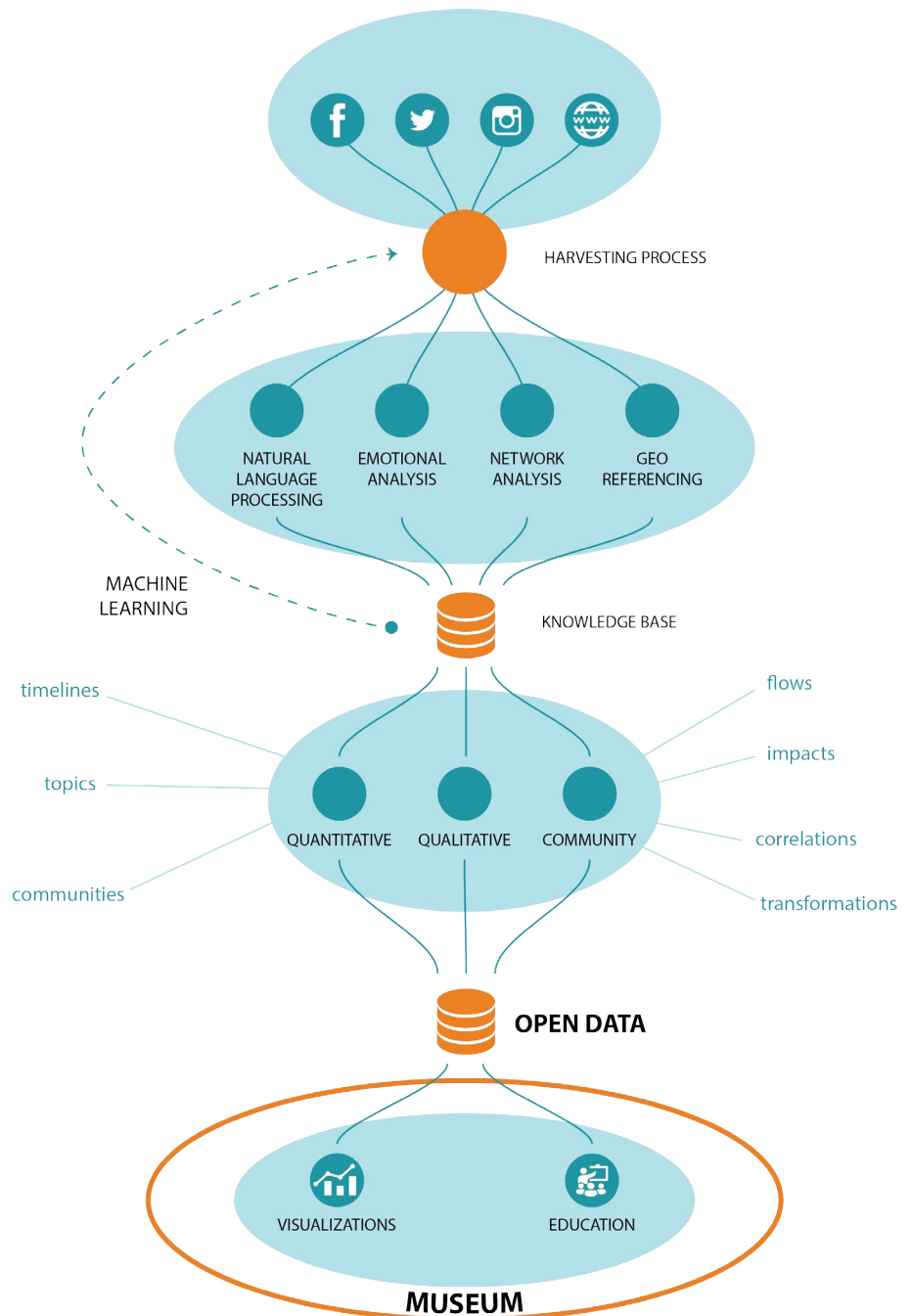

Figure 1. The HUB Process.

which can be searched, on the amount of time in the past for which it is possible to perform searches, and on the overall usage of the APIs themselves). Nonetheless, by combining the available data access points and modalities, it is possible to explore thoroughly the public content generated regarding specific topics and in specific locations (for example the city of Bologna).

Other services, such as Facebook, are much more restrictive. In effect a series of APIs (called the Open Graph) are available, but the limits for their usage are much more stringent. For this reason, Facebook harvesting (and processing) follows an entirely different process, involving the collection of those contents which are available even without accessing the platform (for example by accessing the web

pages for Facebook profiles and pages without logging in), and by having the direct collaboration of the individuals and organizations running these profiles, pages and groups. In perspective, this second option constitutes, in fact, the majority of the content harvested from this social network. In synthesis, on Facebook: a limited amount of content is harvested directly from the profiles and pages, without accessing the social network (as, for example, search engines such as Google do); the larger part is obtained by performing an initial search for those social networking profiles, pages, groups and communities which are relevant for the collection process (in this case, the ones of the citizens of Bologna, and of its communities, groups and pages, especially for whatever concerns civic collaboration and participation), directly connecting to them (for example by using the "Join Group" function available on the social network) and, then, using the APIs which effectively allows for capturing the content from these "joined" pages and profiles.

Content has also been captured from websites and pages which are of particular importance for the topic of collaboration and participation in the city of Bologna. This process is much simpler, as it involves basic web scraping techniques (that is what search engines do, by collecting what appears on each of these pages, to be forwarded to the processing stage).

On top of this, all of the services impose limits about how the harvested content can be used. For example, it is not possible to store it directly in databases, it is necessary to provide the indication of the links from which it originates, it is necessary to provide attribution and declaration that the use is non-commercial, and and similar ones.

As the content gets collected, it enters the **processing stage**, where it is temporarily stored in anonymized form in a database, which is used to process all of it and, thus, to produce knowledge. There are a number of processing

and analysis techniques used, such as Natural Language Analysis, Emotional Analysis, Network Analysis, Geo-Referencing. They will be described in more detail in the next section.

In this overview, it is important to highlight how these techniques are able to transform the unstructured data collected from the Internet (messages, images, comments, conversations…) and process it in order to transform it into structured data, forming **HUB's knowledge base**. At this stage three typical types of knowledge are available:

- *topics*, as content is scanned for what it is talking about, and for what topics are discussed together in the same contexts;

- *emotions*, as content is scanned to gain understandings about what emotions (such as happiness, surprise, fear, anxiety, disgust, trust…) they are expressing;

- *times*, using both the content's meta-data and the phrases it actually contains to understand what time it refers to;

- *places*, where the content's meta-data (such as geographical coordinates) or sentences describe geographical locations;

- *networks*, in which the focus is to understand which people, organizations and other entities these contents put together, describing relational networks and graphs.

Of course all the information elements are semantically linked with each other and, thus, can be combined to infer more complex knowledge (for example, by combining knowledge about topics, places and times, we could be able to infer what the people at a certain event discussed; or by combining topics, emotions and networks we could understand which communities express which emotions about certain topics).

The content of the knowledge base is also used as a feedback process, to fine tune the data harvesting process, using a **Machine Learning** mechanism:

here all the accumulated knowledge is used to evaluate new information to generate new knowledge about how to modify the data capture process, in terms of other words/topics to listen to, other individuals, pages, groups and communities to include in the capturing process and other insights of similar nature. The acquired knowledge is used in the following cycles, obtaining a **system that learns and adapts** to the evolving scenario (for example by understanding that at a certain time it may be interesting to include some other elements in the harvesting process, as they are particularly active and relevant).

The knowledge base is, then, used to perform some more **standard analysis**, such as qualitative, quantitative and community/network analysis, to gain better understandings about the scenario that all of this information describes, such as:

- the **timelines** according to which the topics, emotions, places and communities of collaboration in the city evolve;

- the **topics**, according to which we are able to gain better understanding of how much certain topics are discussed, with which emotions, by which communities and in which places;

- the **communities**, with which we are able to understand how diverse or coherent different communities are, what they focus on, how they converge or diverge, what are their main concerns or desires;

- the **flows**, using which we are able to model how information, opinion, influence spreads in the city;

- the **impacts**, with which we are able to gain understandings about the results of certain actions, such as how a communication campaign or even a single social networking message is able to influence people's behaviour;

- the **correlations**, with which it is possible to evaluate the possibility of possible

sequences of cause/effect, also taking into account other information sources (such as news, change in policies…);

- the **transformations**, in which it is possible to take the dimension of time into account, to study how all of the above evolve in time.

All of the above constitute the **source of Open Data** which is produced at the end of the processing stages, and which is composed both of the knowledge base and of the results of the subsequent analysis.

The Open Data is, then, used to produce the **info-aesthetic visualizations** which are part of the HUB visualizations in the Urban Center, and for the **education program** for administrators, citizens, students, children, elderly, which has in part been executed and in part will form the following stages of the project (see the other sections of the report for more information).

Technologies & Techniques

This section is intended to provide a short description of the main techniques and technologies used for processing the data harvested in HUB. Some links are given to obtain further information about each technique.

Natural Language Analysis

The objective of Natural Language Analysis (or Natural Language Processing, NLP) is to transform unstructured data such as text into structured data.

It can be performed in multiple ways, with different objectives, such as understanding the topics which a certain text deals with, creating automatic summaries, machine translation and more.

In HUB NLP is used in the following ways:

Discourse Analysis, which deals with understanding the structure of text and its components; for example using the way a certain sentence is written to understand if it is a question, an exclamation, a sentence providing information of some sort, an answer to a certain question, etc.

Semantic Analysis, which deals with starting from text to understand its meaning, in terms of whether it assesses a certain topic and in what way, if it has a certain style for expression or if it uses a certain language;

Topic Discovery, in which large numbers of sentences are observed to discover if recurring patterns may identify new topics to listen to which are relevant for the ones currently being observed; new topics come under the form of words, word patterns, sentence patterns and more;

Named Entity Recognition, which uses streams of texts and their structure to identify proper names for people, places, events and more;

Relationship Extraction, which uses text to identify the relationships between Named Entities (e.g.: who is married to whom; who is the employer of whom; etc.);

Sentiment/Emotional Analysis, in which the words and the patterns in which words are composed are used to gain better understandings about what Sentiment the sentence is expressing (positive, negative, neutral), or, if enough information is available, what emotion it is expressing (such as joy, fear, anxiety, surprise, trust, satisfaction, etc.);

Information Retrieval and Information Extraction, which, given the procedures listed above, deals with the possibility to store and extract the types of information which can be extracted from text.

In HUB NLP is performed in 29 languages.

More information on NLP can be found here:

https://en.wikipedia.org/wiki/Natural_language_processing

Emotional Analysis

As described in NLP, it deals with the possibility to automatically recognize emotions in text, by recognizing how text uses word, phrase or sentence patterns.

In HUB 13 different emotions are recognized when enough evidence is present in the texts, using the Circumplex Model of emotions.

More information about the Circumplex Model of emotions can be found here:

https://www2.bc.edu/~russeljm/publications/Russell1980.pdf

Network Analysis / Social Network Analysis

Network analysis studies graphs, networks of relations between discrete objects, or nodes.

In HUB Network Analysis is used to study the composition of the networks represented by the people, organizations, companies whose expressions are captured through their public online expressions and, given these and their transformations, the flows of communication, information, knowledge take place in and through them, effectively describing how information, opinion, emotion, knowledge and influence spread across communities and cultures.

HUB implements a custom version of Latour's ANT (Actor Network Theory) to describe the behaviours of networks and of their participants, and to identify roles within them, such as influencers, experts, hubs, bridges among different communities.

For more information about Network Theory:

https://en.wikipedia.org/wiki/Network_theory

For more information about Social Network Analysis:

https://en.wikipedia.org/wiki/Social_network_analysis

Geo-Referencing

This technique is the process of attributing a geographical context to a certain content. The geo-

context can be of multiple types: the location in which a photo has been shot; the area for which a certain content is relevant (for example Bologna, or one of its neighbourhoods); the path along which a certain information is relevant (for example the path that takes from the train station to Piazza Maggiore).

In HUB geo-referencing is performed in two ways:

- using the meta-data included with contents, for example the geographical coordinates which social networks users can associate to their posts;

- using the results of NLP; in this case the Named Entities identified in text may be of geographical relevance (for example the name of a church, or a landmark, or the name of a restaurant); if the sentence includes enough evidence of the spatial character of the expression (for example the sentence may state that "I am going to…"), sufficient information may be present to identify the geographical context for the content. HUB currently uses a database of about 12000 named locations to enact this kind of spatial attribution.

On top of that, a GIS (Geographical Information System) is used to establish the hierarchical characteristics of space, according to which certain coordinates are contained in certain blocks, which are contained in certain neighbourhoods, which are contained in certain zones of the city, which are contained in the city, and so on.

Machine Learning

Machine learning studies the possibility to design algorithms which are able to recognize recurring patterns (in this case: patterns in texts) and to use the fact that certain patterns have been recognized to learn, producing systems which automatically adapt themselves to changing scenarios.

In HUB, Machine Learning is used

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in multiple ways: for the NLP techniques; in Topic Discovery; in Emotional Analysis; and to fine tune the data harvesting processes by adjusting what keywords, phrases and forms of sentences are monitored on social networks.

To learn more about Machine Learning:

https://en.wikipedia.org/wiki/Machine_learning

Critical Issues

A series of critical issues have been identified while working on HUB. The following table lists them.

Terms of Service

Most online operators provide their services under condition of accepting their Terms of Service (ToS) documents. These are legal documents which Internet Users acknowledge and approve when subscribing to these services. Social networks have very complex, strict ToS documents, which are intended both to preserve people's rights while they use the online platforms, and to ensure that the business interests of the providers are protected.

Limits described in the ToS documents include the ways in which information from these platforms can be extracted and used.

To address the many legal issues created by the presence of these ToS documents, and the necessity to adhere to them while creating HUB, Human Ecosystem's legal team has been engaged to express the requirements which a system such as HUB should have to avoid breaking such legally binding agreements and, at the same time, to be compliant with current national and international laws and regulations (for example on Privacy and Copyright issues).

The result has been a requirements and specifications document which has been used in the implementation of the HUB

systems, describing the characteristics of its technologies, proposing countermeasures such as content anonymization and encryption, avoiding storing the harvested content on HUB's databases, avoiding providing service-specific statistics and counts, and more.

The requirements and specifications have been fully implemented in HUB and in its Code of Ethics (see next section).

Privacy

Multiple forms of privacy related issues came about when designing and implementing HUB.

Some of them, mostly related to the legal implication of data harvesting activities, have been confronted with as indicated at the previous item, making HUB completely law and ToS compliant.

Other issues were present, too, of different forms.

For example, social network users may not realize that they are publishing a certain content in public, for example using those functions found on social networks which make a content "accessible to all".

In this case, HUB may become legally entitled to harvest this content, and to use it for its purposes. But at the same time, that could be not right for the originating user, who has performed a mistake and could wish to fix it.

And, of course, this is just one of the multiple types of problem which can bring harm to a person's privacy, reputation, relationships, etc.

In HUB we have decided to answer to these types of issues in a variety of ways:

- by providing and publicizing ways in which users can ask to have any content removed;

- by making dedicated efforts to capturing only information and content which is explicitly marked as public;

- by not adopting the many technical loopholes (currently

used by advertisers and social media operators) using which it is possible to capture content with partial accessibility (generally using the scheme: if A authorizes B, then C can ask B to fetch the content, so that C can use it);

• by sincerely and completely adopting a Code of Ethics.

Quality of Automatic Interpretation

This issue deals with the quality of the interpretation of the content as processed by the automatic algorithms. This means to try to ensure that if algorithms detect that a certain content deals with topic X, the content effectively deals with topic X.

This is a very complex thing to do. While performing tasks such as NLP, algorithms are de-facto collecting bits of evidence across texts, such that at a certain point enough evidence can induce us to believe that a certain content is effectively talking about X.

But these are not final determinations, they are probabilistic: for any combination of such evidence, we will be always XY% sure about this fact, and XY% will never fully be 100%, there will always be a doubt.

In HUB we confront with this problem by establishing very high thresholds. Currently HUB accepts a certain interpretation only if there is evidence to prove it which accounts for more than 95% of probability.

Irony

This issue is a peculiar version of the previous one.

Social media (and Internet in general) is a context which is characterized by high degrees of irony.

This means that the situation in which someone is expressing something and really meaning its opposite will happen more than often.

In computational terms, this means

that the situation in which an algorithm will efficiently identify topic X or emotion Y in a message and the user generating it meant the exact opposite, will happen very often.

This is currently one of the most pressing issues in Natural Language Analysis: Irony.

There are a number of techniques which are currently used to mitigate these issues. All of them take into account the context in which each message is generated. By studying the context in which a certain user communicates (her beliefs, opinions…) we will have better tools to interpret an ironic content.

This is what HUB does: if for a certain topic at least 75% of one users' expressions is polarized in a certain way, a further expression which is polarized very differently will not be accepted immediately, but placed in a limbo, "on hold", until enough further evidence will be able to prove that the user has changed opinion.

Lack of Intentionality

With this issue we refer to the possibility that online expressions do not always reflect what online users chose to express, with intention.

This is an issue with multiple faces.

For example, by understanding a certain message we could be able to collect enough evidence about a person's behaviour, or opinion.

This fact is only partially related to the same person's belief system, or values, or desires. The person might have been angry, or in a hurry, or even forced to express in a certain way, for respectability, reputation, work, shyness, or multiple other reasons.

Or, on the other hand, people may not consciously realize that they are debating issues in the public sphere. Or they may even not realize that they can establish such debates, and not talk at all about such issues, even if they care about them.

In general, little can be determined about the intentionality of the

expressions, due to their emergent, informal character.

To deal with this issue, HUB, as in the overall philosophy of the Human Ecosystems project, acts in two directions:

• create accessible, inclusive perception of the digital public sphere of the city, in order for its inhabitants to become more aware about it and, thus, to use it to consciously and mindfully bring up discussions about the civic issues they care about; this is done, among the others, through the idea of the real-time museum of the city, such as the exhibit at the Urban Center, which embodies the digital public space of the city through engaging, beautiful info-visualizations which make it perceivable and tangible;

• enact a constant state of participatory performance, using communication, education, public events, research, citizen engagement, in order to make HUB perceived as a tool which the inhabitants of the city can use to pursue their goals.

Divides

There are multiple forms of divide: technological divide, age divide, cultural divide, geographical divide, literacy divide, digital divide, and more. Each of these has impacts on how precisely it is possible to use the data which is captured online to gain better understandings about what is effectively happening in the city.

How well are the opinions of elderly people expressed? Why are there so few expression in a certain neighborhood? Is it because there is no network or because they truly don't have anything to say? Etc.

Whenever we look at HUB's visualizations, whether they are maps or graphs, seeing what is on the map is just as interesting as discovering what is not.

HUB confronts with this type of issue in two ways:

• first, by research, performing

constant analysis of the findings obtained by interpreting data captured from websites and social networks, and verifying them by weighting the data through other types of data which are able to more completely describe the actual composition of the city, such as census, registry offices, zoning and more;

- and, second, through the education process, whose aims include the decrease in digital and technological divides, and the augmentation of inhabitants' awareness for the use of the digital public sphere as a tool for active, collaborative citizenship.

- operate with transparency and integrity;

- protect people's data and rights, even going beyond current laws and regulations, by providing tools, protocols, contact points for support, public inclusive events and other means through which people can fix issues, obtain information, help, tips, advice, education.

Ethics

Many of the issues identified in the previous section can be merged together with other, more general, ones in defining the need for the composition of a comprehensive ethical code.

Such a code currently exists in informal ways, as it is used by all participants of the actors which are currently involved (from Human Ecosystems ltd, to the City administration, to the organizations which have collaborated with the project thus far).

As the second phase of the project comes about, it is the intention of all participants to open up the definition of a shared, public ethical code, to be co-designed together with the inhabitants of the city.

Currently, these are the principal elements of HUB's Code of Ethics and Conduct:

- full respect and compliance for recognized laws and regulations, at regional, national, european and international levels;

- explicit and avoid conflicts of interest of any form, especially for whatever concerns the code of ethics and conduct;

- provide clear and accurate communication;

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SOCIAL NETWORKS & BOLOGNA

Internet and Social Networks

When we deal with Internet and with Social Networks it is necessary to take in serious consideration what part of the population actually uses them, to be able to understand how the results of the research and analysis performed online are actually able to describe the behaviour of all of the population.

In this section we will give a few numbers which may help us to highlight the global, European and Italian context, while in the next one we will use data to confront with the scenario in Bologna.

The data and information sources used in this process are:

• Wikipedia: https://en.wikipedia. org/wiki/Global_Internet_usage

• Internet Live Stats: http://www. internetlivestats.com/

• Internet World Stats: http:// www.internetworldstats.com/

• Facebook Report 2015 Q3

• Twitter Report 2015 Q3

• Instagram Report 2015 Q3

• Tencent Report 2015 Q3

• VKontakte Report 2015 Q3

• GSMA Intelligence: https:// gsmaintelligence.com/

• Global Web Index: http://www. globalwebindex.net/

• e, per l'Italia, CENSIS, 49° Rapporto sulla situazione sociale del Paese/2015

Let's start with some numbers at global level:

Total population	7,210 billions	+1.6%
Active Internet Users	3,012 billions	+21%
Active Social Media Accounts	2,078 billions	+12%
Unique Mobile Users	3,649 billions	+5%
Active Mobile Social Accounts	1,685 billions	+23%

In Europe:

Total Population	837 million	urbanisation: 72%
Active Internet Users	584 million	penetration: 70%
Active Social Media Accounts	387 million	penetration: 46%
Mobile Connections	1,104 million	vs. population 132%
Active Mobile Social Accounts	287 million	penetration: 34%

In Italy:

Internet Use (penetration)	60%	vs. global average: 42%
Time spent on the internet (h/day) Computers	4.5	vs. global average: 4,4
Time spent on the internet (h/day) Mobile	2.2	vs. global average: 2,7
social media use (active accounts vs population, FB Q3 2015 report)	46%	vs. global percentage: 29%

Using CENSIS' report 2015, it is also interesting to analyze the distribution of social network penetration across age groups, visible in Figure 2.
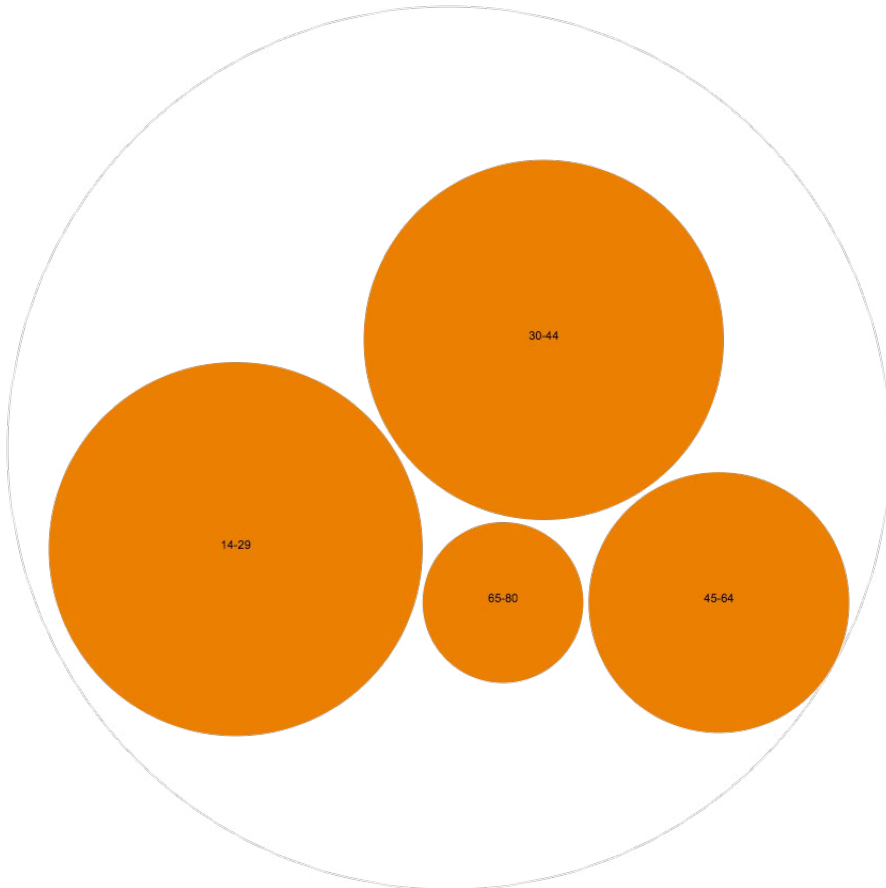
Figure 2: Social Networks in Italy by age group. (Source: CENSIS)

The data for Figure 2 is the in the following table:

AGE GROUP	%
14-29	77.4
30-44	71.8
45-64	37.6
65-80	14.3

Putting this data all together, it is clearer how one of the main determinants of how well represented the population is on social network is the age group: if numbers as high as 46% of the population is on Facebook, for example, according to CENSIS only 14.3 of the people aged 65 to 80 are present on Social Networks.

