# THE SOCIAL MEDIA IMAGE:
# MODES OF VISUAL ORDERING ON SOCIAL MEDIA

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My dissertation considers the organization of large sets of user-generated photographs across social media platforms, and delineates the ways in which time and place are mediated through their presentation and analyses. Addressing the unprecedented scale of social media visual expressions, together with their implementation, structure and presentation within specific media platforms, I examine how visual social media data is processed, structured, and presented, and theorize the consequences of these forms for the ways we culturally understand and experience contemporary visual information.

Taking an integrated approach, this work offers a qualitative and quantitative analysis, and draws on methodologies from media theory, information science, software studies, art history, cultural studies, and computer science. I combine distant critical reading of larger organizational patterns and their cultural meanings (studying visual arrangement in exiting platforms, experimental computational research, and artistic works) with a close analytical reading of groups of photos, using computational and visualization tools. This twin process allows me to develop my theoretical understanding based on particular results, but also illustrates the problem that is the focus of this dissertation: how to understand new visual production scales, their organizations, and their interpretation.

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# PREFACE

I would like to express my deepest gratitude for the exceptional support, care, and generosity of my thesis advisor Terry Smith, my committee members Geoffrey Bowker, Barbara McCloskey, and Josh Ellenbogen, and all other friends, colleagues, teachers and staff at the History of Art and Architecture department at the University of Pittsburgh.

Throughout my work, I had the fortune of collaborating and discussing my work with a diverse group of people. I owe Lev Manovich a special debt for his encouragement and support, as well as to other members of the Software Studies Initiative, Jay Chow, and Mehrdad Yazdani. Considerable thanks are due to Justin Crenshaw from Carnegie Mellon University, and to Mor Naaman and the members of the Connective Media Lab from Cornell-Tech.

All the other longer and brief social encounters between Tel Aviv, Pittsburgh, New York and San Francisco that shaped and inspired myself and this work in recent years are much treasured.

As ever, this is all for Raz.

# 1.0 INTRODUCTION

The recent transition of the web structure from static content made by professionals, companies, and organizations, to interactive platforms where people can share, comment and tag their own media, poses new challenges for computational, social and humanistic research. This change has precipitated the development of theoretical and practical tools for dealing with this new type of data. This includes the expansion of existing meaning production processes into new forms of knowledge acquisition and representations, through the analyses of new data attributes and their socio-cultural and political implications, to the ways in which we come to see ourselves and the world through the intermingled operation of the production, dissemination, organization and analyses of this data.

Situated within these incipient informational conditions, this dissertation examines one particular subset of this new class of data: social media images. More precisely, it examines the organization of large sets of user-generated photos over social media platforms and delineates the ways in which time and place are mediated through their presentation and analyses. My analysis revolves around what is typically termed in research the "material conditions" of information and concerns the ways in which visual information within social media platforms is structured, processed and presented. I then discuss the consequences of these forms for the ways we understand and experience these images, and analyze particular case studies within these informational conditions.

My discussion circles around three levels of inquiry that intertwine with each other. I ask:

How do we currently organize visual social media?

How is our experience of time and place mediated via these organizational forms?

And finally, what are some of the possible ways to look at visual social media?

The first two questions are related to each other and revolve around the "aesthetics of information": I use a comparative method to look at similarities and differences between the ways we currently organize visual information on social media and compare them to the organization and conceptualization of information in earlier cultural periods. If the organization of visual information on social media is indeed (emerging as) different in kind from earlier information organization and representations, what are the distinct qualities of this change? How is it similar? How are these differences and similarities manifested computationally (by new technological methods) as well as culturally (how do they conceptualize the representational world in relation to earlier understanding)? This interest also directs my analysis of the implication of these new organizational forms of data. I ask how do these structures of visual social media mediate a distinct experience of time and place compared to earlier understandings of similar and precedent phenomena?

The third question involves the presentation of new potential organizational forms for large sets of photos, as well as the survey and analysis of existing computational and artistic experiments in this direction. The goal here is to suggest, analyze and theorize existing and alternative large-scale visualization tools and formats that grapple with the problem of large visual production scales, and which offer possible solutions to this problem.

The resultant answers thus form three center points or axes for my work: first, I discuss the ways in which we conceive and experience time through the organization of contemporary

user-generated large-scale visual productions ("the fabrication of visual time-binding"); next, I analyze how place is mediated through social media representation and application ("the formation of collective visual place-making"); and thirdly, I illustrate how we can "view" the world differently via emerging informational organizational modalities ("the creation of cumulative world-picturing").