In the next section we will use these and more numbers to think about the city of Bologna.

Social Bologna

We can use the statistics in the previous section to approximate the number of people in Bologna use social networks.

According to the City of Bologna Open Data sets (and, in specifics, the datasets which describe the number of residents, classified by age group and voting district, which can be found here http://dati.comune.bologna.it/node/90) there are more than 335 thousand voting residents in the 14-80 age groups.

Using the percentages shown in the research by CENSIS, this means that the following table shows about how many people use social networks in Bologna, classified according to age group.

age group	voting residents	on social networks
14-29	63401	49072
30-44	87036	62492
45-64	103501	38916
65-80	64842	9272

This result is also shown in Figure 3.

By joining the data sets with the digital cartography using the voting administrative zones, and using the data from the number of people from each age group in each zone, we can map the approximate density with which people from the various parts of the city use social networks. This result is shown in Figure 4.

Thus, in the following sections we will be able to use this weighted map to evaluate the results of our investigation: where in the map the color is of a darker, fuller shade of blue, our results will match more closely the complete expression of the city; in the other cases, the lighter the tone of blue, the more the results will express only the online part of the population, and further investigation should be performed to check whether these findings actually match the opinions of the rest of the inhabitants.

Bologna out of Bologna

To understand the interactions on social networks coming from outside the city of Bologna a reference level should be described, to enable research to establish a ground level with which to compare observations in order to discern what is part of the normal flows of communication from/to the city from what isn't.

For example, our objective in this phase of HUB is to identify the conversations about collaboration in Bologna and, for this, it could prove to be useful to be able to identify what part of these conversations are part of the ordinary flow of communication of the city with
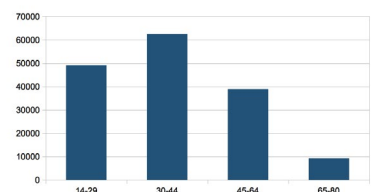

Figure 3: approximate number of residents on social networks in the City of Bologna, by age group.
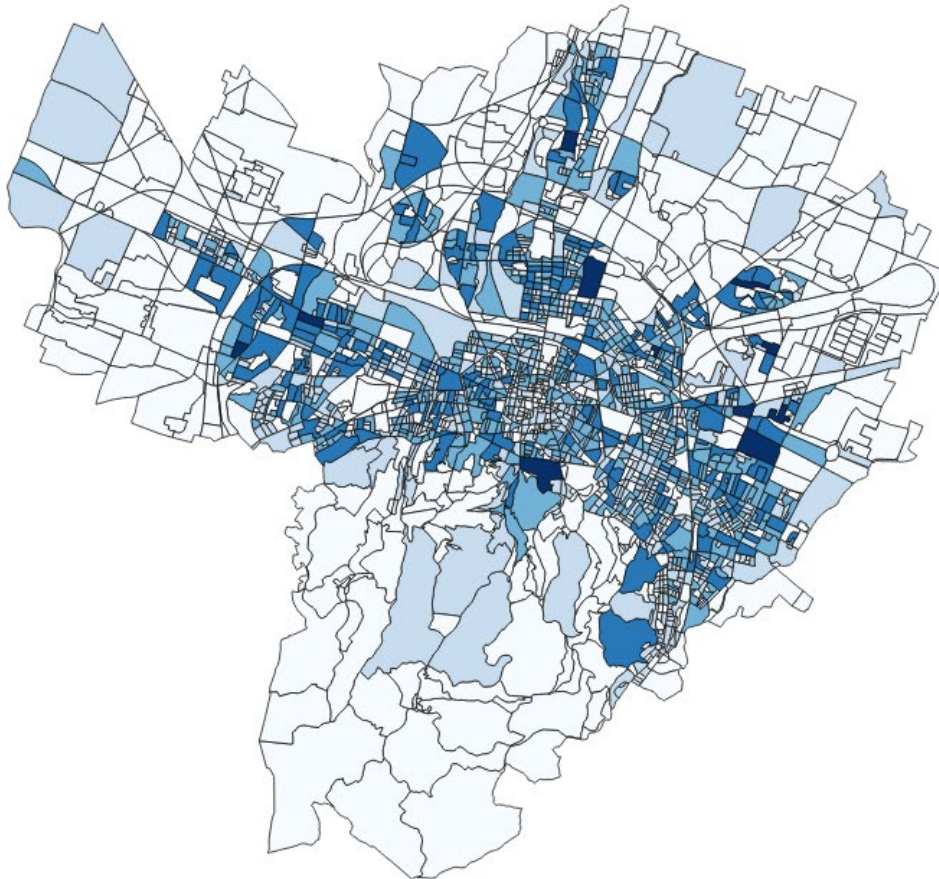
Figure 4: the density of residents with an account on major social networks in Bologna.

everything that is outside of the city: we want to be able to have all the tools we need to highlight how people outside of Bologna deal with the collaborative actions in the city.

For this, we have collected 6 months of the public communication flows from/to Bologna, before the beginning of HUB.

These are all of those public messages which originate from the city and which manage to establish relationships outside the city (because people appreciate, comment, forward or share them), and by all of the messages from outside the city which manage, similarly, to establish relationships within the city. Also, all of the mentions of the city of Bologna and of the events, places and people (using our database of named entities) in Bologna which are generated from outside of Bologna are added to this data source.

By distributing them on a world map, it is possible to gain a better understanding about where are the people who normally speak about

Bologna and with Bologna, and what are their densities. This can be seen in Figure 5, and constitutes our "ground level" for helping us to identify those initiatives which have produced impacts which are recognizable, as they go well beyond the ordinary levels of communication.
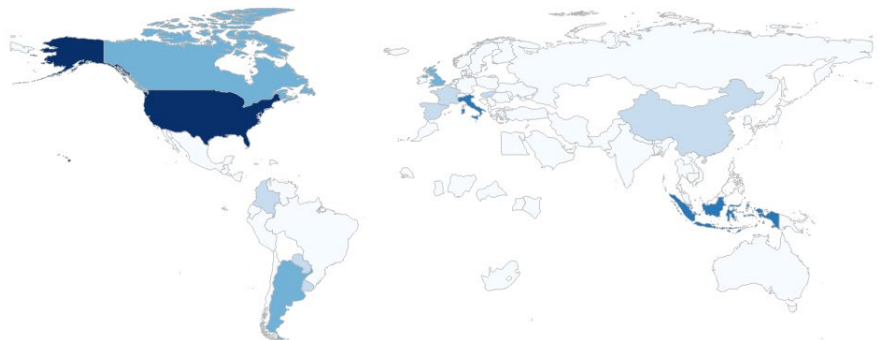

Figure 5: The densities of people having public social network conversations about Bologna or with Bologna in the countries of the world, in the 6 months before the beginning of HUB.

"Collaborare è Bologna"

What does it mean to listen to "collaboration in the city"

HUB observes collaboration in the city of Bologna, aiming to describe the "Collaborative City", in synch with the strategic objectives of the city's administration.

When we started the project we investigated about the best, more interesting ways in which we could think to observe the phenomena of collaboration in the city.

We came up with two main approaches:

- one is *strategic* and deals with starting our observation from the communication and action campaigns performed by the city administration about the theme of "collaboration", along the strategic line of the overall "Collaborare è Bologna" (http://www.comune.bologna.it/collaborarebologna);

- the other one is *tactical* and emergent, and it deals with the possibility to observe how the inhabitants of the city spontaneously express themselves about collaboration, active citizenship, participation to the civic life of the city, about the commons and their desires, visions, expectations, delusions, opportunities and possibilities for collaboration in the city, to "do something" with others.

In this way we were able to achieve a multiplicity of goals:

- understand the effects and impacts of the "Collaborare è Bologna" campaigns and actions;

- understand how inhabitants deal with collaboration in the city, outside of these campaigns;

- try to infer, where possible/evident, how the official campaigns for collaboration influence the overall culture of collaboration in the city, across time and space, managing to engage people, transform the language of collaboration in the city and, in general, change the mood and feeling of the city;

- compare the two modalities, by understanding the differences in topics, desires, goals, ambitions, visions, perspectives and opportunities which are addressed by the official campaigns and by the spontaneous expression of the city, to try to identify missed opportunities, matching goals which have not produced joint actions, the different languages which are used, the flows in which the different aspects agree and disagree, act synergically or not, support each other or not, act on specific topics, and many more.

These two types of observation can be effectively realized using the same set of technologies and methods, but focus on different aspects.

For the strategic one, observing the life of the "Collaborare è Bologna" campaigns and its derivations:

- the general hashtags for the "Collaborare è Bologna" campaigns have been put under observation on major social networks (Facebook, Twitter and Instagram);

- the profile pages of the main actors of these campaigns (the city administration, the organizations, associations, companies) connected to these initiatives have been captured in dedicated ways, so that any of their contributions to the campaigns would have been detected;

- the participants to the collaboration agreements which exist in the city of Bologna, who have public presence on social networks have been included in the harvesting process;

- the main events of the campaign have also been monitored, through their official hashtags and through the profiles of their participants;

- through simple web and social network searches, the profiles, pages, groups and communities which have shown interest or conversations on these campaigns and actions (for example by speaking about them) have been found, and they have been included in the observation;

- spreading out from the capture configured in this way, all of the relevant contacts which engaged in one of the above modalities have also been progressively collected to be included in the observation, so that any of their expressions on these campaigns and actions could be detected.

For the tactical one, observing the collaborative life of the city as it is expressed spontaneously and in emergent ways with the city's inhabitants:

- the observation started with a preliminary research in which about 2000 keywords and sentence templates (actual structures of sentences in which some parts are filled in and some are not, used to describe possible sentence constructions) were identified in quantitative ways to describe the most common ways in which people talk about collaboration in the city for civic or citizenship related purposes;

- these keywords and sentence templates were originally in Italian, and they were then translated to the 29 languages

which Human Ecosystems is able to analyse;

- on top of that, 300 social network hashtags and keywords were selected, among the ones which are more popular in dealing with civic collaboration, collaboration practices in cities and in the commons (we used Twitter's and Instagram's top hashtags search tools to do that, as well as their annual reports); most of them correspond to actual words, and hey have also been translated to the 29 languages supported by Human Ecosystems;

- furthermore, a general preliminary search was performed, to find those social profiles, pages, groups and communities which deal with collaborative practices in Bologna and who were left out from the ones included in the previous search; these profiles and groups were added to the data harvesting process;

- as a last step, we observed

the most influential people and organizations on social networks who deal with collaboration in cities and in commons-related topics to see if any of the inhabitants of Bologna shared, retweeted, forwarded their content; these, as well, were included in the observation;

- from all this, the machine learning processes have worked as indicated in the previous sections, constantly searching for recurring patterns and expressions which could provide sufficient evidence of their correlation with the conversations on collaboration practices in the city; whenever enough evidence was found these elements were added to the observation, allowing to obtain an adaptive system and to confront with emergent behaviours.

Some Numbers

This section includes a numeric overview of the data we have captured.

Over the observation period, **we have captured the public expressions about collaboration in the city of Bologna coming from 73883 social networking users.**

Figure 6 shows how they are distributed across the territory of the city, divided across the administrative census sections.

Of these users, 23% are attributable to the official "Collaborare è Bologna" campaigns and actions, 46% express spontaneously about collaboration in the city, and the remaining 31% does both.

238342 public conversations have been harvested about collaboration in the city, for a total of 968227 public content elements (messages, comments and media objects such as images and videos). This figure does not include the sharing actions (likes,

Legend

Users per Sections

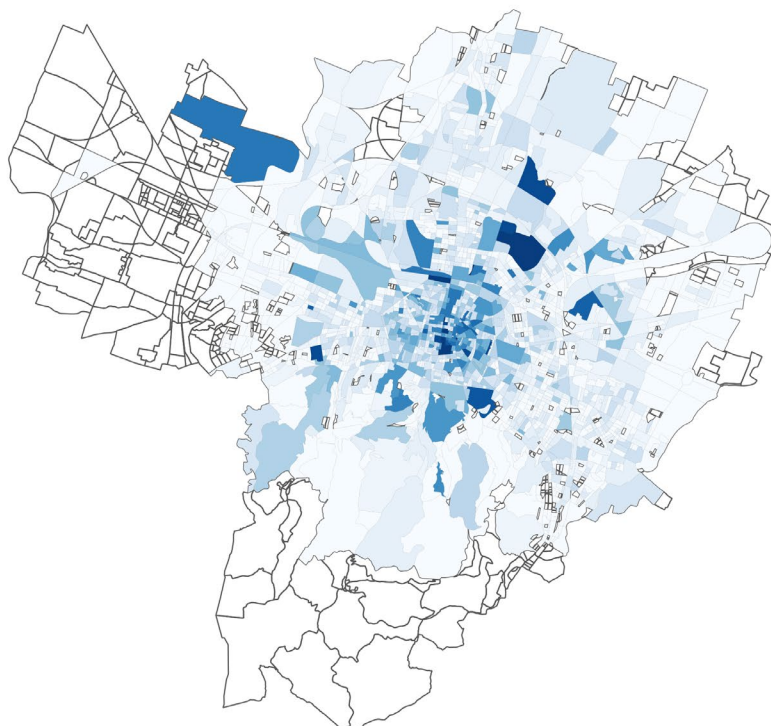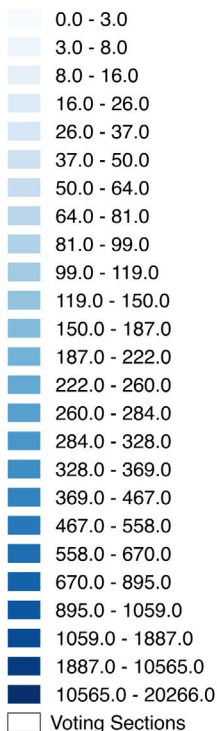|	
	0.0 - 3.0
	3.0 - 8.0
	8.0 - 16.0
	16.0 - 26.0
	26.0 - 37.0
	37.0 - 50.0
	50.0 - 64.0
	64.0 - 81.0
	81.0 - 99.0
	99.0 - 119.0
	119.0 - 150.0
	150.0 - 187.0
	187.0 - 222.0
	222.0 - 260.0
	260.0 - 284.0
	284.0 - 328.0
	328.0 - 369.0
	369.0 - 467.0
	467.0 - 558.0
	558.0 - 670.0
	670.0 - 895.0
	895.0 - 1059.0
	1059.0 - 1887.0
	1887.0 - 10565.0
	10565.0 - 20266.0
	Voting Sections

Figure 6. Users per census section in the city of Bologna.

retweets and similar), which are included in the analysis of the relationships. Of these, 41% have been generated directly by the official "Collaborare è Bologna" campaigns and actions.

Figure 7 shows how the ones which can be precisely geo-referenced (about 45% of the total, using the direct and indirect ways described in the previous sections) are distributed on the territory of the city.

Among these users and through these conversations **8728 strong relationships** have formed in discussing collaboration in the city, and 264281 weak ones. In our study a relation is said to be strong when it joins two subjects through more than 25 interactions over a period of at least 3 months, that is to say that it manifested continuity on this topic for at least 50% of the observation.

388359 emotional expressions have been observed during the data capturing process.

12 languages, over the 29 observed, have had notable presence during the observation (meaning that they were featured in at least 50 messages).

What emerges from the observation

In this part of the report we will analyse some aspects of the data we observed, to represent the characteristics of how *the collaborative city of Bologna manifests itself using social networks.*

For this we will analyse:

- the **people** who express collaboration and their relationships;

- the **times** of collaboration;

- the **places** of collaboration in the city;

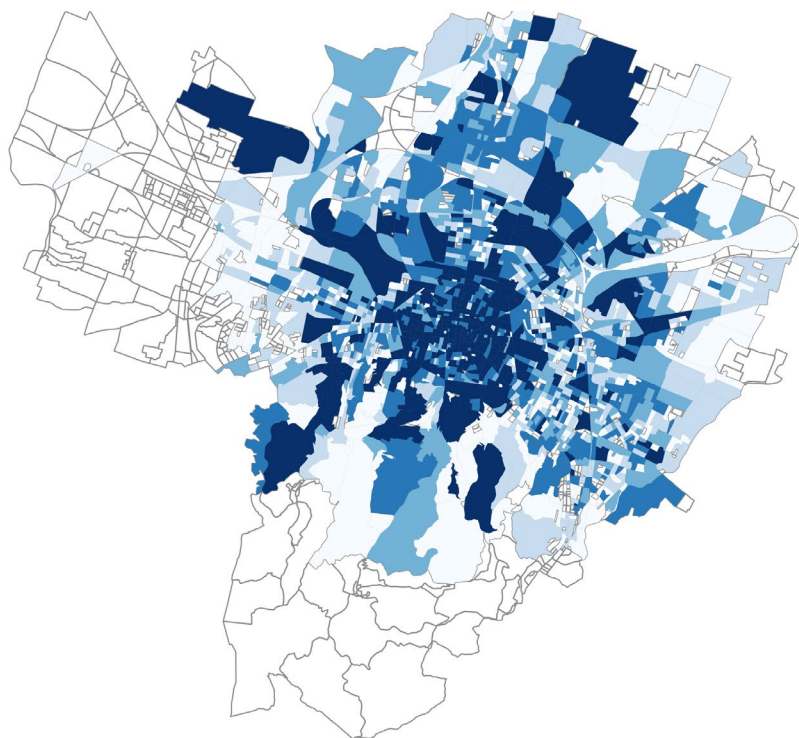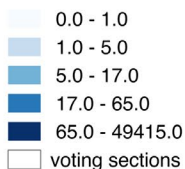- the **topics** of collaboration and the languages and imaginaries which they use;

- the **emotional landscape** of collaboration.

Legend

content per section

Figure 7. Conversations per census section in the city of Bologna.
14

People & Relations

Number of
subjects:
73883

Number of strong
relations:
8728

Number of 'weak'
relations:
261877

% of the strong
connections
attributable to
"Collaborare è
Bologna":
41

% of all subjects
in the weak
connections
scenario who have
no relationships:
12%

the user with most
strong connections
has:
214

64% of the users
with strong
connections have
about:
9 to 14 strong
connections

number of
influencers:
64

number of hubs:
147

number of experts:
85

number of
bridges between
communities:
956

The more than 70 thousand subjects which we have been able to observe in the expressions of collaboration in the city of Bologna have formed many relationships, of which almost 9 thousand of them are strong and more than 260 thousand exist overall, but weaker.

Figure 8 shows the relational ecosystem of collaboration in the city, as expressed on social networks and represented through its strong relations.

In Figure 8 we can see circles, the nodes, which represent the single users on social networks (and, thus, they may correspond to individuals, organisations, companies…), and whose size correspond to how prominent their role is in the relational ecosystem (e.g.: how many connections they have, and how strong they are, according to our definition).

Nodes are connected to other nodes, to represent a relationship of some sort. Relations can be established by having conversations (messages, comments…), by appreciating other people's content (like, favourite…), by sharing it (share, retweet…), or by being mentioned in the same contents (tags, mentions…). Each of these modalities have different weights, in that they represent different kinds of relationships, which may be stronger or weaker: a conversation is stronger than an appreciation, a mention is slightly stronger than a sharing action, and so on.

In Figure 8 all connections are drawn with the same weight and color for simplicity. In the next diagrams we will highlight some types/weights of relation to obtain specific results.

Figure 8 is a complex diagram. It is beautiful to see and it may become a beautiful addition to the offices of the city's administration.
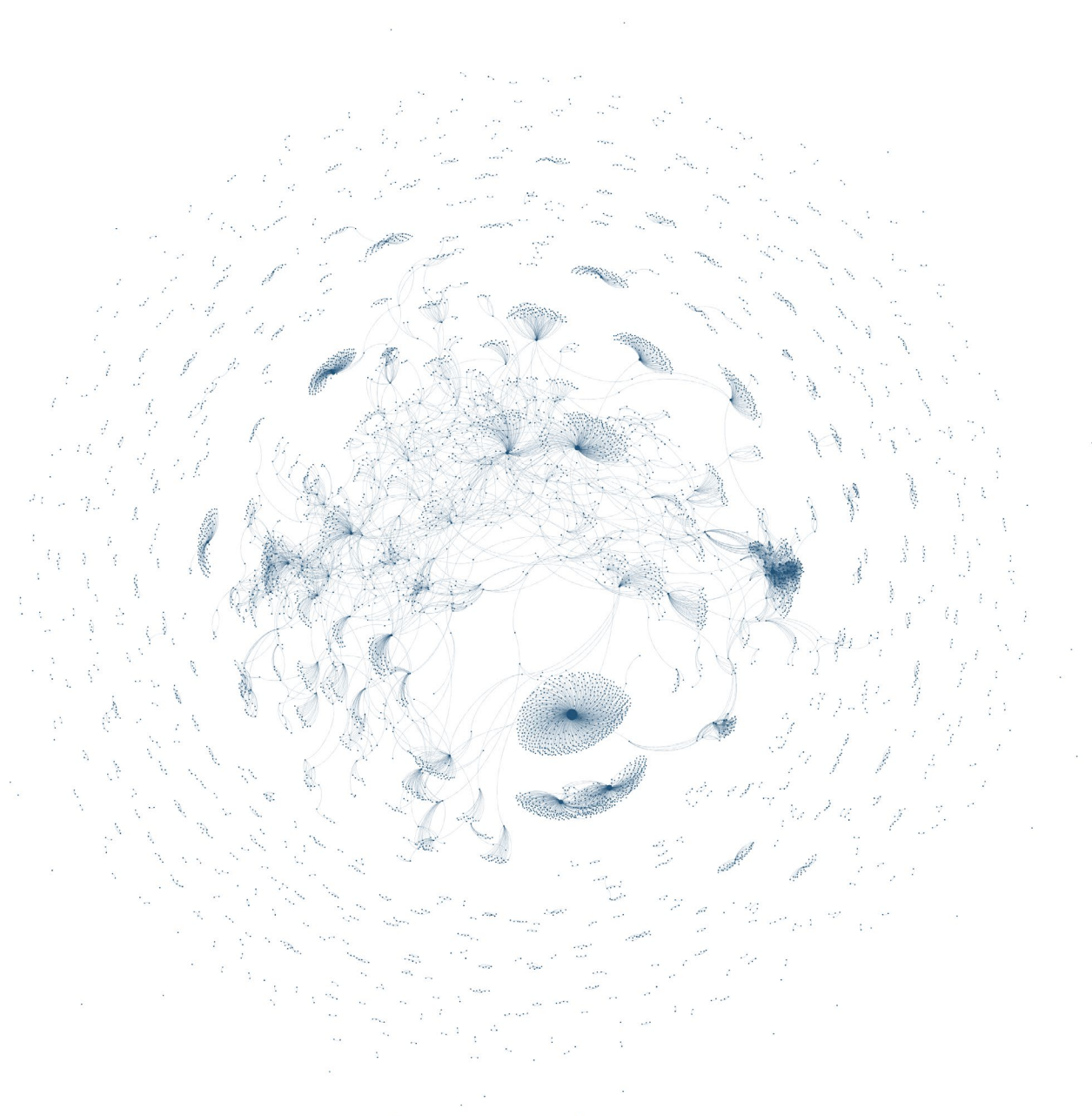

Figure 8. The general relational ecosystem of the collaborative city, represented through its strong relations.