## 1.1 METHODOLOGY AND SCOPE

The historical development and convergence of photography and computing since the 1990s can be roughly divided into three stages. First, there was the "digital image" of the 1990s in which the main research interest was focused on a singular image, and its "interactivity" and "malleability" within forms of media storage (i.e. CD-ROM), and media software (such as Photoshop and Macromedia [Lister, 1995: 4]). In these conditions, many scholars noted the ''death of photography,'' and undermined photography's privileged status as objective and real (Mitchell, 1992; Ritchin, 1990; Rosler, 1991; Robins, 1995). Since the beginning of the 2000s, the center of scholarly attention has shifted from the digitally encoded image to the dispersed nature of images online, and to what is increasingly referred to as "the network image." This term described new modes of image "transmission, encoding, ordering and reception" (Rubinstein and Sluis, 2008). Towards the end of the 2000s, the convergence of the networked computer with distributed, "ubiquitous," and mobile computing, social networks, GPS technologies, real-time streams, and Application Programming Interfaces (APIs), expanded previous accounts of photography such that it came to be seen as: mobile, social, user-generated, locative, and pervasive (Kember, 2013; Rubenstein and Sluis 2008; Van House 2011).

Existing research into this most recent stage of photography is relatively limited in scope. In my home disciplines of visual culture, cultural studies and art history, researchers mostly offer historical descriptions of social photography, and track the changing nature of, for example, temporality, memory, and representation within it (Murray, 2008; Van Dijck, 2011; Vitulano, 2013; Forrest, 2012). In the social sciences (i.e. cultural anthropology, STS, communication) the priority is to explore how and why people use social photographs (Van House, 2011; Wang, 2012; Mendelson and Papacharissi, 2010; Cox et al., 2008). Within the realm of computational analyses, numerous papers in computer science have worked with large-scale social media data (including images), but these studies typically identify general patterns and regularities in the data, and, if possible, model this data. Digital humanities and digital history projects that study large sets of digitized artifacts have not yet extended this work to contemporary social media data. As such, insufficient attention has been paid to two of the most fundamental cultural "conditions" of these images: (1) their implementation, presentation and structure within specific media platforms, and more crucially, (2) the unprecedented scale of production and availability of social vernacular photographs from many places, people and times.

Taking an integrated approach that offers theoretical and analytical perspectives, my research addresses these fundamental factors by offering a qualitative and quantitative analysis and drawing on methodologies from media theory, information science, software studies, art history, cultural studies, and computer science. As mentioned, my goal is to show how large-scale visual social media data is organized, and the consequences of these forms of information for the ways in which we understand this new type of data. To do so, I rely on existing applications, experimental computational research, and artistic investigations that grapple with

various techniques of large-scale visual information organization, analyses and conceptualizations.

On the one hand, I analyze the changing syntax of today's "visual software ontology", and chart the ways in which social images appear to their users—i.e. how we can create, share, organize and store visual information today via social media platforms. Assuming that the particular functions and presentation of a media interface embed assumptions and models about a user and society, I ask: what are the affordances of a specific visual social media application (how can we use it?), and what do these practices can imply for a culture's values, hierarchies, standardization and infrastructures? I analyze the structure of social visual information representations, and trace the levels in which the social media image might offer new experiences, conception, and interaction in regard to contemporary cultural productions.

This line of inquiry draws upon a long research tradition devoted to uncovering the ways in which organizational forms and knowledge practices are intertwined–ranging from the study of esthetics properties as symbolic forms (Panofsky, 1991), to the analysis of historical literacy (Ong, 1982; Goody, 1977), to more recent efforts by software and algorithmic studies (Fuller, 2008; Manovich, 2013; Beer, 2009). While different forms of materiality have been considered from this perspective they all explore the particular shapes of information; how these forms influence our experience of it; the types of analyses and interpretations it supports; and how it reflects particular values and hierarchies of particular times and places (Dourish, 2011).

On the other hand, and as a reflection on and expansion of the theoretical part, I offer a series of analytical case studies, examining how socio-cultural knowledge is produced across planetary-scale publicly shared metadata and images from social media platforms. In this case, I

use large sets of publically shared social media images posted over the photo sharing application Instagram (http://instagram.com).

In compliance with Instagram API (Application Programming Interface) terms of service (http://instagram.com/about/legal/terms/api/) I crawled images and their associated metadata. It is possible to download images in four ways: by geographies (particular location coordinates); usernames; content tags; and locations actively associated with images by users from a predetermined list. Data downloaded from Instagram includes a username for each image, along with the date and time it was shared, geo location, tags, descriptions and the type of filter (visual manipulation embedded in the application) used on the image. It also contains a link to the user's profile on Instagram.