But what can we understand from it?

We can look at its shapes and layout to understand the general form of the relational ecosystem of collaboration in the city, for how it is expressed on social networks.

One note before we proceed: as you will see, **here and in the other sections of the report we do not show the names of the individuals connected to our data harvesting process.** This is because of several reasons:

- we do not store them in the database (and in the Open Data sources), to protect their privacy and rights, as stated in the ethics code;

- it is forbidden both by national and european laws, and by the social networking services terms of service;

- we provide tools for each person to explore the relational ecosystem of the city individually and as groups, so that they will be able to see what people chose to share in public by logging in to social networking platforms; these tools are available in the Bologna's Urban Center and in the workshops which we provide (and will provide in the future) in the city.

With that said, let's proceed.

We may choose to highlight several clusters of relationships based on their characteristics, for example by colouring them according to their more direct, stronger connections.

In Figure 9 we have done this for a series of clusters:

- the social network users who are strongly connected to the "Collaborare è Bologna" campaigns and actions are shown in **red**;

- the autonomous/alternative social movements in the city are shown in **green**;

- a pop-star, selected among the many present in the city just to provide an example, is shown in **purple**.

Even with this simple analysis, a series of very interesting characteristics emerge. Let's start to understand them.

First, let's start from the pop-star, in purple. As we can see, its node brings together in strong ways large number of subjects: they are its *fans*. It is interesting to note that this particular type of relationship, called *fandom*, does not propagate within the relational ecosystem. In the discussion for collaboration in the city, this pop-star has said something "collaborative", "civic", or "participative", and thousands of its fans have appreciated it, commented it, shared it, thus appearing in the relational ecosystem, but, basically, not interacting with any other of the discussions which go on in the rest of the ecosystem.

This is a very interesting thing to note, as it gives us tools for reflection:

- first, we may notice that there is a whole set of population who does not usually discuss collaboration in the city, and who did so just because their favourite pop-star addressed this topic;

- second, we may study what these people usually say, their desires, expectations, wishes, values and visions for the future, to be able to understand how to engage them in the discussion and action for the collaborative city; as a second option in this point, we may try to understand how to engage this pop-star (or other ones) to activate its fans more frequently;

- third, we may want to analyse other contexts/topics to see if there are any other situations of this kind, to be able to bring in more people, to activate them in the collaborative processes in the city.

In all of these cases: we have found an entire part of the population which does not usually engage in the conversations and actions for the collaborative city, and made some hypotheses on how to activate them more constantly.

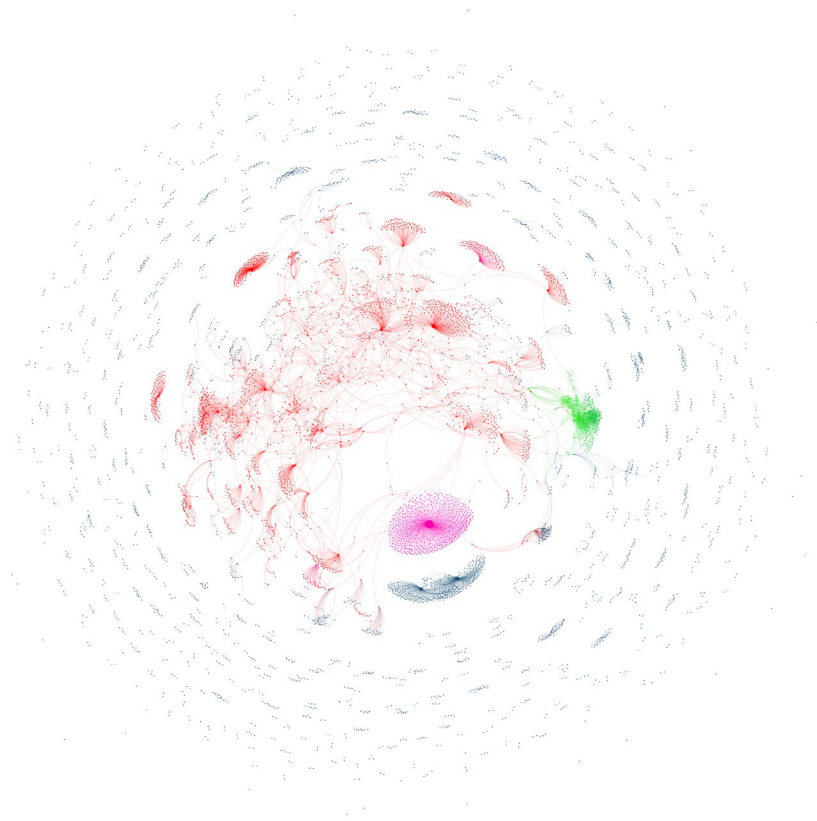Let's notice, as a second focus, the green nodes and connections in the

Figure 9. Some clusters of relationships are highlighted on the graph.

graph. These represent the main actors in the social movements, in the countercultures which in Bologna have a historical presence. Of course, as said previously in the text, what we see in this graph is only a representation of the strongest links among people and organisations. Their green network is much wider than this. But if we focus on the strength, weight and persistence of their presence in the relational ecosystem of the city – for everything that concerns "collaboration in the city" – a series of interesting elements start showing up.

Their networks are complex and multi-centric. There is no single principal node, it is very horizontal and interconnected: each node is probably interconnected with many of the others. This means that there are frequent, daily exchanges, conversations, sharing actions: they forward and share each other's communications; they appreciate or comment each other's messages; they mention each other consistently. It is a real community, in which everyone basically knows and supports each other. They are also very tightly coupled, with few (although interesting) connections with everyone else.

This last point is of particular interest. Although they have many connections with the rest of the relational ecosystem (in Figure 9 you can count 27), none of them are connected with other relational hubs. This shows how they are rooted within the general community in the city (and visualizing the weaker connections would show this fact even better), but they do not establish relations with those hubs, influencers and opinion makers which are outside of their community. This, of course, is a phenomenon that goes both ways: the hubs outside of their community do not really establish relations with them, too.

What can we learn from this type of behaviour?

We may, in the first instance, notice the role of the *bridges*, meaning those nodes which in this context play the role of interconnecting this community with the rest of

the relational ecosystem. Bridges are important, but not necessarily "big" nodes in the network. In this case, for example, we can visually appreciate how, in fact, they are rather small. But, for their characteristics, they have the ability to interconnect different contexts, communities, tribes. They are "friends" with multiple communities, with which they establish relationships, and function as a layer of permeability between them, enabling content, information, knowledge, news and updates to propagate from one to the other.

This is a very important role:

- it allows to establishing connections between communities and tribes;

- it allows to coordinate, especially in these cases in which direct communications between hubs may be complicated, or even counterproductive; bridges allow communities to establish conversations without engaging the power and influence structures, so that what is positive about conflict (diversity) is preserved, while still being able to allow dialogue;

- it forms an interconnective texture for the relational ecosystem, avoiding isolation and making possible to interconnect diversity; bridges are adapters.

In this case, what we see on the relational graph is the fact that the green nodes (the people in the area of countercultures and politicised social movements) actively, publicly and intensely discuss collaboration in the city, and their ideas and expressions are connected to the rest of the ecosystem through these bridges. In practice, it means that, through these bridges, other people outside their communities will see their expressions and opinions. And, viceversa, they will appreciate and discuss (even conflictually) what is happening "outside" of their circles mostly through these bridges.

This is also an interesting scenario for another reason: diversity. If used properly, this scenario is, in fact,

one of the many ways in which diversity can flourish in a relational ecosystem. That is by ensuring for the existence of an interconnective human infrastructure with the domains of diversity, which, thus, maintains the possibility and autonomy to express and represent itself while ensuring the existence of human interfaces which are able to propagate visions, desires and expressions in both ways, realising permeability.

Of course, boundaries in "real life" are much more blurred and fuzzy, but this scenario may provide useful insights which could be used effectively, by both sides.

For example:

- "clash of titans" scenarios may be avoided, using bridges; given the oppositive dynamics of these kinds of scenarios, whenever hubs converse directly with each other, violent clashes occur which live only on the dialectical level, and do not bring any real change (there is the arguing, but not the change that follows it); strategies and tactics may be designed, for all parties involved, in order to avoid such clashes and, instead, design communication which manages to propagate expressions, opinions, points of view through these bridges, and adding more bridges, to infiltrate people's perception and, thus, imagination and desires, to achieve the possibility to avoid a fight and start constructive dialogues;

- other scenarios in which bridges can be useful may be searched, to be able to reach those communities which do not usually engage in the conversations and actions for the collaborative city;

- bridges may be valorised, by systematically empowering those subjects who have interconnective characteristics within the relational ecosystem, to be able to form interconnective tissues through communities;

- and, last, the characteristics of these bridges can be explored

to understand why they are able to open dialogues with certain groups and networks, thus understanding possible co-existence and integration strategies and tactics.

Let's proceed with our analysis by observing the red nodes and connections, which represent the main actors of the official "Collaborare è Bologna" campaigns and actions.

These are spread apart and very organic. There are multiple hubs, all interconnected with their reference communities as well as being connected with each other, directly or indirectly, through one or more of their members.

It is interesting to note where the city's main online presence, *Iperbole* (for example TWIperbole, on Twitter), is positioned, as can be seen in Figure 10.

This part of the graph is positioned in the center-left quadrant of the overall graph (you may easily localise it by visual inspection). Iperbole, the name of Bologna's civic network, is a hub (as it has

many connections, all focused on it) and an influencer (as the communication it emits constantly influences other people's online behaviours and expressions on everything concerning collaboration in Bologna). But its quantitative dimension is not its salient characteristic. It's not such a big hub or influencer, after all. Not at all comparable with our pop-star from one of the examples above.

Its main characteristic can be found in its positioning within the relational ecosystem, because it is at the center of a wide, extended, complex, multi-centric network of individuals and communities which are also connected among each other. It is an hub, a bridge and an influencer at the same time. We can understand this by looking at its connections, and where they end up. It is connected to hubs for other communities, for example the LabGov hub, to its left – which then is consistent in interconnecting its members –, just as it interconnects with other hubs. And, within communities, it does not interconnect only with the communities' hubs, but with many

of their single members. Most of the time it is not a connection of the "community-hub-hub-community" type, in which communities orbit around their hubs, which are then connected, by a single or a few links. It is a "community-Iperbole-community" type of connection, where not only it is connected to the community's hub, but also to multiple of its participants, and it serves as a bridge from many of them to many of the other communities.

If seen its evolution in time, as the links are progressively established, this phenomenon is even clearer, as it happens almost systematically that this type of node assumes an active role in creating interconnections among the others.

The shape and structure of the relational network related to the "Collaborare è Bologna" actions and campaigns is consistent in this sense:

- it is multicentric;

- it hosts multiple hubs;

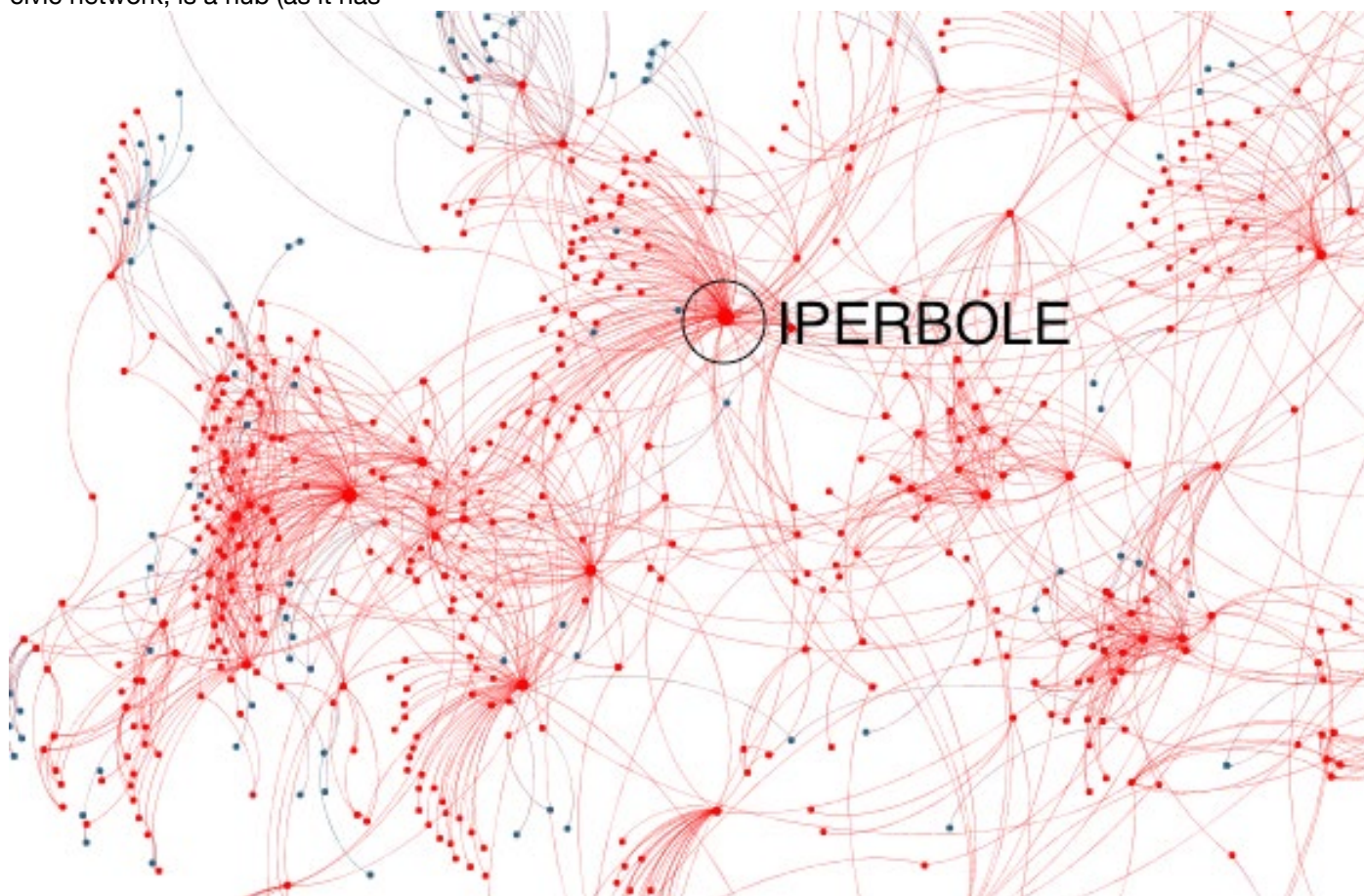- the hubs are very interconnected with each other;

Figure 10. Iperbole, positioned in the relational ecosystem of the collaborative city.

- the communities each hub gathers around itself are also connected in multiple ways with members of other communities;
- it has an expansive pattern, as more communities are progressively added;
- it maintains its semi-hierarchical structure, with the compresence of hierarchies and of peer-to-peer connections.

All of these are the characteristics of an organic, well-grown ecosystem, in which multiple polarities coexist (also with their conflicts and disagreements), but which are easily (visually, in this case) recognisable as part of the same environment.

With the colors purple, green and red examined, we have covered a lot of the people in Bologna expressing about collaboration in the city. But there's still many people left (visible in the image coloured in dark blue).

Who are they?

They are the "none of the above". They are all the people that, with some constancy and persistence, discuss collaboration in the city of Bologna.

They are individuals, friends, families, associations, organizations, companies, students, researchers, artists, migrants and others who, during their presence in Bologna, consistently deal with the issues of collaboration, active citizenship, participation in the city.

We can imagine them using the "people at the bar" metaphor. Some people in a bar will know each other: they will greet when they arrive, say goodbye when they leave, chat while they're there. Not everyone knows each other in the bar. Even if it's a small space, there will be different groups and cohorts. They will speak different languages. Different as in "Italian" versus "French". But also different in the fact that they have different linguistic configurations and patterns: they will use different metaphors; deal with different issues and contexts; talk about different subjects, or about the

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same subjects, but in different ways. These people may live their entire lives without knowing each other. Even if they were in the same little bar at the same time, and even if they liked the same music or were fans of the same soccer team, they may never speak to one another.

Here we are in approximately the same situation.

All the "blue" nodes/people (about 59% of the observed subjects) actively and persistently express themselves about collaboration in Bologna. They create communities and groups. Even relatively large ones, as can be seen in the lower part of Figure 9, just below the purple community of the "collaborative pop-star". They create actions and "do things" in the city dealing with collaboration and civic participation.

If the weak relationships would be shown in the graph, this phenomenon would be even more evident: about 72% of the observed subjects express themselves in some way about collaboration in/for the city, but are not connected to the communities and networks of the official collaboration policies of the city. In this case, 12% have no connections at all: they express about collaboration in the city, but they really have no persistent connection with anyone else.

These may seem like large numbers. Even worrying numbers, if we think about the impacts of the city's policies. But they are not. They are good and positive, in fact.

Because this is a recurring scenario, not only on social network, but also in the physical life of cities. In effect, the fact that about 41% of the subjects which express themselves on social networks about "collaboration in the city" connect to the general area of "Collaborare è Bologna" is quite an outstanding figure. Social networks (and cities) are places of diversities, of multiple bubbles which often fail to be permeable, or even visible. Communities are often invisible to one another, and the differences in language, culture, literacy, views, opinions and factions do not ease permeability. On top of

that, on social networks, the filter bubble phenomena also support this scenario. Social networks are designed in order for people to see what systems "think" people need or want to see. This causes people to easily experience only a small part of the available content and information: what their "friends" like; what the advertisers advertise; what the algorithms decide they should see.

With all probability, these communities may be "invisible" to one another, to an extent.

This is where systems like HUB come into play.

By allowing to capture and visualize all of the expressions in the digital public space, it becomes possible to understand the forms, compositions and layouts of these communities, and think/act about how to connect them to each other.

We're not alone or invisible anymore: we see the everyone's nodes and relations, and we can start acting with them.

In the following sections we will analyse the times, places, topics and emotions expressed and lived by all of these subjects and communities. This will help us to understand the differences and similarities, and to simultaneously understand the scenario of collaboration in the city, and to grab more than a few hints on how to create new connections, or strengthen the existing ones.

Time

communication
about collaboration
in the city takes
place in cycles

the average
constant
persistent mass
of conversations
about
collaboration:
1482 per day

"Collaborare è
Bologna" actions
create a growing
trend in the
conversations
about collaboration
in the city

the recurrent cyclic
structure of online
communication
can help identify
promotion,
execution and
feedback loops,
which may be
used to design
communication
and engagement
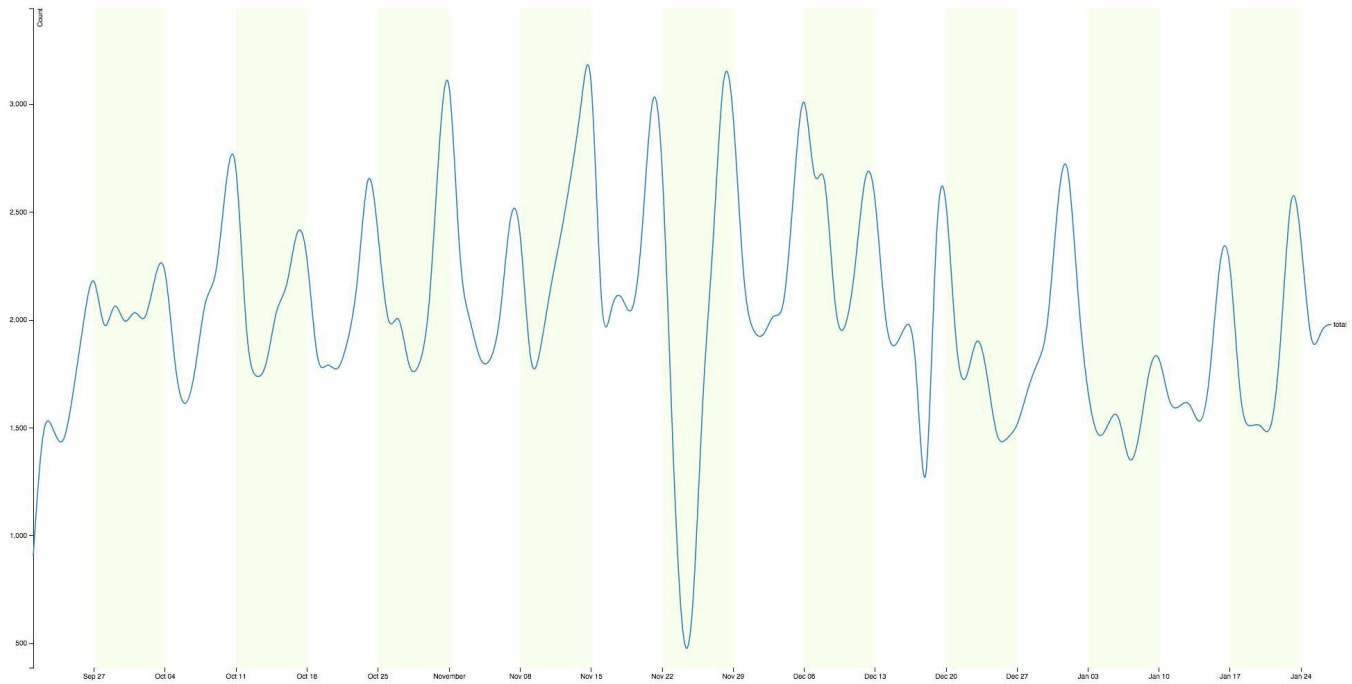
Figure 11. Collaboration in Bologna, through the number of expressions over time, on major social networks.

Let's now look at the first dimension: time.

Here we will investigate the evolution of the expressions and conversations about collaboration in the city across days, weeks and months, during the capture process. We will also match these evolutions with the news and events which took place in Bologna, to try to make sense of them by trying to formulate possible cause-effect relationships for the various communities.

Here above, in Figure 11, is a timeline of collaboration in the city of Bologna, through the number of expressions per day, on major social networks.

On the chart, weeks are highlighted, from sundays to saturdays.

The first thing that appears as clear while looking at the chart is how communication is cyclic, on a weekly basis. Taking each one of the weekly boundaries highlighted in the graph, it is clear to note a few things:

- most communication happens on weekends, or in the parts of the week adjacent to them;

- the beginning of the week (mondays) start slowly;

- it is not until wednesdays/ thursdays that communication really starts;

- if something "interesting" happens on fridays, saturdays and sundays, it also carries on into the beginning of the week (as for example in the

week starting December 6t);

- there is a constant mass of expressions, centered around the 1500 mark.

Note: the negative peak in the week starting November 22nd is due to a breakdown of our servers. Online systems such as Facebook and Twitter impose severe limits and constraints when you need to fetch content from the past, even from a single day, and they don't provide the full information. For this reason it was impossible to get all the information from the previous day, as soon as the server problems were fixed.This is yet another example about the importance of becoming able to autonomously manage the digital public sphere of the city: once it is passed (even on a single day) it's gone and you can't have it.

Let's see what happens if we overlay to this graph to the one which shows the quantities of messages over time which are attributable to the "Collaborare è Bologna" campaigns and actions, like we can see on Figure 12.

The result is very interesting: we can draw a line around the 1500 messages mark, highlighting the constant, spontaneous
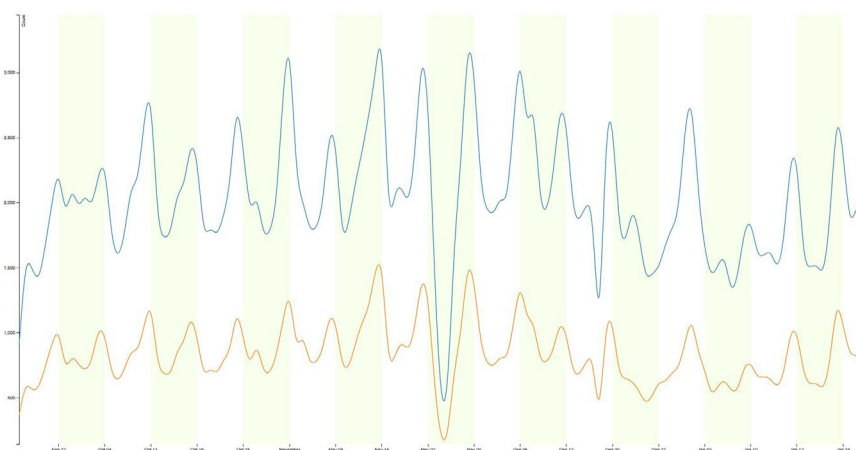

Figure 12. Total collaboration in Bologna, through the number of expressions over time, on major social networks, in blue, as compared with the number of expressions attributable to the Collaborare è Bologna actions and campaigns, in orange.

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conversation about collaboration and civic participation in the city and the communication generated by everyone who, on social networks, operates at any title within the "Collaborare è Bologna" could be added to it to obtain, almost perfectly the total expression of collaboration in Bologna.

What does this mean?

Simply put, it means that the expressions deriving from "Collaborare è Bologna" add to the spontaneous "background noise" of the expressions of collaboration in the city, and to try to understand their impacts we could try to understand if the mark which we imaginatively placed around the 1500 mark could instead represent a curve, which could show evidence of a trend: how has the communication about collaboration changed with the actions of "Collaborare è Bologna"?

Let's do that.

The curve can be seen in Figure 13, in red.

In Figure 13 the red curve has been slightly exaggerated to make it more comprehensible. Also, the "valley of data" from the week starting November 22nd has not been taken into consideration.

This red curve shows the trend in growth (exaggerated by a factor of 10%, in positive and negative) on

the average number of expressions about collaboration in Bologna.

Let's analyse it. It starts low, as the initial collection of content was just starting (within the first 3 days of observation), then it ramps up with a gentle curve until the week of December 6th-13th, then it curves down until January 17th, then it starts rising again.

If we take into consideration the Christmas holidays, in which people may not have been particularly focused on discussing collaboration in the city, an interesting insight comes about: there is a possible (meaning: to be verified) correlation between the spikes of communication coming from the "Collaborare è Bologna" initiatives and the curve, which possibly seem to cause effects: *each time that there is an initiative or communication campaign, the overall conversation about collaboration rises a bit.*

This correlation, of course, has to be verified (we will do it in this report), but the effect is present. We could picture this by describing how each action from "Collaborare è Bologna" contributes to spread knowledge and awareness about collaboration in the city, and that at least some of the people who came to know about the opportunities for collaboration in the city become more consistent in discussing them

and the topic in general.

We can inspect further.

Let's see what happens if we overlay yet another layer on top of the chart: the principal events about "Collaborare è Bologna". The result can be appreciated in Figure 14.

Here we can find yet more evidence. The events match the starts of rise in the peaks of communication: people begin to talk at the event, keep on doing it sometimes after it, also preparing for the next events, the following week, where the cycle will start again. When the events stop for the Christmas holidays break, the curve begins to fall, only to rise again at the beginning of the new season, when the activities have started again.

Dissecting the scenario even more, each cycle sees two peaks: one relative to the communication performed by the city's Administration and its direct partners, one from the inhabitants of the city participating to the initiatives. The first one feeds the second ones, which provide feedback that is appreciated (establishing new relations, or confirming existing ones, making them stronger) and, after that, the cycle starts again, ready for the next initiative.
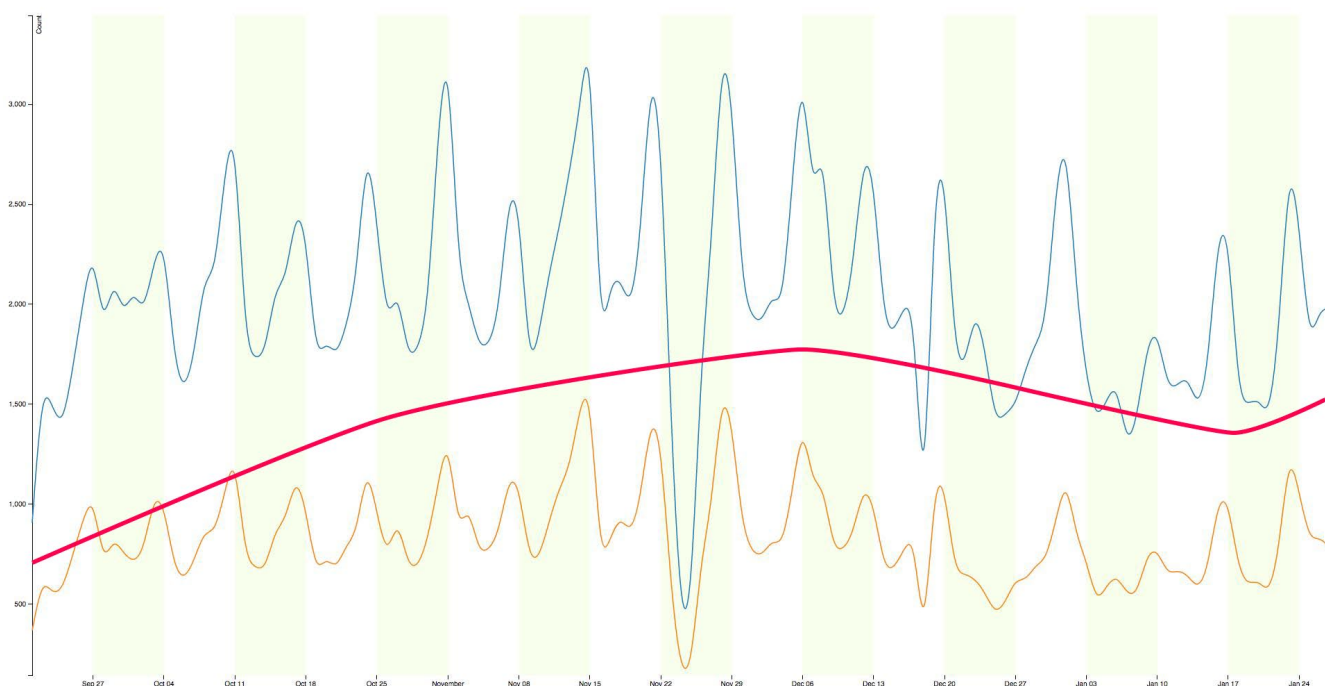
This is a clearer connection to

Figure 13. Trend curve (in red) represented by the change in the difference between the blue and orange lines.

the hypothesis of a possible correlation for the rising trends in the expression of collaboration in the city. It provides sufficient evidence to transform into a quasi-certain theorem: in the current scenario, *the more "Collaborare è Bologna" goes on with its events, the more the idea of collaboration and civic participation effectively spreads in the city, together with the actual participation of the city's inhabitants.*

Before closing the Time sections, to understand the "times of collaboration" in the city, let's analyse for a moment these cycles in their structure.

As shown in Figure 15 these cycles can be subdivided in their phases.

The first highlighted phase (between the first two red dashed lines) is the event/initiative: this is when people are actually at the event or other initiative by "Collaborare è Bologna", discussing, posting images and selfies and establishing the general communication for these events. This is the digital life of the event, and we can look in it to find the impressions and expressions that people (and the administration and its partners) highlight: the sentences which have been more meaningful; the images that were more significative; the concepts which emerged; the

most curious things; the selfies and the other amenities which are typical of online communication. Also in this section the seeds of the communication of the next events may be found, usually under the form of announcements and their appreciations and shares.

The next section is the feedback. As the days go by, some of the conversations continue. This is the place/time in which to search for the most meaningful feedbacks for the initiatives. Here the more meaningful, relevant and interesting things and concepts (in positive and negative) will appear. We can look for them here, collect them, respond to them, use them to bring up new dialogues, and also to create hooks to promote the next initiatives, generating even more dialogue and participation, which will bring to the last phase, which is symmetrical to the first: the event/initiative is about to start.

With this analysis done, we are ready to move from time to space, by analysing the geography of collaboration in Bologna, as expressed on social networks.
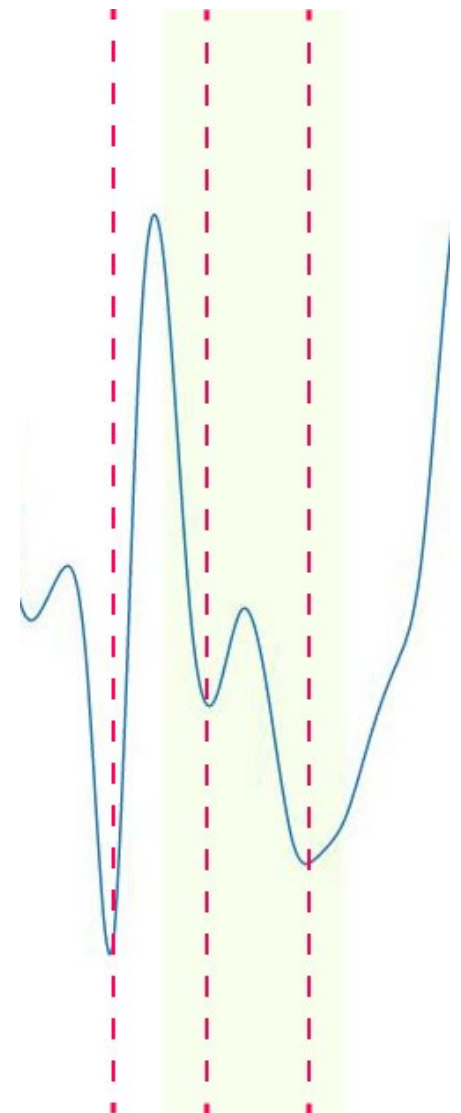

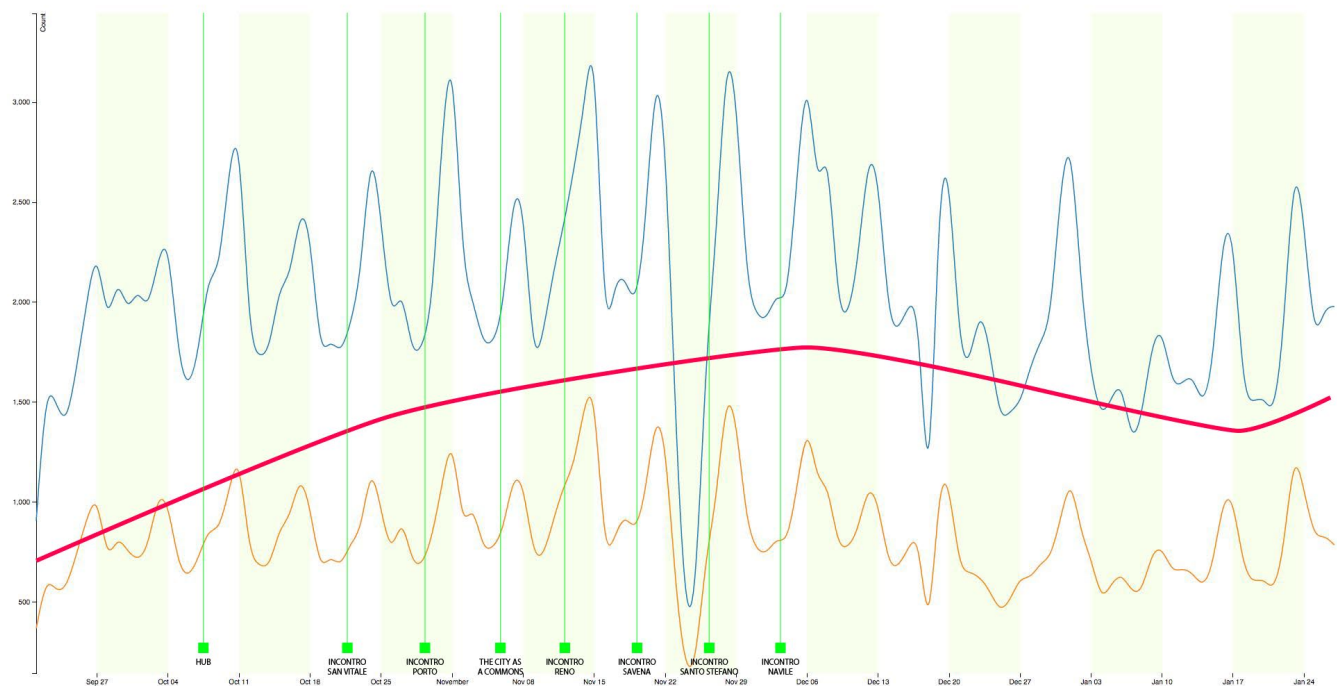*Figure 15. Subdivision in time of the communication cycles.*

Figure 14. The quantities and trends of expression of collaboration in the city, over time, with the indication of the principal events of "Collaborare è Bologna".

24

Places

High numbers of expressions about collaboration in the city towards the center of Bologna, and in various other areas radially spreading out from the center.

Parks play an important role: many times they are catalysts for collaboration (or at least for its expression).

Entire streets can become hubs for the expression of collaboration.

Transport hubs (e.g.: airport and station) are peculiar hubs for the expression of collaboration: communicative postcards of the expectations for collaboration in the city; and places to express the wishes for the presence of collaborative services.

Administrative areas with high numbers of expressions about collaborations which have at least 1 organisation in Iperbole:
62%

Administrative areas with high numbers of expressions about collaborations which have at least 1 project from a pact for Collaborare è Bologna:
31%

Administrative areas with high numbers of expressions about collaborations which have at least 1 organisation or at least 1 project with a pact for Collaborare è Bologna:
87%

In the "Some Numbers" section we have already shown the distribution of the users and contents in the city, and we also demonstrated ways in which we can discover how the expressions on social networks can be taken in consideration to gain more precise insights about the overall life of the city, expanding from online domains.

Here we will focus on the actual initiatives dealing with collaboration in the city, to gain insights about what are the places of collaboration in Bologna.

To do this, we will start from where we left off in Figure 7, by zooming into the city.

As can be seen in Figure 16, the communication on social networks about collaboration in the city is spread out across most parts of the central part of the city, and across several other areas, mainly spreading out from the center of the city, along the directives of the principal roads and of the more populated boroughs.

By zooming into the city, as can be appreciated in Figure 17, it is possible to highlight some additional detail. The convergence towards the center of the city is confirmed: the many venues and happenings which take place in downtown Bologna, together with the general density of the population in this area across all hours of the day, contribute to creating this phenomenon. This also explains the marked evidence of the general directions which constitute the axis of collaboration in the city: major roadways and historic or popular locations are the ones which host the larger numbers of inhabitants in the city and, thus, produce more content, both in the everyday life and in the occasion of the many events. All converges towards the main hubs in the city: Piazza Maggiore, for example, the University, the Two Towers, St. Peter's cathedral and the general area defined by these and other major vertices of presence in the city.

To better highlight the meaning of these presences of expressions about collaboration in the city, we will match them with the existing initiatives from "Collaborare è Bologna" and their locations: this will allow us to gain better understandings about where these presences originate – and whether there is a correspondence with the initiatives by the administration and its partners –, and about their logics and meanings.

Before doing that, we will highlight a few interesting details.

First of all, the role of parks and nature in the city. Most parks and natural spots in town feature interesting densities of expressions of collaboration. This is true starting from the ones towards the center, but also arriving to the ones which are farther away from it, progressively proceeding towards the periphery of the city. For some of these last ones the process is clear, such as in the case of the ex-Velodromo, the Giardino Bandiera De Coubertin, the Parco Nord, the
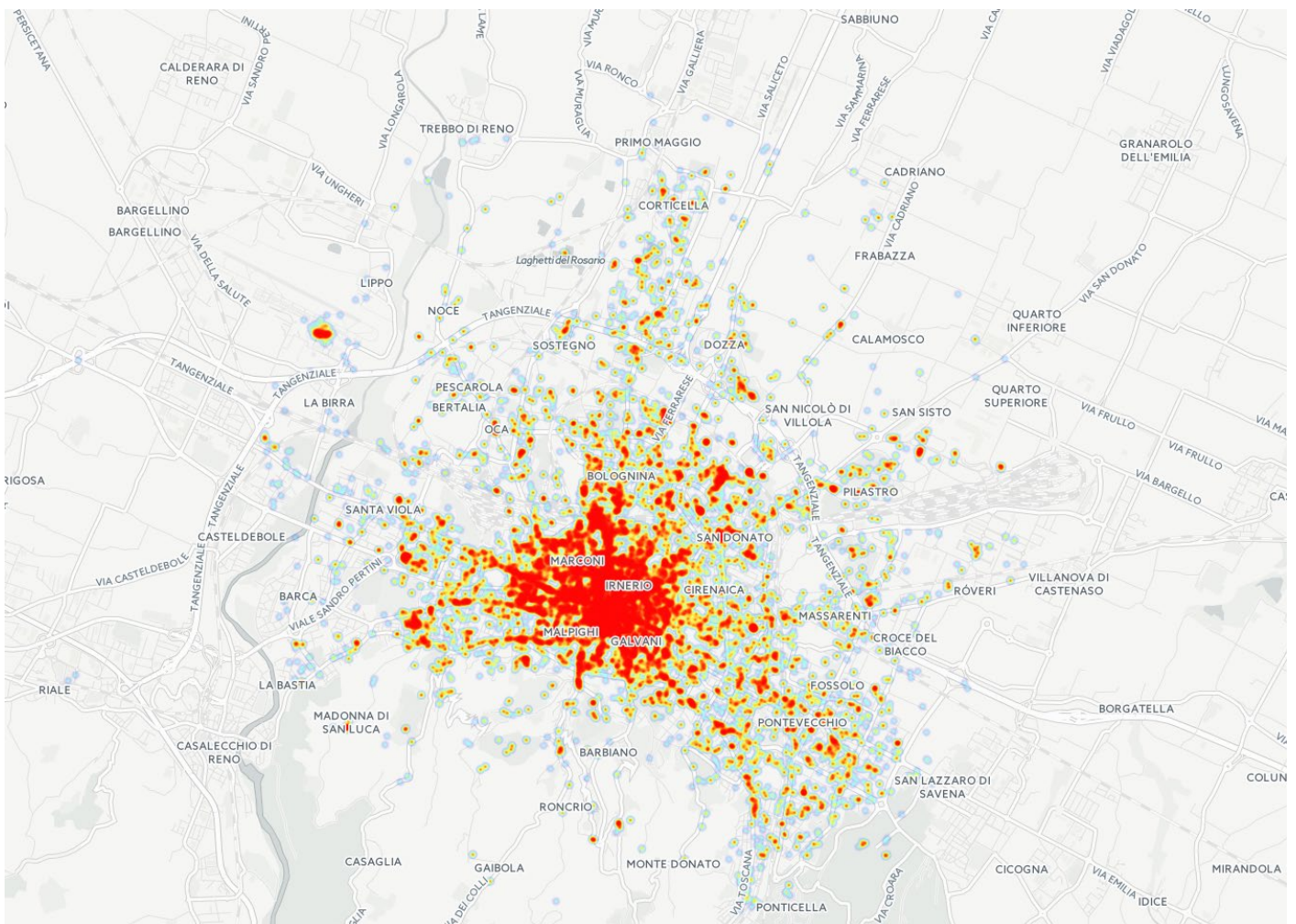

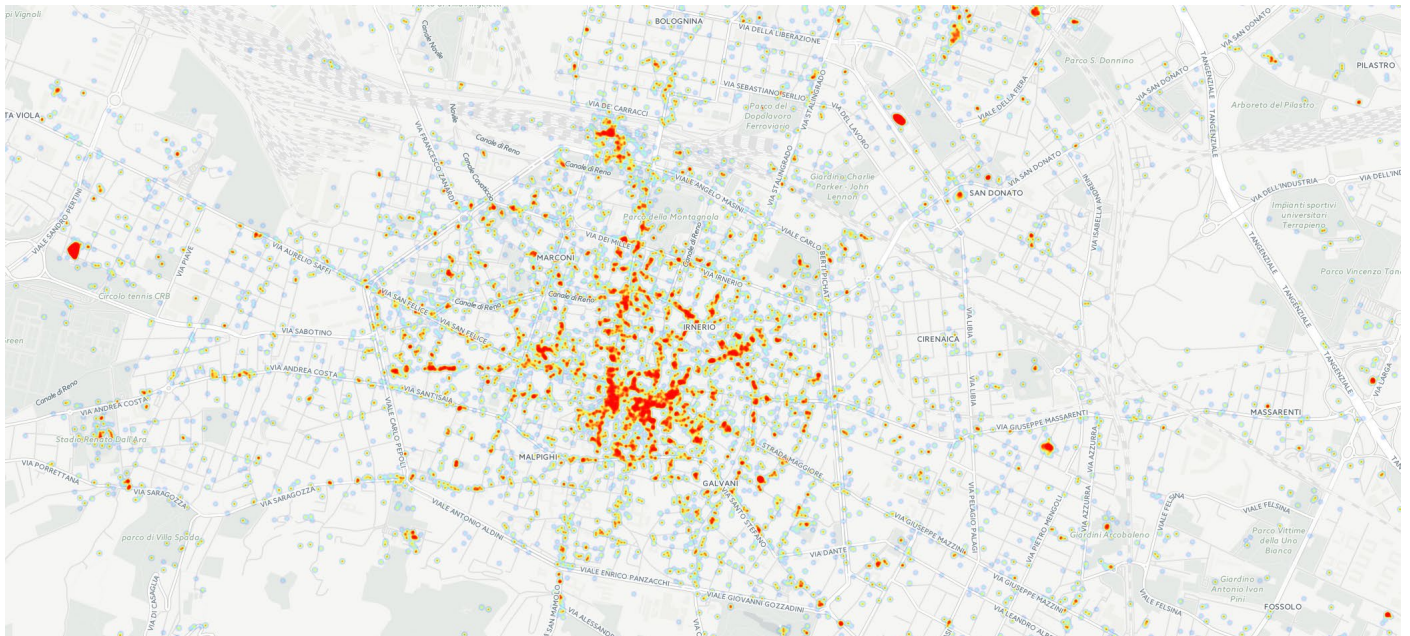*Figure 16. The places of collaboration in Bologna; zoomed out view.*

Figure 17. The places of collaboration in Bologna; zooming into the city.

Parco Pier Paolo Pasolini, the Parco San Donnino, and the Giardino Renato Bentivogli. These, as well as the ones directly attached to the city center systematically express multiple forms of desires and visions for collaborative practices in the city, even spontaneously (meaning across all moments of the daily life, not necessarily in the occasions of events): clean parks, the availability of services, people's behaviours, civic collaboration towards maintaining the nature in the city and adding value to it are the main subject of the expressions.

Other interesting locations where high numbers of expressions for collaboration in the city emerge, and which deserve additional explanations are the Airport, the Central Train Station, the BolognaFiere neighbourhood and infrastructures, and Shopping Centers. Each one of these types of locations manifests expression for collaboration in peculiar ways.