The applicable parts of this research were developed in collaboration with designers, artists and computer scientists.[1] To explore the data we used a variety of software tools such as R, Python, CartoDB, Excel, and Mondrian, as well as custom image processing software. We then used visualization tools to create high-resolution images showing all individual images in a collection sorted by their visual properties and/or metadata. Such "media visualizations" allow us to explore patterns in the available photographs' metadata (dates, dimensions, places, etc.), and the photographs' visual form and content. This method allows us to create many alternative views of the same collections, organizing its images in different orders. All "media visualization" tools were developed in the Software Studies research lab at the California Institute for Telecommunication and Information at UCSD, and are distributed using open source

[1] The visualizations in chapter 2 were developed in collaboration with Lev Manovich (Computer Science, The Graduate Center, CUNY) and Jay Chow (Calit2, UCSD). Image clustering in chapter 5 was developed in collaboration with Mehrdad Yazdani (Calit2, UCSD).

license: http://lab.softwarestudies.com/p/software-for-digital-humanities.html. All other textual, conceptual and theoretical elements of this dissertation are my own.

It should be emphasized that my analysis of visual social media and the social media image is restricted here to "social awareness streams" (SAS), characterized by their public (or personal-public) nature of the communication; the brevity of posted content; and a highly connected social space (Naaman et al, 2010). As such, what I refer to here as the social media image denotes particular types of images that are taken, manipulated and shared within social media awareness streams (natively uploaded images), and are archived in a retrievable public or semi-public database. In doing so, I am not accounting for those contemporary social media platforms that are not organized as streams, those on which images are not predominantly created for and within a particular application (for example, platforms such as Pinterest which is organized around building collections that are not stream or real-time oriented). Nor do I refer to non-retrievable and non-public images (i.e. apps like Snapchat which are organized around a specific ephemeral logic).

The result of my complementary "qualitative" and "quantitative" paths thus combine a "distant" theoretical reading of larger organizational patterns and their cultural meanings (studying visual organization in exiting platforms, experimental computational research, and artistic investigations) with a "close" analytical reading of groups of photos, using standard and experimental visualization tools. This twin process allows me to develop my theoretical understanding based on particular results, but it also illustrates the problem that became the focus of this dissertation: how to understand new visual production scales, their organization, and their interpretation.

## 1.2 GOALS

My research is intended to make a three-fold contribution. First, I show how the structure of the social media image represents time and place in new and particular ways, and how emerging forms of large scale visual arrangements shape the kinds of analyses they support. Second, in a series of case studies, I look at visual social media data from a digital humanities perspective, merging together the macro-scopic and the micro-scopic element of the data for the analysis of global patterns as well as specific places and times, using visualization and computational techniques. Third, this project challenges traditional boundaries of humanistic research as it combines quantitative and qualitative methodologies, bridges 'positivist' and 'hermeneutic' approaches, while working in collaboration with teams of researchers.

Existing "interdisciplinary" forums dedicated to the study of the social, cultural and political aspects of contemporary "big data" productions typically include members of the social sciences, computational sciences and the information technology industry. Humanistic perspectives, however, are rarely heard and tend to be repressed. In this state of disciplinary affairs, my work aims to "infiltrate" this somewhat closed circle and tries to offer a cultural, historical and practical account that will, I hope, appeal to both sides of the discussion.

To these reasons, I chose to present and publish various analytical and theoretical elements of my work in computational and social sciences academic venues (i.e. premier computational conferences such as *CHI* or *ICWSM*, and prominent interdisciplinary open access journals such as *First Monday* and *Big Data and Society*). In addition, this research have been recognized and was reported upon by prominent design, culture and technology media outlets around the world, such as *The Guardian* (Arnett, 2013), *Wired* (Stinson, 2013), *The Atlantic* (Badger, 2013), *Der Spiegel* (Lischka, 2013), and many others.

The challenges that accompany the process of a constant effort to make an academic work relevant for various readerships, disciplines, and intellectual interests, while maintaining rigorous standards in each academic domain are inscribed in various elements of this work, and shaped its form and content.

## 1.3 RESEARCH OUTLINE

My dissertation is structured in two thematic sections, each contains two chapters: the first theoretical in nature while the second elaborates on particular questions raised in the theoretical part and offers an analytical case study as it main focus. The first section revolves around questions of time representations, organization and mediation while the second section deals with the construction, representation and experience of place and space via the organization of large-scale social media images.

I start by asking how does the organization and presentation of large-scale social media images recondition the process by which visual knowledge, value and meaning are made in contemporary conditions. The opening chapter analyzes fundamental elements in the ways current social media platforms and aggregators organize and categorize social media images. Entitled “from database to data stream,” this chapter discusses how visual materials created within social media platforms manifest distinct modes of knowledge production and acquisition.

First, I analyze the structure of social media images within data streams as opposed to previous information organization in a structured database. While the database has no pre-defined notions of time and thus challenges traditional linear forms, the data stream re-emphasizes the linearity of a particular data sequence and activates a set of new relations to

contemporary temporalities. Next, I show how these visual arrangements and temporal principals are manifested and discussed in three artworks: *"Untitled" (Perfect Lovers)* by Felix Gonzalez-Torres (1991), *The Clock* by Christian Marclay (2010), and *The Last Clock* by Jussi Ängeslevä and Ross Cooper (2003).