The Airport (Aeroporto G. Marconi BLQ) and the Central Train Station (Stazione Centrale) become hubs for expression of collaboration in the city for two main reasons: people arriving in the city for events and initiatives which deal with collaboration in the city, from a wide range of perspectives; and people using the infrastructures and services offered by these locations and wishing (or imagining) more collaborative ways for implementing them. There are other reasons, of course, but these are the main ones.

About the first: it is very common when people arrive to the city (and when they leave, as well) to manifest their expectations, desires and wishes. These kinds of action are comparable to sending a postcard describing what one expects from the city: "Just arrived in Bologna for City as a Commons conference! Let the sharing begin!" was one of the expressions which perfectly describes this approach. Both the initiatives of "Collaborare è Bologna" and other ones which involve collaborative and participatory practices manifest this kind of behaviour.

About the second: people do not really like taking taxis, buses, or dragging their luggage to get to their final destination when they arrive in a city. Apparently, judging from their expressions on collaboration, there's many of them who would enjoy if the services (in arriving and departing) offered by these transport hubs would manifest themselves also in collaborative ways, by sharing rides, having someone walking them to their destination, eating with someone, and more. In general, by inspecting these types of expression it is clear how a variety of collaborative services would be really imagined and appreciated, enabling visitors or temporary inhabitants to experience the company of friendly, helping co-citizens, rather than commercial services.

In a way, the expressions of civic collaboration located at the BolognaFiere and its surrounding neighbourhood follow similar logics. Many of the events held at Bologna Fiere are connected to the idea of collaboration in the city, in multiple direct and indirect ways: first of all the Smart City Exhibition, but also many others. In general, whether they deal with smart cities, energy, environment, food, furniture, sustainability, children, ceramics or else, many of the ideas and concepts which the visitors to the Fiere can experience suggest many possible ways in which collaborative practices could take place in the city. Many of these visitors share these practices online, creating an interesting type of emergent, continuous and spontaneous survey, relating the concepts which are presented to the visitors' interpretation and evaluation in terms of collaboration and well-being in the city.

Shopping centers are also an interesting location for the expression of collaboration. This happens mostly in spontaneous ways, and it deals in many ways with the desire to be with someone, doing things together, wishing for social structures and practices which could provide multiple

forms of "being together" and "doing things together", even as simple (and fundamental) as going shopping.

Before diving deep in the central part of Bologna, let's examine other peculiar and significant locations in which collaboration is discussed in the city.

One of them is atypical for its linear structure: via del Pratello. The entire central part of the street, together with some of it that goes radially outwards from the city, is constantly filled with expressions about collaboration. This is the result of the many interventions performed for "Collaborare è Bologna": collaboration entered a sort of shared vocabulary. It would be very interesting to have access to historical social networking data to explore the rise of collaboration in the language of this linear area, to understand its evolution. One other fundamental case of this kind can be found in via Fondazza, Bologna's social street: many of the same

dynamics apply, if only with more limited numbers.

Other interesting locations are: the area near via San Felice; the portion of the city between via Belvedere and San Gervasio; the PalaDozza; the area around the headquarters of the city administration in via Fioravanti; some locations across the Bolognina borough, towards the Central Station and also towards the external part of the city, arriving to via Alfredo Calzolari; some concentrations in Croce Coperta, Corticella, Dozza. There are some interesting concentrations near Pilastro, and its parks (via Larga and Vincenzo Tanara). Multiple interesting concentrations near San Donato, especially near via Eleonora Duse. As described, parks play important roles: for example in San Lazzaro di Savena, in the Giardini Peppino Impastato and in the area Piazza Grigoris Lambrakis. Another interesting linear concentration which would deserve further analysis is the one found

along the via Toscana, towards where it meets via Augusto Murri. Other important concentrations can be found near the parco di Villa Guastavillani along via di S. Vittore and via degli Scalini.

And then, there is the center of the city, with all it neighbourhoods within the walls and the areas immediately adjacent to them. Adding up these months of observation, these areas have completely been filled by expressions about collaboration in the city.

Since their high number, it is not really meaningful to rank them directly in a specific quantitative order: all of them would come out with high rankings and, thus, the classification would bring few insights, as they would all be mostly at the same level.

Instead, we have decided to show their correlations (geographical and content based) to the locations of the official projects
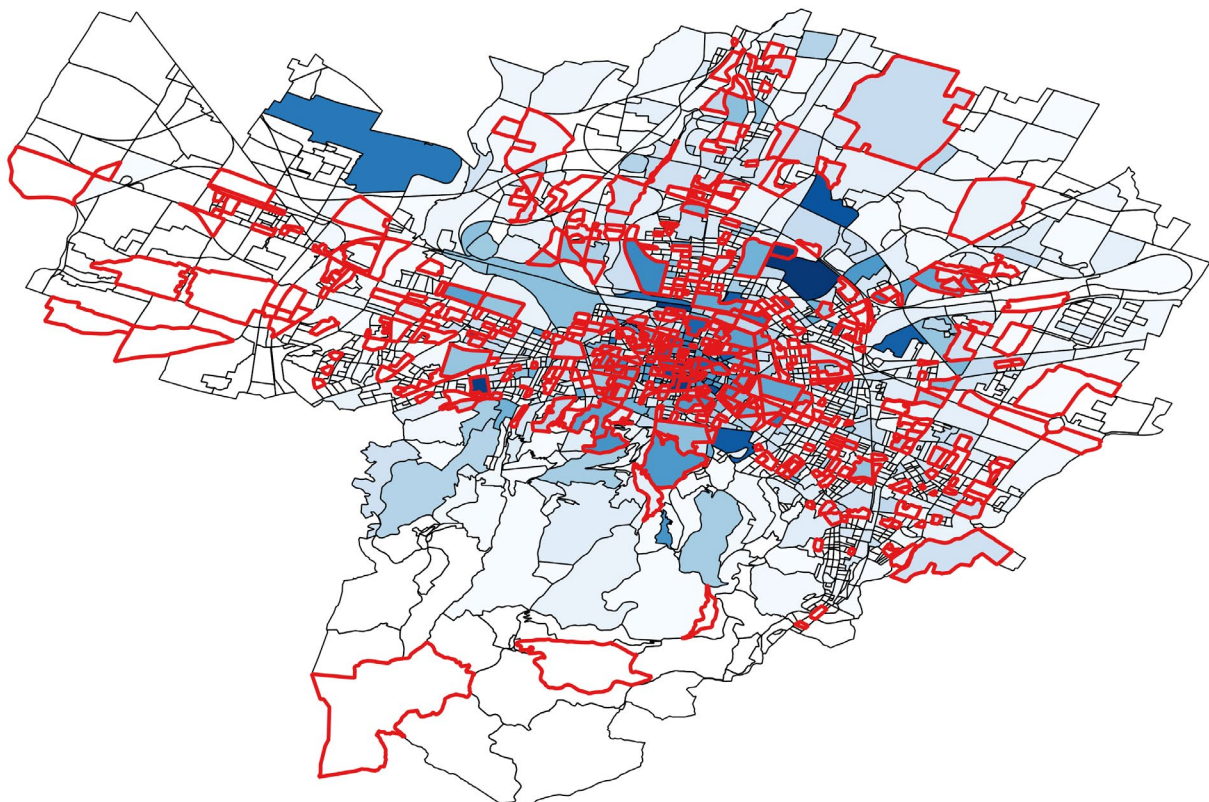

Figure 18. The geographical distribution of the expressions of collaboration in the city (blue) and the locations of the organisations on Iperbole (red).
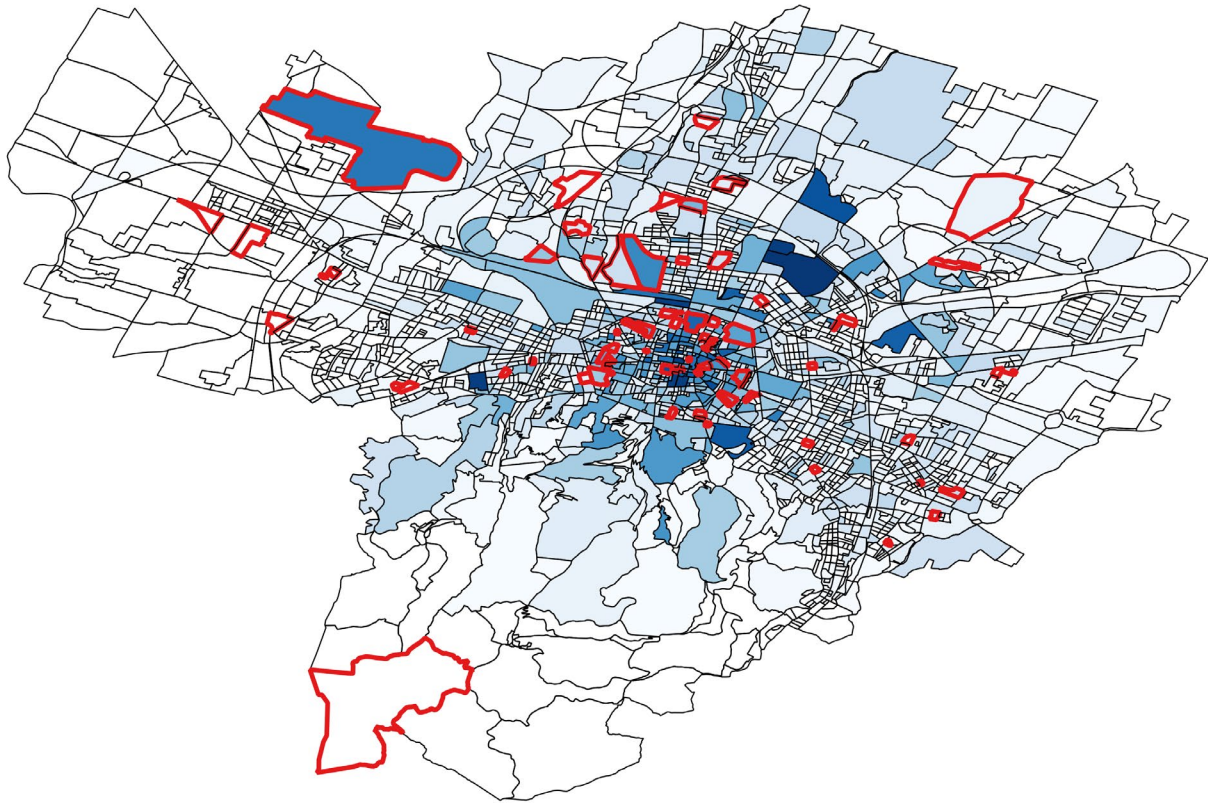
Figure 19. The geographical distribution of the expressions of collaboration in the city (blue) and the locations of the projects with collaboration pacts (red).

for collaboration in the city, to infer where is what, within and outside the city's official policies for collaboration in Bologna. We can do this by overlaying the locations and geographical concentrations of the organizations which have participated to the Iperbole community, and of their projects, as referenced on Iperbole and the city's collaboration pacts.

Figure 18 shows in blue the geographical densities of the expressions of collaboration in the city and with a red border the areas in which the organisations which are active on the Iperbole community are located. As can be visually inspected, there is some degree of coincidence between where the organisations and the expressions of collaboration are. This is not complete. A ratio can be calculated between the number of administrative areas of the city where there are organisations and expressions (at least 100) and the total, resulting in the possibility to

better measure this coincidence. This ratio is equal to 0.62: 6 out of 10 areas in which there is sufficient expression for collaboration also host collaborative organisations.

We can repeat the same experiment with the projects for collaboration promoted by the organisations with the support of the city administration through collaboration pacts. We can see the result in Figure 19.

Here the ratio is 0.31, with an overlap of 0.19 with the previous scenario: 3 out of 10 areas with high levels of expressions for collaboration have projects within them.

Summing up the two contributions, the result is 0.87: almost 9 out of 10 areas where the expressions about collaboration are high have been touched by "Collaborare è Bologna" projects or have organisations from Iperbole within them.

This, of course, is not a strictly causal relationship. As we saw in

the "People and Relationships" section, there are many who spontaneously speak about collaboration in the city even without being connected with the "Collaborare è Bologna" process. On the other hand, the systematic presence of projects and organisations in the areas where expression about collaboration is stronger mark the interesting direction which "Collaborare è Bologna" has taken, addressing people's desires and imaginations about the opportunities for collaboration in the city where they are most present.

In this process, it is also possible to zoom into the center of the city, as suggested at the beginning of this section, to look more closely at the high density expressions and at the sites in which more events and initiatives take place.

As we can appreciate from Figure 20 the situation seems mostly unvaried: most areas in which many expressions about collaboration in
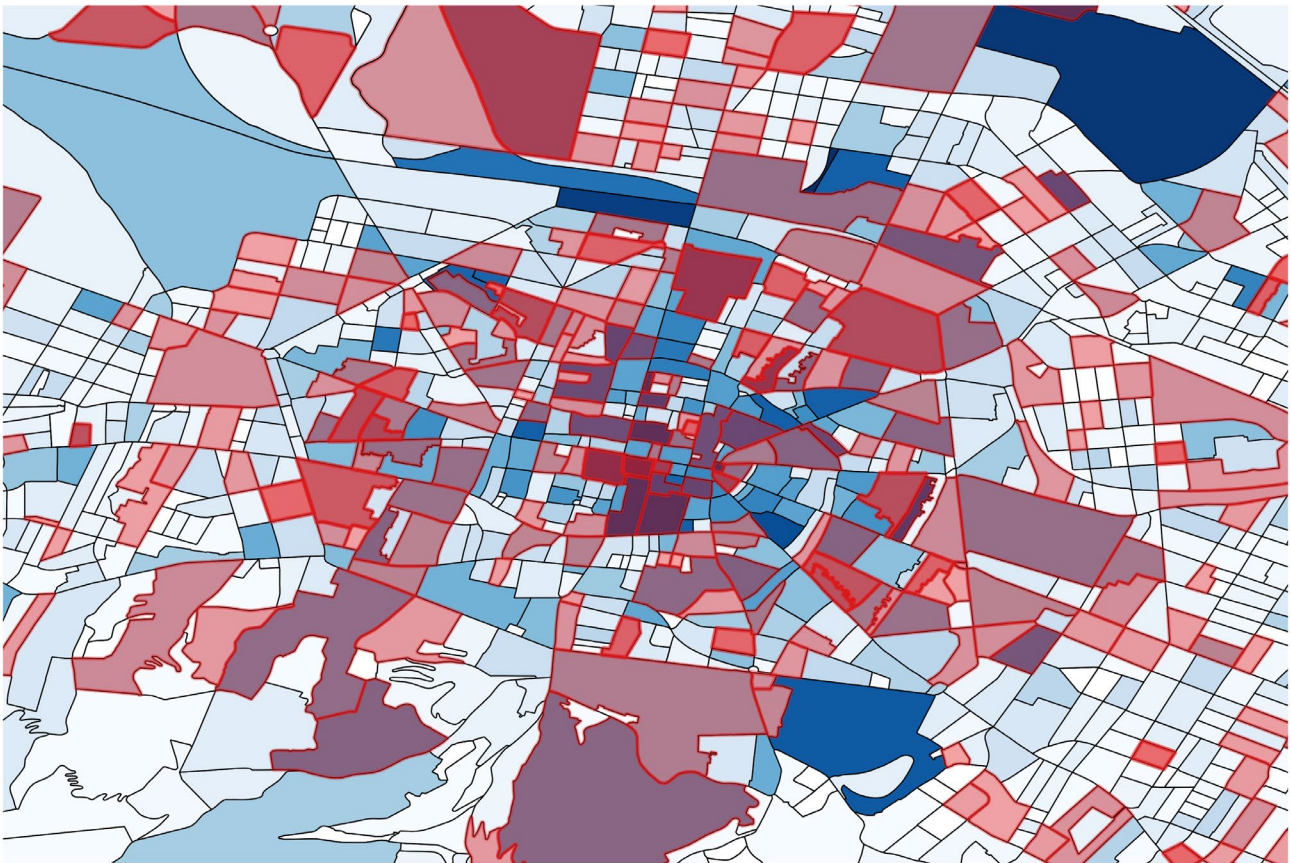
Figure 20. Zooming into the city; the geographical distributions of expressions about collaboration in the city (in blue) matched by the presence of projects or organisations of the collaboration pacts for "Collaborare è Bologna" (in red), in the center of the city.

the city manifest themselves are touched by the presence of projects and organisations for "Collaborare è Bologna". The match becomes even more complete if we take into consideration the events which happen in Bologna for the city's collaboration processes: the ratio, in this case, goes well beyond 90%.
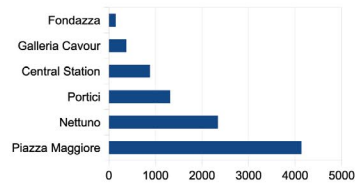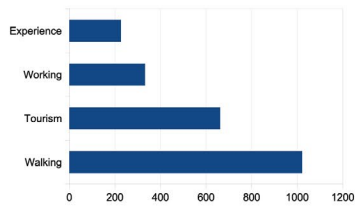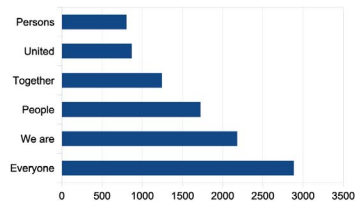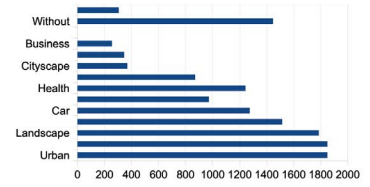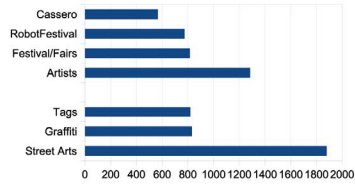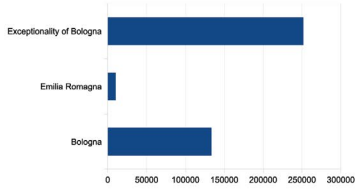
Among the places in which high levels of expression match more presence of projects and organisations are the Galvani, Malpighi, Irnerio and Marconi areas.

What insights can be drawn from this scenario, in order to promote even better continuation of the "Collaborare è Bologna" process? Mainly two:

1. explore new territories, the ones in which expressions are not present, or the ones in which expressions are not yet matched by projects or by the presence of organisations;

2. in the existing territories, it is

possible to use the available data and information to engage more inhabitants and to make sure that all needs and desires are addressed, also raising further conversations which are even more inclusive.

Topics

Chart 1
Topic	Value
Exceptionality of Bologna	~250000
Emilia Romagna	~10000
Bologna	~140000

(x-axis: 0 – 300000)

Chart 2
Topic	Value
Cassero	~600
RobotFestival	~800
Festival/Fairs	~800
Artists	~1300
Tags	~850
Graffiti	~850
Street Arts	~1900

(x-axis: 0 – 2000)

Chart 3
Topic	Value
Without	~1500
Business	~300
Cityscape	~350
Health	~1300
Car	~1300
Landscape	~1850
Urban	~1850

(x-axis: 0 – 2000)

Chart 4
Topic	Value
Persons	~800
United	~850
Together	~1200
People	~1800
We are	~2300
Everyone	~3000

(x-axis: 0 – 3500)

Chart 5
Topic	Value
Collaboration Pacts	~400
Meetings of Collaborare è Bologna	~100
Collaborare è Bologna	~400
Culture Commons	~700
Urban Commons	~550
State/Government	~650

(x-axis: 0 – 800)

Chart 6
Topic	Value
Corso	~300
Markets	~350
Museums	~450
Buildings	~750
Portici	~1200
Streets	~3400
Piazza	~3400

(x-axis: 0 – 4000)

Chart 7
Topic	Value
Experience	~250
Working	~350
Tourism	~650
Walking	~1000

(x-axis: 0 – 1200)

Chart 8
Topic	Value
Fondazza	~100
Galleria Cavour	~350
Central Station	~850
Portici	~1250
Nettuno	~2300
Piazza Maggiore	~4100

(x-axis: 0 – 5000)

Chart 9
Topic	Value
Gardens	~380
Parks	~390
Trees	~580

(x-axis: 0 – 700)

Chart 10
Category	Value
UNIBO	~2700
DESIGN	~2200
TWIPERBOLE	~3700

Trying to synthesize what an entire city said during 6 months is clearly an impossible task. Even if we were able to dedicate infinite resources to this task the output would result in a simplistic interpretation of reality, which would do it no justice. For this reason, we feel that the most important thing that it is possible to do here is to explicitly examine some specific points of view which emerged from these 6 months of observation of the expression of collaboration in the city, to describe what we feel are the most interesting, important, insightful and meaningful of them, and to create the opportunity for other people to autonomously look for other interpretations, by accessing the Open Data (see this among the last sections of this report).

Let's start.

What have been people talking about while expressing about collaboration in Bologna during these 6 months of observation?

Here we will describe the topics of this vast, city-wide conversation, where with "topic" we indicate a certain assembly of words, phrasings and terms (also in multiple languages) which, together, rise to coherence in describing a certain "thing", "theme", "subject". For the information on how we are able to discern different topics among the wildly unstructured text contained in social networking messages, you can refer to the methodological sections of this report and to the many scientific publications available on www.human-ecosystems.com. For the sake of simplicity in this section of the report we will refer to the term "modality", indicating "how many modalities" each topic has. You can imagine them by imagining all the ways in which a certain topic can appear in discussions: if my topic is "cars", I might refer to it in different modalities, for example talking about fixing a car, getting a speeding ticket for my car, finding a parking space for it, or how beautiful someone's car is. Each modality can be cited in a series of online messages. These series, as seen in the "some numbers" section of the report, can be quite

large. Each message can host one or more modalities of one or more topics.

First we will gain a bird's eye view on the situation, then we will dive into some specific topics, to see what they possibly mean for the city.

The king of topics is, of course, the city itself, closely followed by the region: the topic "Bologna" was discussed in 133369 different modalities, followed by "Emilia Romagna" discussed in 10215 different modalities. This is not a surprise, but it serves as a confirmation that we have been listening using the correct techniques: we have been observing people who are actually discussing about collaboration in their territory.

This fact goes well together with the fact that many times a sense of "exceptionality" is clearly expressed about these territories, while speaking of collaboration. It is not uncommon at all to see discussions mentioning "solo a Bologna" ("only in Bologna"), or "La Bella Bologna", or others. Together they sum up to about 25 thousand modalities for expressions of the exceptionality of the place.

The exceptionality of the place is also remarked by the abundance of mentions of its places, among piazzas, monuments and specific locations: Piazza Maggiore (4133 different modalities); the Nettuno (2339, also mentioned is the crowd-funding effort related to it); the Portici (1312); the Central Station (877); Galleria Cavour (371); via Fondazza (143); and more.

Right after these territorial elements, one of the main topics populating the discussion of collaboration in the city is Twiperbole and, in general, the city's online identities, which are mentioned in 3726 different modalities: a landmark of collaboration in the city. This great variety of mentions, attributed to a single subject – even if a complex subject, in this case, corresponding to the city's collaboration initiatives – describe how this subject is perceived as a multi-modal hub for the general topic of collaboration in

the city.

The elements of the city are the protagonists of collaboration: piazzas (3361 different modalities); streets (3305); again the portici (1312); buildings (853); museums (507); markets (430); the corso (372); and more. Many times the activities which one can do in these places are assessed in the messages, like walking (1022 modalities); visiting as a tourist (662); working (332); or having an experience, through collaboration (226 different modalities in which this concept is expressed).

Design is an important topic in the conversations about collaboration in the city: this concept is expressed in 2732 different modalities, using which people express how they feel some design issue constitutes a fundamental approach to the collaboration issues (or opportunities) for the city.

Collaboration is not something you do alone, and the captured messages make sure that this is evident: many of the messages use plural forms, even when they are dealing with the doings and thoughts of single individuals. Many forms of pluralities are used in sentences, giving a marked "collective" feeling to most of the messages: "tutti" (everyone) is used almost indiscriminately, in 2884 different modalities; "siamo" ("we are", as many other forms which indicate the collective characterization of multiple people) is used in 2180 different modalities; "people", indicating the fact that the message about collaboration is affecting multiple types of individuals ("gente") is used in 1724 ways; "insieme" ("together"), 1243 modalities; "uniti" ("united") in 868 modalities; "persone" (a different intention of "people") in 803 different modalities; just to make a few of the most important examples.

UniBo (University of Bologna) is mentioned in multiple ways regarding collaboration in the city, both as protagonist (in itself and through its students, academics, staff, in positive and negative ways) of collaboration in the city, and as the place in which collaborative

processes could take place (and sometimes they don't), for example among students, and between students and permanent citizens. These appear in 2287 different modalities.

Art is a recurring actor of collaborative practices. Among all art forms, Street Arts are by far the most discussed, in positive and negative ways when people in Bologna speak of collaboration in the city. Whether it is to remove "artworks", or to re-invent a place in the city using the work of a street artist, or multiple other cases, Street Arts are the form of art with which collaboration in the city confronts with the most: "Street Arts" in 1879 ways; "Graffiti" in 831 ways; "Tags" in 819 modalities.

Other art forms and the initiatives dedicated to arts and creativity are also widely discussed when dealing with collaboration in the city: as catalysts; as bringers of innovation; as occasions for the emergence of new scenarios; and as possibility to highlight the human condition. "Artists" are mentioned in this sense in 1284 different modalities; Festivals, Fairs and other art-related events are mentioned in 815 modalities; specific ones of these events are also widely mentioned (the highest number of modalities in which an art festival is connected in the discussion of collaboration in the city is for the Robot Festival, mentioned in 774 different modalities; this is also true for specific locations which host artistic initiatives: for example the Cassero is mentioned in 566 different modalities for what concerns collaboration in the city; these specific mentions are biased, of course, because other major art happenings had not happened yet during the observation period; nonetheless, the quantity and variety of messages is outstanding).

Moving towards another direction, it is possible to highlight how most conversations about collaboration in the city also include the context which they're referring to: what they would see collaborative practices enacted on. Most declarations are very general: "urban" (1849 modalities); the "city" (1849); the "landscape" (1785); the "train" (1515) and other means of transport (car, 1274; buses,); "health" (1243); "work" (871); "cityscape" (368); "urban nature" (345); "business" (255).

Also recurrent in the expressions of collaboration in the city are privative forms, claiming the supposed absence of collaboration practices, highlighted through the wide usage of forms such as "without" ("senza", 1447 modalities), "missing" ("mancante", 305), and others. This, of course, is a bias typical of the Internet, where negative statements and lament are often more than the positive, constructive ones. Nonetheless it is a trend which is worthwhile noticing, also for the possibility to directly observe and address them, given the availability of the data.

In this sense, it is also interesting how the "state" is expressed as being the entity who is supposed to be responsible for enabling the practices of collaboration (in 660 different modalities).

As described in earlier sections, urban nature is a fundamental location for collaboration as expressed in the captured messages. "Trees" are mentioned in 575 modalities, "parks" in 379 modalities, "gardens" in 357 modalities.

As described in the "People & Relations" section of the report, the initiatives for "Collaborare è Bologna" constitute a well radicated conversation in the city, and the topics for discussion manifest this fact. Specific topics which are typical of these initiatives are very well positioned in the discussion about collaboration in the city, and are mentioned not only by the direct participants to these initiatives, but also by a somewhat extended population. The concept of "Urban Commons" is mentioned in 425 different modalities. "Culture as a commons" (also in "indirect" and "inexact" ways, alluding to the need of and possibility to have shared cultures of collaboration, and of the possibility to freely access diverse cultures and knowledge) is mentioned in 709 modalities. The public meetings of "Collaborare è Bologna" are mentioned in 81 different modalities. The projects for the collaboration program of the city are mentioned in 286 modalities, distributed across the various different types of projects. "Collaborare è Bologna" itself is mentioned in 332 different modalities.

Last in this synthetic overview of the topics, before deep diving into some of them, are two concepts which we choose to place side by side: "disagio" (the need of better conditions in the urban environment, mentioned in 340 different ways) and "motivation" (in 870 different ways). These constitute points of tension, as they are evenly spread across positive and negative modalities: people mentioning any of them are equally declaring their presence and their lack. This scenario describes in sufficiently clear ways how the practices of collaboration – and, in general, the participatory search for better life conditions – reach only a part of the population. This data could prove to be useful in understanding what "the other part" is, and to use the relational networks to engage them.

Let's proceed now to deep diving into a series of specific topics.

The following graphs show the principal ways in which these topics are mentioned through the principal topics to which they're directly connected. This will be useful to provide some further context into the practices of collaboration in the city, for how they are communicated on social networks. Each diagram is followed by a short description, to highlight some of its characteristics.

Some of the diagrams are very complex and may be better visualised online using the HUB interactive visualisations found on Iperbole, or personalised visualisations can be created using the Open Data (see the section towards the end of the report).
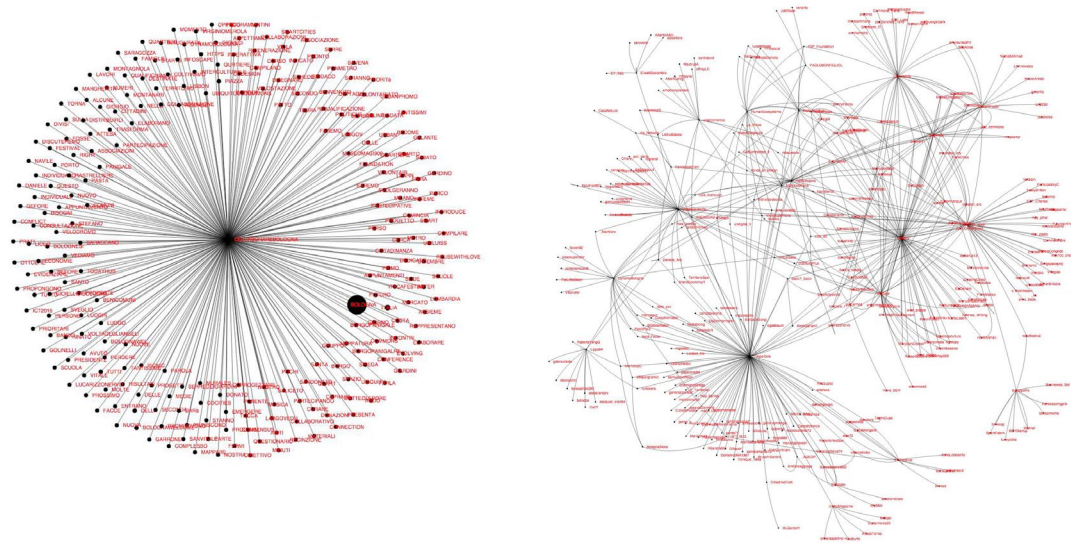
Figure 21. The "Collaborare è Bologna" general topic, with the network of social profiles which explicitly mention it more than 25 times.

Collaborare è Bologna

This visualisation substantially confirms what has been highlighted in the previous sections. The relational network discussing this general topic is varied and spread across multiple hubs (the image shows only the most persistent social profiles mentioning the topic in explicit ways, the full network is much wider). And the relations between the topic and other ones are many and varied. "Collaborare è Bologna" is mentioned together with people, places, events, times, communities. And, most important of all, it is systematically mentioned together with some of the main issues of collaboration in the city: citizenship, participation, education, projects, urban nature, reuse, art, information, knowledge, economy, work, rights, needs, design, mobility and more.
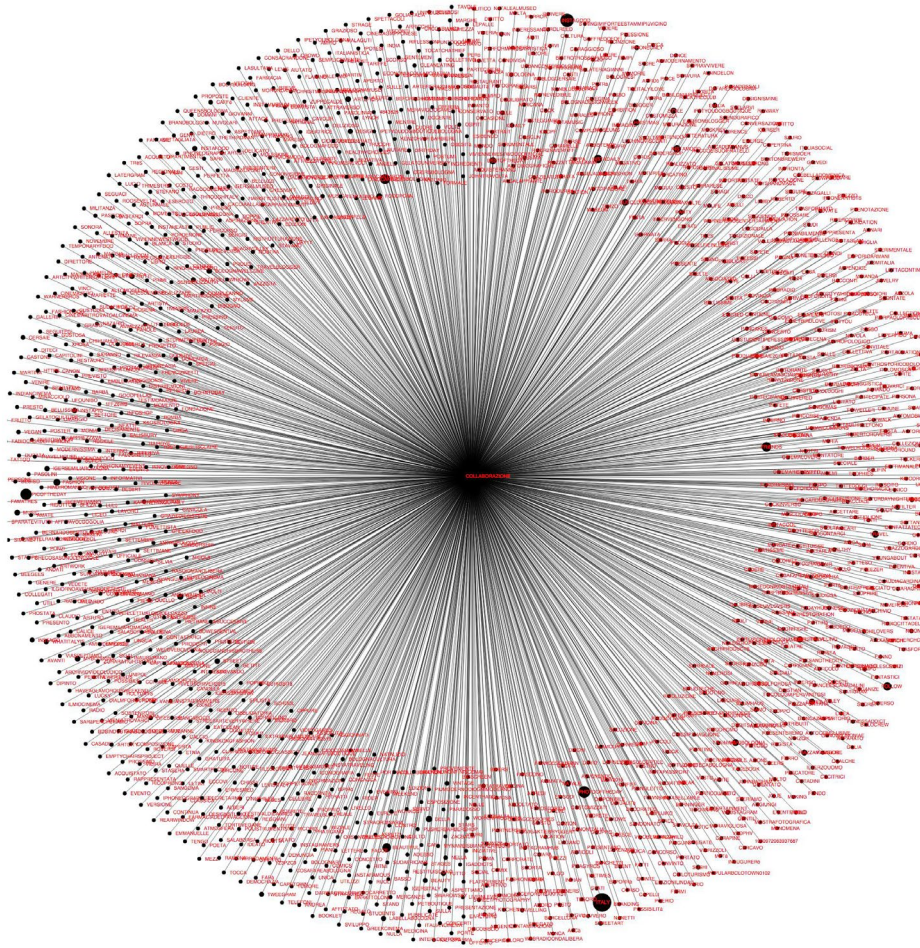
Figure 22. The "Collaboration" general topic.

Collaboration

As described in the "People and Relations" section of the report, the whole collaboration topic is vast and at the center of a high number of other focuses and issues. Figure 22 confirms this fact. If many of the conversations about "collaboration in the city" are shared with the ones from "Collaborare è Bologna", about 64% of them are not: they use different vocabularies and adopt different topics and points of view.

Some examples are: more evident hooks to the practices of everyday life (going to school/office/entertainment, cinema/radio/TV/art); on the one hand, a diffused sense of irony and, on the other hand, a diffused sense of dissatisfaction or open conflict (especially towards the "intellectuals" or "managers"; a wide series of indications that a "vision" and "desire" exist for collaboration, through "paths", "movements", "courage", "ideas", and also through role models and

"heroes", first of all "Pasolini"; a diffused sense that collaboration needs to happen through "culture", "education", "art" and, on the other hand, through actual "actions" and "projects", which have wide impacts on the "population".

From a certain point of view it is possible to say that if the "Collaborare è Bologna" mainly hosts the pragmatic conversations about the projects and actions which are taking place in the city about civic collaboration, the "Collaboration" topic hosts the general visions and desires and imaginations about collaboration, and the expressions about how people are satisfied/dissatisfied in their daily lives from this point of view, as well as their aspirations and expectations, which sometimes are remarked with irony, or even with open conflict.

As an interesting and peculiar note: many expressions feature pop-stars from the movies and music, famous brands and even popular events and TV shows, in connection to the

practices of collaboration in the city. Some of these (most of them, actually) are very ironic and also naive, applying the dynamics and logics of the "TV spectacle" to the possibility to have a more inclusive society. Some, instead, are tentative "reaching out for help" attempts, trying to engage the notorious to confront with issues which traverse work, mobility, education, health and well-being, in ways which are funny, serious, entertaining, ironic, or even desperate and conflictual. Both of these types of pop-culture attempts should be closely monitored (and they touch TV stars just as well as they touch major Internet influencers) to gain better insights about the desire and imagination of a wider section of the population, the one which is not yet touched by processes such as "Collaborare è Bologna".
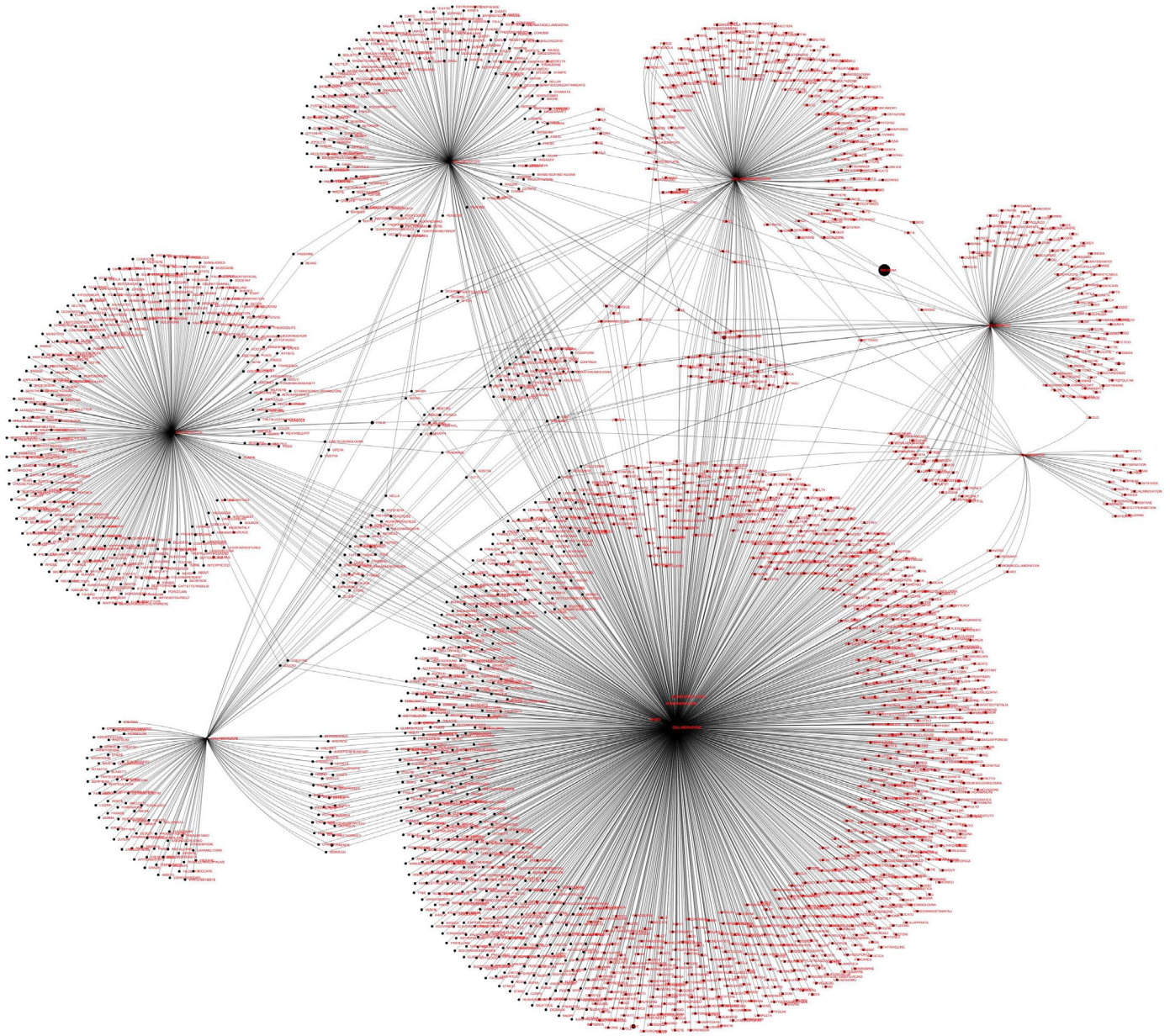
Figure 23. Multiple modes of collaboration, combined together in a single topic.

Multi-modal Collaboration

Figure 23 shows how multiple sub-topics and modalities of collaboration interact and interconnect with one another. In this visualisation it is interesting to notice the elements at the intersections: these are the ones which are systematically shared among the two or more sub-topics and modalities. They are good candidates to shape communication which is able to reach the various communities and cultures.
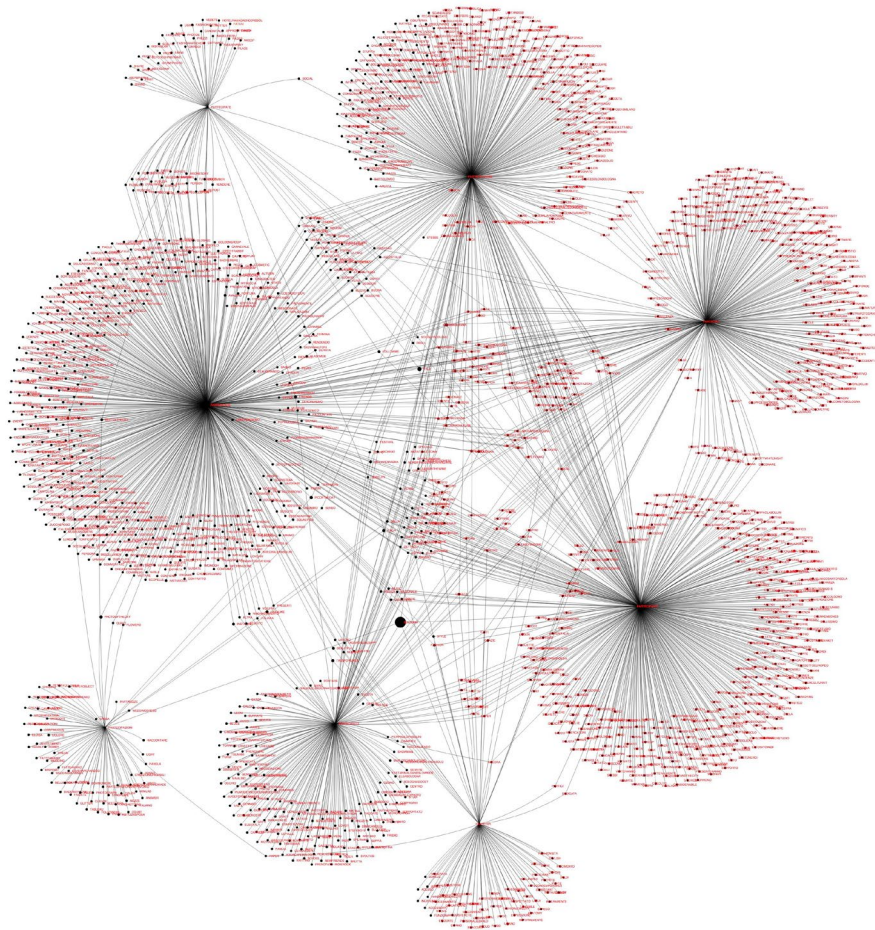
Figure 24. Participation in various modalities.

Participation

As before, the intersections between the modalities are interesting in highlighting the ways in which the concept of participation is strongly perceived and expressed, and, thus, indicating the ways in which it is possible to address needs, enact participatory practices in meaningful ways and widen the reach of the collaboration policies of the city.

In this sense, apart from the many peculiarities of each bubble of concepts in the diagram, which may be conveniently inspected visually, there are a number of fundamental approaches which are shared among all modalities: a sense of shared ownership through "participation", denoted by the wide use of words and phrasings which go in this direction; a distinct and powerful role for the arts, creativity and cultural production

in the practices of participation, as shown by the wide presence of mentions of festivals, music, arts, aesthetics, archives, cooking, cinema, museums and publishing; the desire and expectation for wonder, surprise and a general sense of exceptionality, through expressions which include "discovery", "creation", "special", "vision", "great", and more along these lines; the expectation that the "change" (embracing participation) should take place "now", or at least "soon"; the expression for the need to "support" participation, to "design" it, and to provide a meaningful role for "knowledge" in it; the expression of the need to abandon administrative and bureaucratic forms of participation, and to embrace more "human", "emergent", "relational", "personal" forms of participation, which are able to address people's "needs", also exploring different "times" and "forms"; the expression of the

desire of forms of participation in the city which are also more "pop", for example through "fashion"; the ways in which participatory practices can be added to the experience of "work", with "colleagues", or among "students", in "concrete" ways, by coming together ("meeting"), and also opening up to other territories ("Europe"); the fact that participatory processes should sit in the "public" sphere, and that to implement them meaningfully they would have to be the result of personal and sincere "dedication" by "everyone"; the importance to be able to include different points of view and perspectives in these practices, the ones which are "against", which offer the opportunities for "confrontation", the ones with specific "purposes" which can also be "different" than one's own.
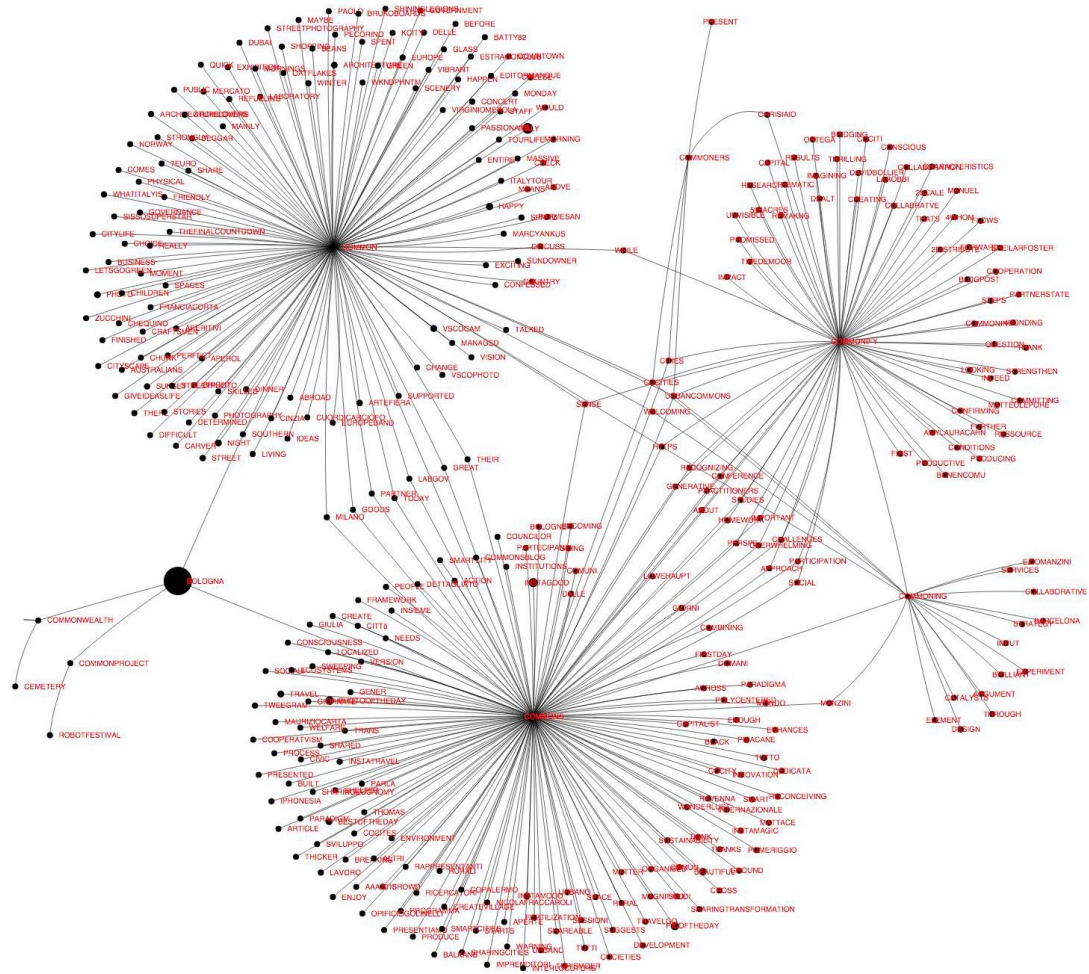
Figure 25. The Commons.

The Commons

The discussion on the commons is very active, but limited in its reach: the terminology and vocabulary is yet something which is not shared by wide areas of the population. Nonetheless, Bologna has become a sort of hub for this kind of conversation, as can be seen from the many subjects and organisations which are part of or mentioned in the conversations. One concept which highlights the tension towards making the commons a part of the perceived everyday life for more people is represented by the word "recognize", which is mentioned in this sense multiple times in different modalities.
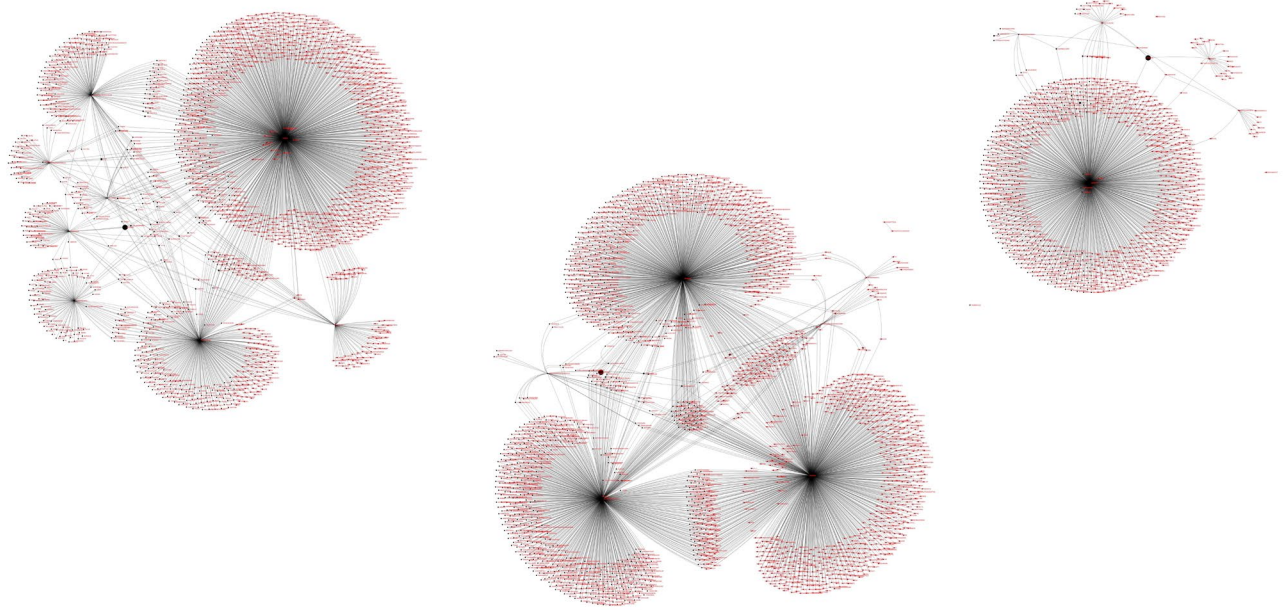
Figure 26. Urban Nature: parks, gardens and the environment.

Urban Nature

Urban nature, under the form of parks, gardens, trees and, in general, all of the manifestations of nature within the urban environment, is a great protagonist of collaborative practices in the city. The analysis of the topics in these conversations confirms that. Figure 26 shows only the 3 main topic clusters which are related to urban nature: parks, gardens and the environment.

In the discussions about collaboration in the city, urban nature is mentioned for: its beauty, colour, history ("Risorgimento", "statues", "culture"); for the possibility to do things in it ("lunch", "party", "relax", "run", "breathe", "concert", "cocktail"); for their positive impact on life ("happy", "wellbeing"); for their importance for health and the environment in general; for being the place in which to cultivate relations ("friendship", "serendipity"); for the importance of protecting and maintaining them, through public intervention and participatory initiatives ("projects"); and also for the fact of being the places which sometimes offer degraded views of the city, mentioning drugs, prostitution, unacceptable behaviours and abandonment ("jungle").
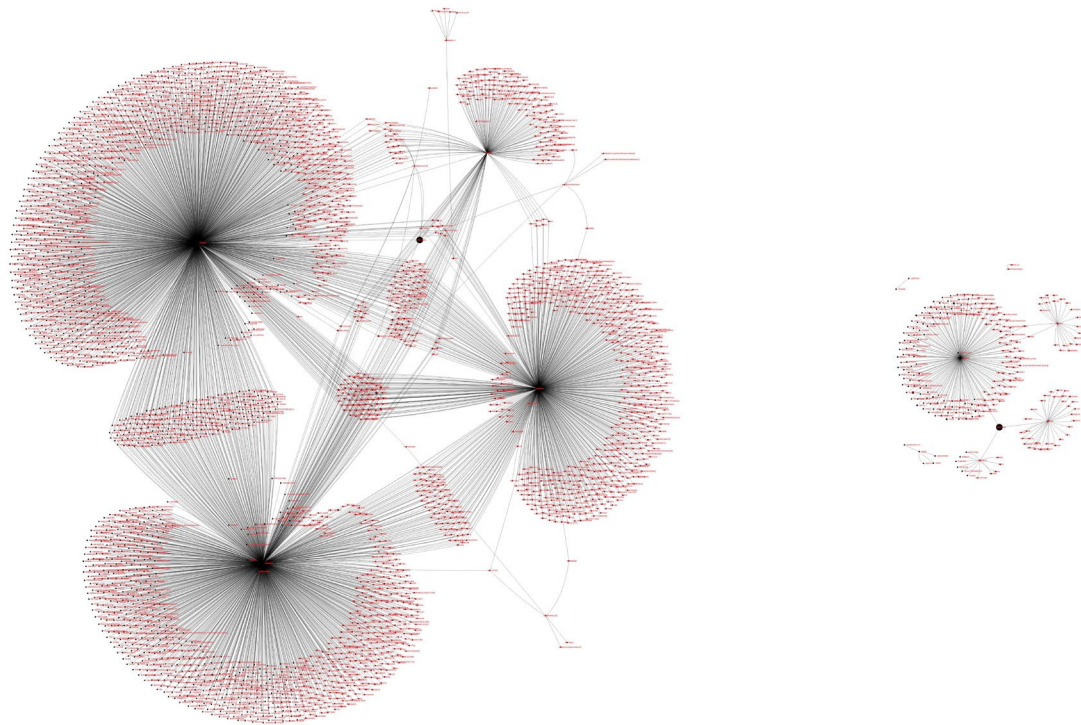
Figure 27. Children (left) and the elderly (right) in the conversations about collaboration in the city.

Children & the Elderly

The volumes and number of topics and modalities in which people discuss children while having conversations about collaboration in the city are much higher than the ones dedicated to the elderly, as can be easily appreciated in Figure 27.

The general topics related to children and elderly are almost identical: the beauty and emotions they suggest; the expressed need to create projects which are dedicated to them and which are felt as currently not sufficient; how to deal with them collaboratively during official or everyday recurrences (holidays, christmas, work, travel); their security and safety, and how to guarantee health and hygiene; being able to go to places with them, and the appropriateness of the experiences; things to do for them, as a community. Even given the abundance of different types of expressions, the general impression is one of staying on the surface: many discussions are centered more or less on simple or really complex or advanced forms of entertainment which is created for children and elderly, delegating them to services (even of the collaborative kind) so that their relatives can be free to lead their "ordinary" life.
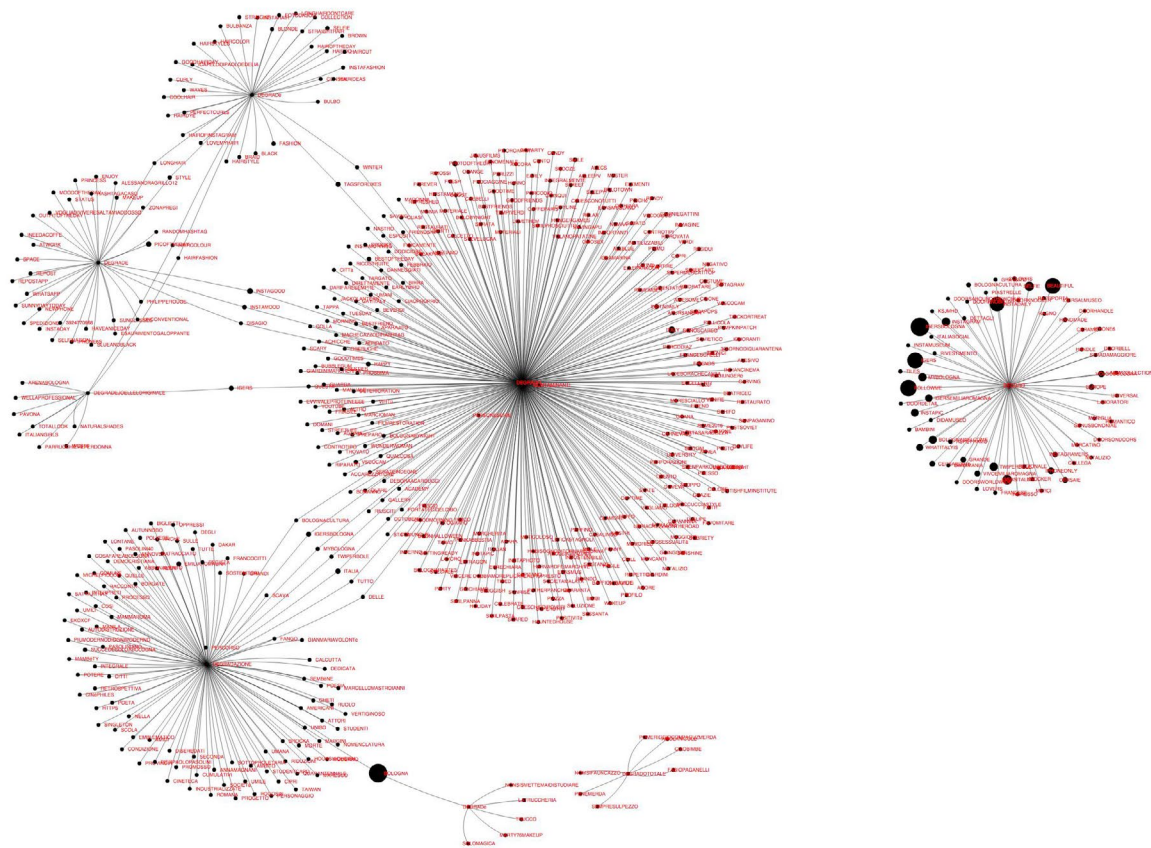
Figure 28. Degradation and Decency.

Degradation & Decency

The conversation around urban degradation and decency is active and coherent (there are a limited number of different modalities: everyone basically says the same things) and refer to a precise set of subjects (there are a limited number of highly active subjects).

Going into some detail the conversations on this topic: refer to the diffused spatialisation of the phenomenon; bring up the implications for children, elderly and the general population; clearly express the desire for "someone to do something" ("aspettiamo"), or for someone to organise forms of collaborative actions; and highlight the cultural implications which, in the first instance, allow for the rise of such phenomena ("ignorants" is a recurring word among the general public) and, on second instance, the ones which are a result of such phenomena, for example in terms of security, of providing a healthy environment, or referring to the general beauty of the city.
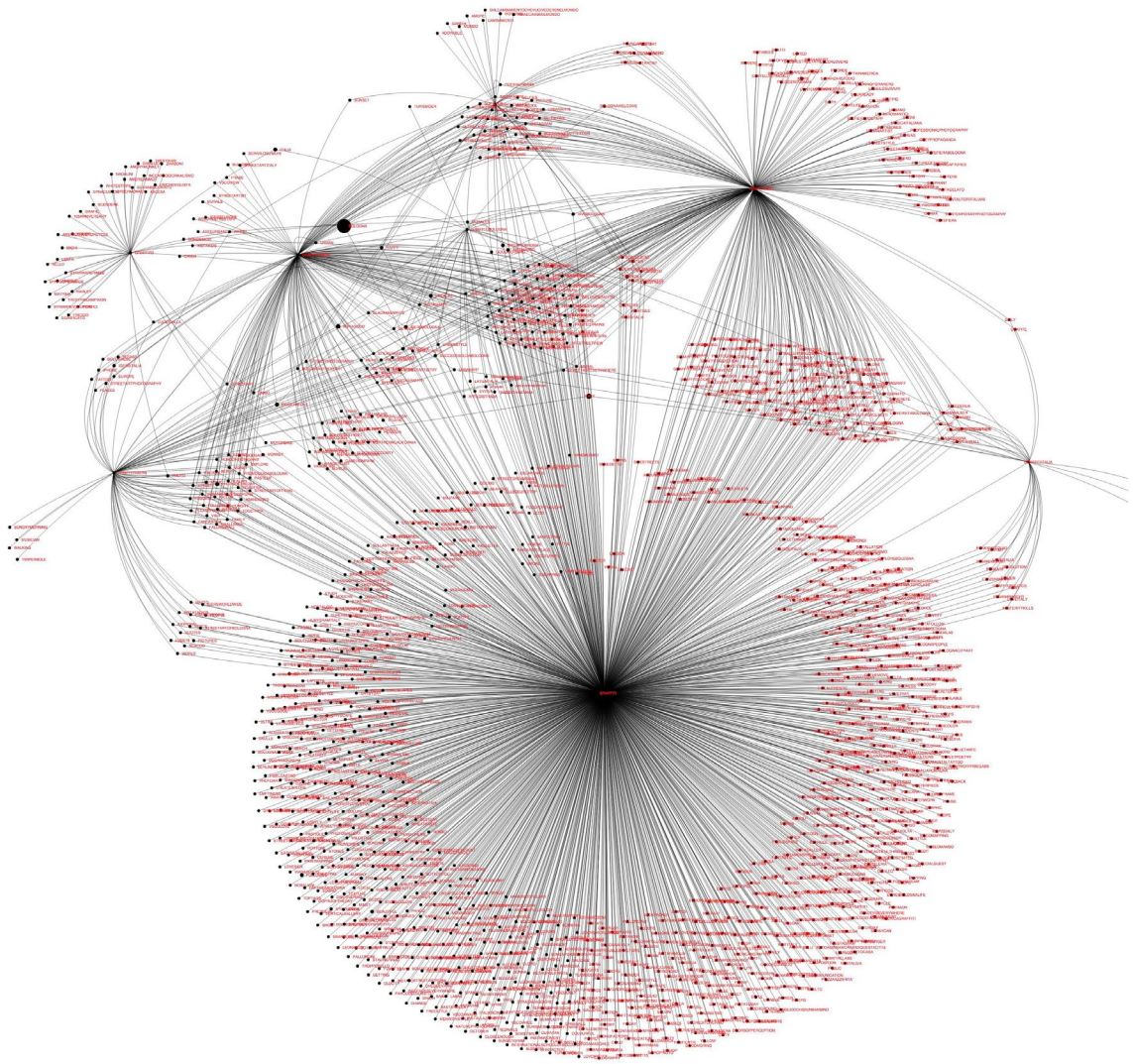
Figure 29. Street Arts.

Street Arts

The topic of street arts is sometimes connected to the previous one, and always among the protagonists of the discussions on collaboration in the city.

It engages (also historically) large numbers of subjects discuss it, establishing connections which go well beyond the city boundaries. These discussions sometimes raise conflicts as they represent the clashes between different cultures and points of view, also in peculiar and symptomatic ways. For example the popularization of street arts, which have now often left the streets and entered galleries, brings upon the lack of reflections about their origins and significance, so that any of its more extreme manifestations are usually contrasted by the majority of discussants (for example the "tags", the signatures which street writers disseminate through cities).

Wide, popular audiences, united with niche, vertical ones: these are the actors of this topic.

Let's go into some detail.

Graffiti and other expressions of street arts are definitely perceived as landmarks: remarkable, beautiful, and with history (although "recent", if not only contemporary) and significance. Some forms are perceived as acts of vandalism, especially "tags", and are commonly defined as "scritte sui muri" ("writings on the wall") with a deeply negative connotation.

They are, in any case, integral parts of what is defined the "streetscape", the urban landscape
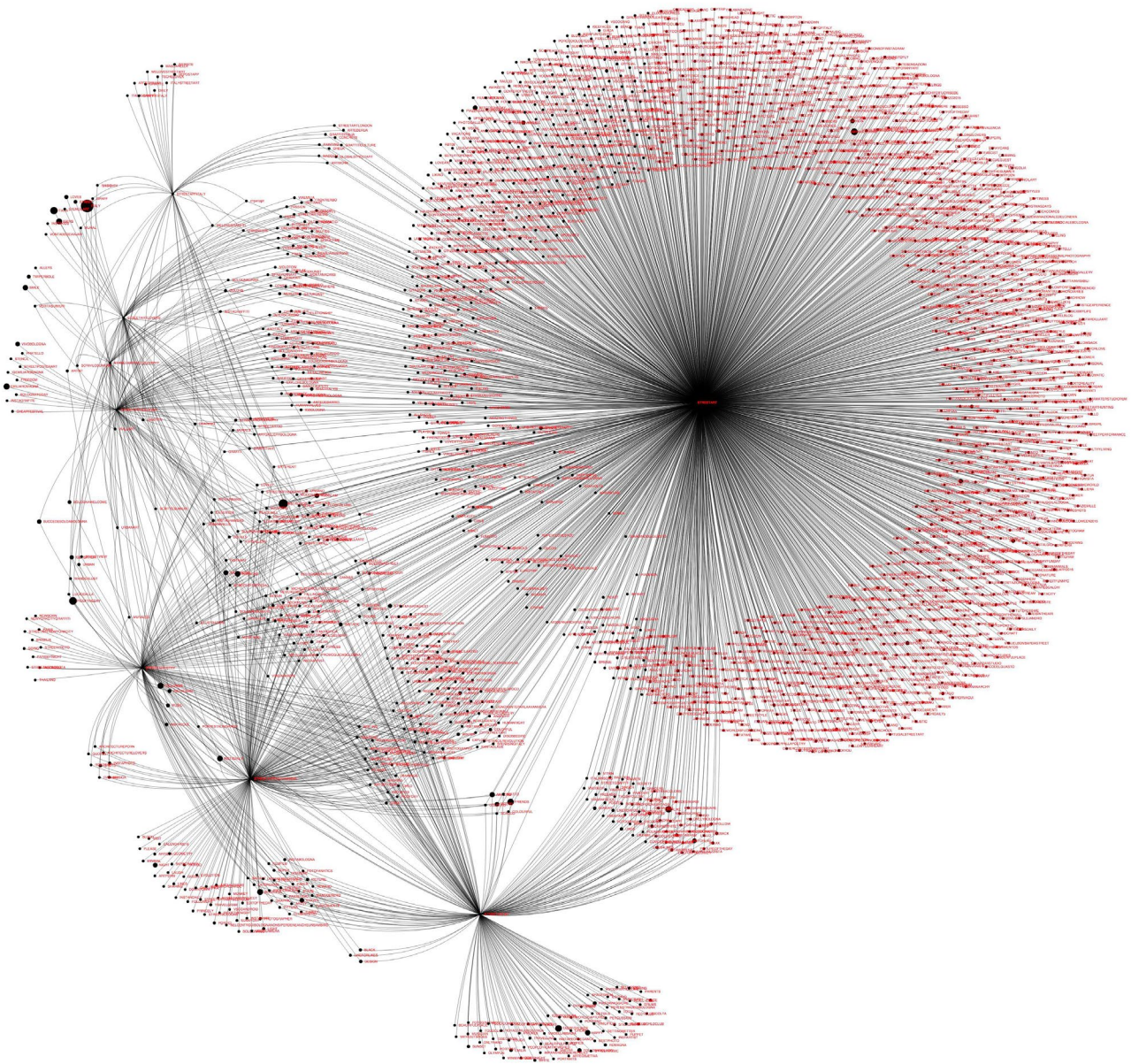
at street level. And they are among the most frequent objects of comparison with other cities across Europe and the world, in positive or negative (in negative, by saying that in many other cities, for example across Europe, "illegal" graffiti such as the ones in Bologna would not be permitted).

Graffiti and street arts in general often bring up considerations about abandoned places and spaces: in positive, as opportunities to revitalize these spaces, and to add value and beauty to them; in negative, as they are often seen as the marks of these abandoned spaces, which would need to be taken out to start effective regeneration processes.

Many people, in many modalities, see expressions of street arts as evidence for social transformation, and are associated to phrasings or hashtags like "vivoBologna" ("I live in Bologna"), which suggests how their perception is connected to the perception of the city one lives in.

Street arts are also the subject which hosts a number of political, antagonist discussions, mentioning "revolution", "punk" and "anarchist" approaches and, in general, they are often the starting points of many discussions which deal with countercultures in many ways.
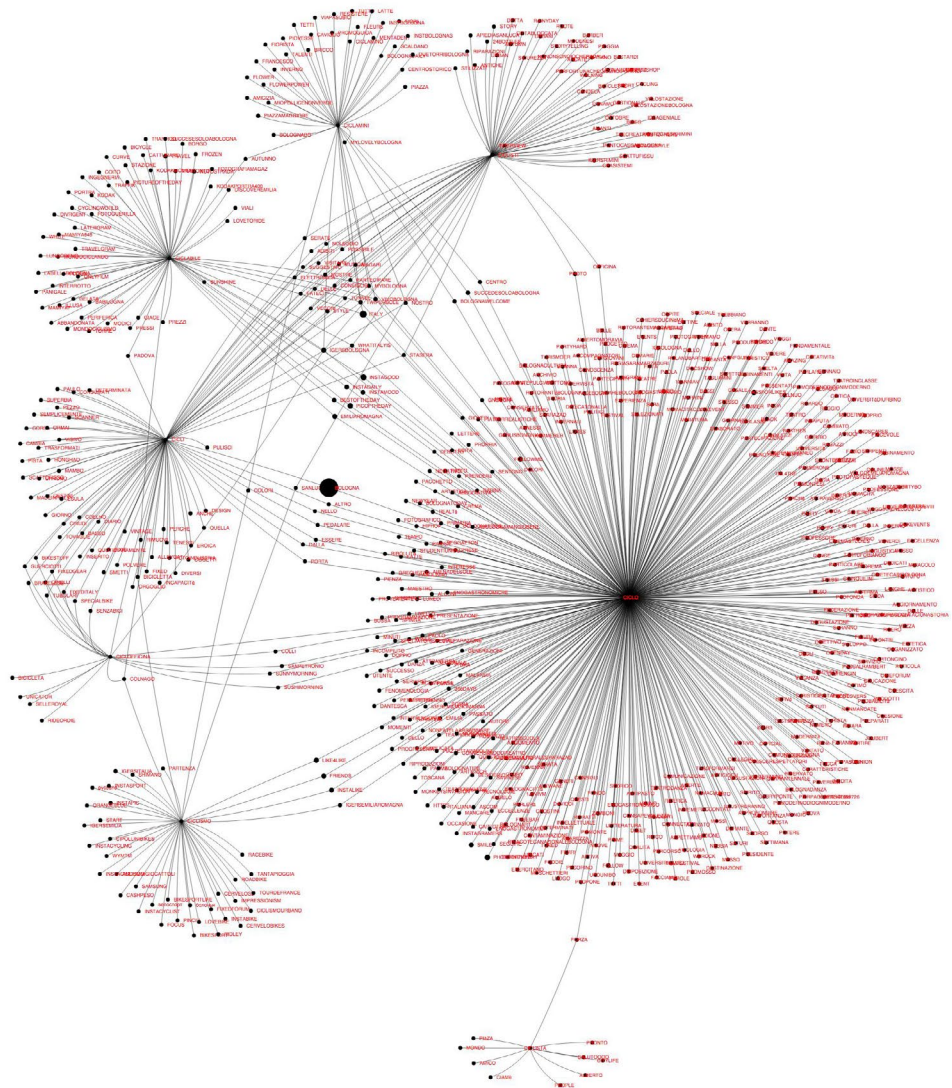
Figure 30. Cycling and collaboration.

Cycling & Collaboration

Cycling is one of the important ways in which collaboration manifests itself in the city. This is due to the number of projects which unite the two themes, and for the spontaneous solidarity which is expressed in cycling and among people who use bicycles in their daily lives.

There are many elements which characterize cycling in the conversations about collaboration in the city. Cycling and bicycles have special times and timeframes: going to work, coming back home, fixing the bike, being able

to freely stop in the flow of the city. It also has distinct places (like the "ciclofficina"), and patterns of movement which are described as being shared. This is also related to the sense of connection to the conformation of the city, its viali, hills, rain, weather, which brings about the expression of a sense of ownership of the city, which is also shared, not exclusive. This also goes well together with the sense of continuous discovery of the city which is expressed by many cyclists.

Expressions of sharing act at many levels: on pathways, indications, advices. These multiple layers of expression communicate explicitly the cohesion, openness and

creativity which is connected to how people using bicycles use the city: collaboration results in being extremely facilitated through this type of expression.

The patterns of collaboration emerge in speech also through the many events (formal, informal, serendipitous) which take place across the city, and also of the ones which emerge spontaneously through the rituals of cycling: stopping at the traffic light; going to fix the bicycle which becomes a social time for encounter; being able to change plans due to the freedom of having a bicycle instead of a car, to meet with someone.

In general, in the discussion about collaboration, cycling shows up

44
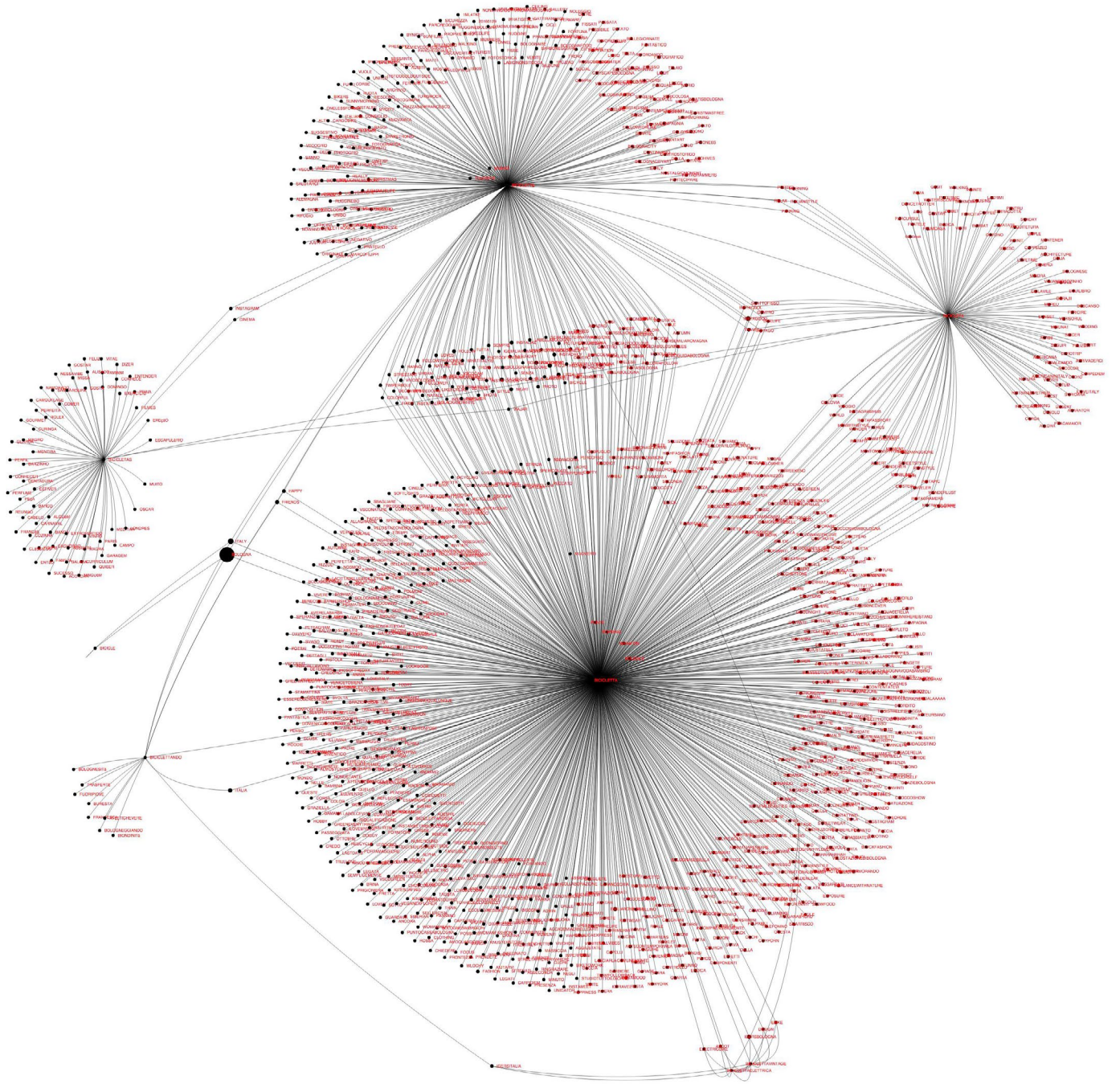
with a diffused sense of well-being
and of happiness, and with a shared
sensation (mostly coming from the
bikers themselves) of being a sort
of "heroes" of the city (this word
is explicitly mentioned multiple
times and in multiple variations and
modalities).

Emotions

"Love" and "Trust" are the most commonly expressed emotions while talking about collaboration on social networks.

Positive emotional expressions about collaboration in the city outnumber negative ones by a factor of 6 (6:1).

Emotional expressions are evenly distributed almost everywhere. The few peaks are towards the center of the city, and in the Bologna Fiere area, the Parco Nord area, the Central Station area.

The Giardini Margherita show intense emotional expressions which are typical of the places where intense conversations happen.

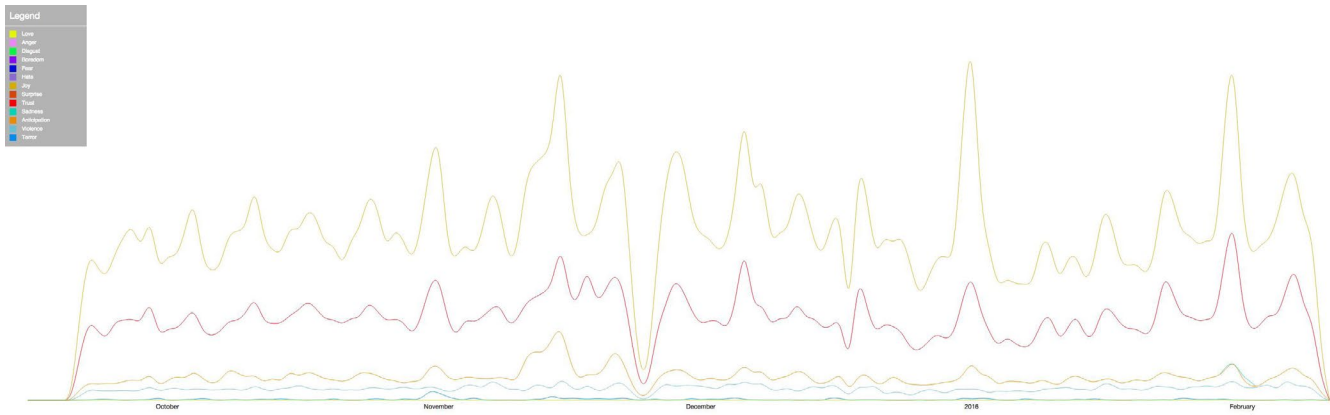The Scandellara regeneration processes have generated positive emotional responses.

Figure 31. The timeline of emotions expressed about collaboration in Bologna on social networks.

Automatic emotional analysis is a powerful technique which allows to gain better understandings about the emotional appraisal of the expressions contained in large quantities of text (in this case: the messages on social networks).

There are many types of emotional analysis. Sentiment analysis collects evidence from texts to understand whether they are expressing a positive, negative or neutral condition. Full emotional analysis comes, instead, under a variety of forms, depending mostly on the definition of emotion, and on the technique which is used to detect it within text. As a matter of fact, our common sense definition of "emotion" only partially matches the definitions found in cognitive sciences, psychology, anthropology and other disciplines. These last ones are more formal and "analytic", meaning that they aim at classifying different emotional states according to multiple parameters, to position them in a multi-dimensional space, just like a mathematical formula. For more information about how emotions are classified in sciences, you can refer to this link: https://en.wikipedia.org/wiki/Emotion_classification

For example, in this research we use a version of what is called the circumplex model of emotion, which classifies emotions according to the energy level which they express (also called arousal) and by their corresponding level of pleasantness/unpleasantness, comfort/discomfort. For example, in this definition, "joy" corresponds to a high level of pleasantness and to a low level of arousal: it is a

"quiet", "calm", "pleasing" emotion. Using the same classification, "fear" corresponds to a high level of discomfort matched by a low level of arousal: it is a state of anxiety and doubt.

These definitions imply one major consideration in looking at the results which we'll present in this section. **When looking at these results, one must not succumb to the temptation of using their common sense definition of the emotions, but, rather, should interpret them analytically, as they have been constructed.** For example, we will find the emotion of "fear" across a number of topics. This does not mean that people fear those topics of collaboration. It means that, for those topics, they have expressed some doubt, typically for the future, that they are posing questions about some aspect of that topic, and they don't yet know the answers as they would, and that makes them feel somewhat uncomfortable.

The texts accompanying the graphs will help out in this kind of interpretation.

Let's start from observing the evolution of emotions across time.

By comparing Figure 31 with Figure 14 (the general quantities of messages over time) it is possible to see that the two graphs almost match each other. This is normal: the more messages are published, the more emotional expressions will be generated.

It is possible to find meaningful

insights by analysing the general levels and by exploring the differences for the various emotional levels during the same timeframes.

"Love" and "Trust" are the most commonly expressed emotions while talking about collaboration on social networks. "Love" corresponds to a state of extreme pleasantness and to a high level of arousal. "Trust" corresponds to a state of high pleasantness and to a state of middle/low arousal. This means that the general sensation for collaboration is highly to extremely pleasant, with a wide range of energy levels: collaboration makes people feel good (or at least express in positive ways) and it creates a diffused sense of tranquillity, which mutates into open excitement through certain facts or events.

Minor levels of "Violence" and "Terror" are also expressed. "Violence" corresponds to a middle/high level of discomfort and to a high level of energy/arousal. "Terror" corresponds to an extreme level of discomfort and to a middle/low level of arousal. By uniting these quantifications to the analysis of the messages (for example through the topics they deal with) it is possible to evaluate how these types of expressions match the reactions to the unfulfilled expectations which are manifested by the inhabitants of the city for what concerns the practices of collaboration: not only they energetically would expect and desire more (or different) than is currently available, they also strongly doubt that things are going

to change. These expressions are few, but they bring interesting reflections to the conversation, and they should be observed and understood to comprehend how to address the missed expectations.

In one case, a small peak of "Sadness" arises, as February begins. "Sadness" corresponds to a middle-high level of discomfort, matched by a low level of arousal. This means that around the beginning of February something has begun (and ended soon after, luckily) to worry people, in ways which do not allow or suggest their activation (thus, the low level of energy): something to be monitored, so that people can be more actively engaged towards the positive resolution of their doubts.

"Joy" constitutes another important element of the emotional scenario. As it can be appreciated by the chart, it has less spikes than the other ones: it is constant and present, almost a background noise, and surpassing the levels of the negative expressions. This goes to strengthen the initial consideration: even with all the problems that dealing with a complex and diverse population brings about, the topic of collaboration in the city brings joyful, confident expressions.

After looking at the temporal evolution of emotions about collaboration in the city, let's look at their spatialisation.

As can be seen in Figure 32, there are only a few peaks: emotions are evenly distributed along where the expressions are. Let's investigate on these few peaks.

Most emotions feature a peak in the San Donato area: this is the location of Bologna Fiere and, correspondingly, the location of many heated discussions, in positive and negative, about the topics of collaboration. This is also one of the areas which generates the highest quantities of social networking messages in the city.

The many events which happen in the Parco Nord area justify its presence among the peaks of different emotions.

The area of the Central Station is also among the peaks for multiple emotions: as said in the previous sections, transportation hubs are among the most interesting places in which to observe emergent expressions about collaboration.

The Irnerio, Santo Stefano, Galvani and Saragozza zones have peaks in multiple emotions.

The Giardini Margherita park

has interesting peaks in multiple emotions. From highest to lowest: surprise, joy, love, sadness, anticipation, terror. This indicates a location which becomes the place in which expressions of multiple kinds happen, in which doubt (from extremely positive to extremely negative) arise. It is a place in which questions are asked, both spontaneously and through the "Collaborare è Bologna" actions, and for which answers are sometimes provided, always expected and desired, a few times with the profound doubt that they would not come.

The Scandellara area has a peak of "love", mostly connected with the general regeneration of the location, with housing, parks, street art and murales interventions.

By comparing how various emotions appear on the different locations in the city, we can determine the general sentiment for collaboration in Bologna, as expressed on social networks.

In Figure 33 we can appreciate the relative distribution of positive and negative expressions in the city about collaboration in Bologna. The maps show relative values, to be able to appreciate the level
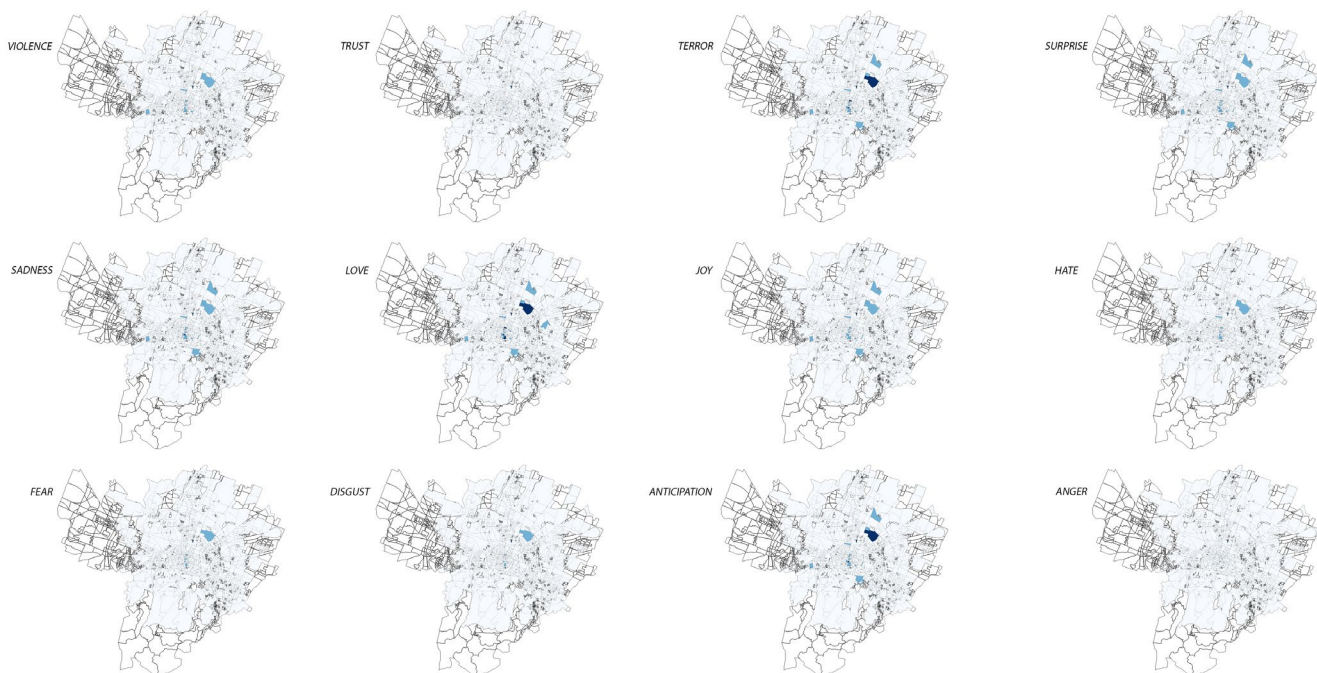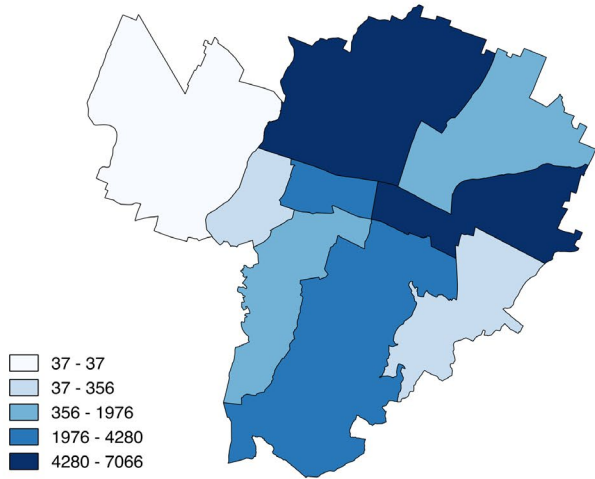

Figure 32. The peaks of various emotions about collaboration as expressed on social networks. (the peaks are shown in darker shades of blue).

NEGATIVE SENTIMENT

37 - 37
37 - 356
356 - 1976
1976 - 4280
4280 - 7066

POSITIVE SENTIMENT

83 - 83
83 - 1848
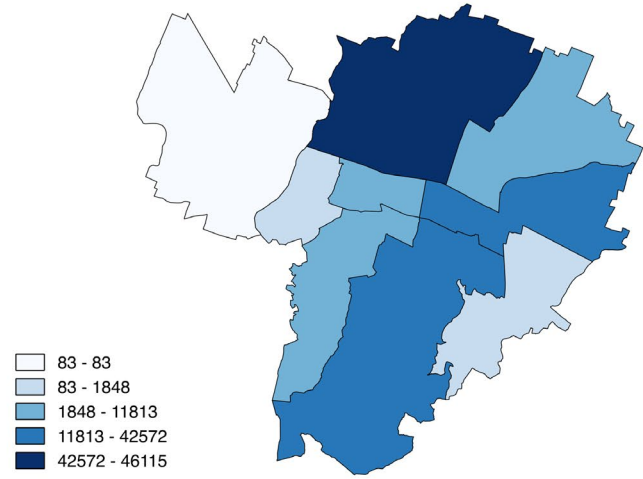1848 - 11813
11813 - 42572
42572 - 46115

Figure 33. The general sentiment about collaboration in the city of Bologna, as expressed on social networks. The values are intended as relative, as they appear in different scales.

of proportional intensity. From a quantitative point of view, the positive emotional expressions are more than the negative ones, by a factor of around 6.

Open Data & Tools

A set of Open Data is released through this first phase of the HUB project.

All data is cumulative on the period of time relative to the first phase of HUB: from September 2015 to the end of January 2016.

Here are the details of the various elements of the set:

HUB-collaboration-sentiment-negative

- Shapefile (WGS84) points
- Content locations containing negative sentiment

HUB-collaboration-sentiment-positive

- Shapefile (WGS84) points
- Content locations containing positive sentiment

HUB-collaboration-sentiment-negative-quartieri

- Shapefile (WGS84) polygons
- Negative sentiment in each neighbourhoods polygon

HUB-collaboration-sentiment-positive-quartieri

- Shapefile (WGS84) polygons
- Positive sentiment in each neighbourhoods polygon

HUB-collaboration-content-per-section

- Shapefile (ED50) polygons
- Content density per census section

HUB-collaboration-projects-content-sections

- Shapefile (WGS84) polygons
- Social network content in census section in which there are projects with pacts

HUB-collaboration-content

- Shapefile (ED50) points
- Content (social network messages which can be geo-referenced)

HUB-collaboration-emotions-anger

HUB-collaboration-emotions-anticipation

HUB-collaboration-emotions-boredom

HUB-collaboration-emotions-count

HUB-collaboration-emotions-disgust

HUB-collaboration-emotions-fear

HUB-collaboration-emotions-hate

HUB-collaboration-emotions-joy

HUB-collaboration-emotions-love

HUB-collaboration-emotions-sadness

HUB-collaboration-emotions-surprise

HUB-collaboration-emotions-terror

HUB-collaboration-emotions-trust

HUB-collaboration-emotions-violence

- Shapefile (WGS84) polygons
- Social network content in census sections in which a certain emotion is expressed

HUB-collaboration-content-organisations

- Shapefile (WGS84) polygons
- Social network content in census sections in which there are organisations registered on Iperbole

HUB-collaboration-users-per-section

- Shapefile (ED50) polygons
- Social network users talking about collaboration per each census section

This set of Open Data is constituted through aggregated data and anonymised data, to protect people's rights and privacy.

It is possible to access the tools available at human-ecosystems.com/HE_BO/visualizations/ to operate according to one's own online identities, so that access to data is regulated through the agreements which stand on the social networks of origin (if you are able to see something, whether it is a name, a photo, a message or else on a certain social network, you will be also able to see it there, as you will be using the same credentials; as per social networks go, there are some things which everyone can see).

Using these tools one is able to fully explore Bologna's Human Ecosystem, focused on collaboration in the city.

Conclusions

This is the end of the first report from the HUB project, documenting how collaboration in the city of Bologna lived on major social networks.

It is an interesting first phase: we now know what can be observed and what cannot. How we can use the data we capture and how we cannot. How we can understand collaboration in the city through this data, and how we can't.

Most important of all, we now have, for the first time, something on which it is possible to work on with the rest of the population.

For the first time this data about the inhabitant's desires, wishes, expectations, relations, actions on collaboration in the city are not only available to large marketing agencies, statistics institutes and social network and telco operators.

Now they are available to everyone: in a museum (in Bologna's Urban Center, under the form of beautiful info-visualisations) and as a source of Open Data, through which people will be able to learn how to understand their city much better, and how to use this augmented perception of the city to act more effectively, and together with the other inhabitants.

The adventure has just began.
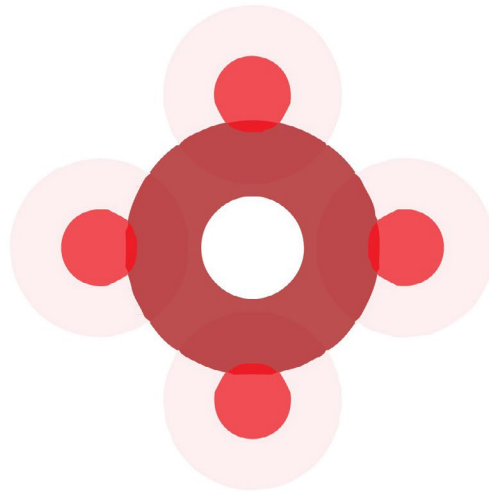
HUB
è Bologna

COMUNE DI BOLOGNA

HUMAN ECOSYSTEMS