By emphasizing technical and poetic ways in which social media situate the present as a "thick" historical unit that embodies multiple and synchronous temporalities, this chapter illuminates some of the conditions, challenges, and tensions between former visual structures and current ones, and unfolds the cultural significations of contemporary big visual data.

The second chapter, titled "Imagined Data Communities", continues to elaborate on the ways in which time is mediated through the interface of particular social media platforms, and introduces the visualization tools and techniques used throughout this research. I ask: How are users' experiences of production, sharing, and interaction with the media they create mediated by the interfaces of particular social media platforms? How can we use computational analysis and visualizations to study social and cultural patterns? How can we visualize this media on multiple spatial and temporal scales? The chapter examines these questions through the analysis of the popular mobile photo–sharing application Instagram.

First, I discuses the affordances provided by the Instagram interface and the ways this interface and the application's tools structure users' understanding and use of the "Instagram medium." Next, I visualize the visual signatures of 13 different global cities using 2.3 million Instagram photos from these cities. Finally, the chapter concludes with spatio–temporal visualizations of over 200,000 Instagram photos uploaded in Tel Aviv, Israel over three months to show how they can offer social, cultural and political insights about people's activities in particular locations and time periods.

The third chapter is entitled “Image Space.” It turns away from the representations of time discussed earlier, and examines the types of *spatial relations* that are created by the organization of large sets of social media photos. The recent proliferation of visual documentation mechanisms within social media platforms—images and videos taken, recorded and shared via devices such as mobile and wearable cameras—has resulted in an unparalleled increase in the volumes and availability of idiosyncratic representational spatialites. In turn, new ways to organize large sets of these visual materials have been developed, aiming to reconfigure some versions of these expanded documentational spaces.

What types of space are created within the emerging modes of information organization of social media images? How does the activity of “image mapping” change between one space to another? This chapter argues that the social media image performs several kinds of spatial relations with other images in a collection. Following Mol and Law (1994), I trace three organizational modes of large sets of social media images and analyze the ways they establish distinct spatial understandings for their images. First, I describe ‘images as network’ which sets the properties under which an image participates in the construction of large-scale organizations, and signifies a relational distance between elements within a dataset. Second, I point to the treatment of ‘images as region’ in which images are clustered together and positioned over a Euclidian map in order to reconfigure a sense of mobilization within a physical space. Third, I consider the arrangement of images in a “fluid” spatiality which does not depend either on geographical boundaries or on the rigidity of the network elements and thus performs multiple visual content continuities.

Using examples of existing, emerging and experimental forms of information orderings of large sets of social media images, the chapter reviews, analyzes and theorizes these three

approaches for the organization of large-scale visual materials produced over social media platforms, and chronicles the ways in which each method constructs a particular functionality for these images.

In this way, I show how the organizations of large-scale social media visual information transform our understanding first of space, secondly of image function, and thirdly of visual meaning production. Putting all these together results in what I call an "image space": a representation of image 'topologies' (continuities or proximities) with other images in a collection, and the locus of an informational organizational practice which sets itself up as the axis of contemporary large-scale visual experiences and knowledge practices.

The fourth chapter, "Form Site-Specificity to Hyper-Locality," elaborates on the representation of place via social media photos and asks: How have the treatment of visual materials have historically come to define the relation between a physical place and its visual representations? How are these historical conceptualizations reincarnated in contemporary social media visual organizations? And finally, how do these modes of visual arrangement redefine the relations between physical places and their social media representations?

In this chapter I historicize, visualize, and theorize the distinctive ways in which localities are experienced and preformed through their social media hyper-local representations. I combine quantitative and qualitative analysis, and employ perspectives from the fields of Digital Humanities and Art History in order to offer a theory of hyper-local social media, and visualize its manifestations and operations using a particular case study.

I start by drawing historical parallels between "site-specific" artistic conceptions from the late 1960s and early 1970s and current organization of hyper-local geo-temporal social media images. Next, I exemplify the hyper-local using the case study of 34,522 photos taken in

prominent Modern art museums around the world, and 28,419 photos taken during the street artist Banksy's month-long residency in NYC during October 2013. Finally, based on these results I offer a theoretical analysis, identifying what I see as some of the key characterizations of hyper-local social media data.

As illustrated by the structure of my discussion, the theoretical and practical sections of this dissertation operate together as a *kaleidoscope*—they always start with a view of the documented world as ill arranged, as containing bits and fragmentary pieces, and slowly develops into means by which structured patterns and knowledge are realized. They show how discrete representations from many people, places and times can dissolve into visual fragments that are no longer considered on their own rights, but rather it is now the pattern, the design, and the forms of all these discrete representations have become the content (figure 1).

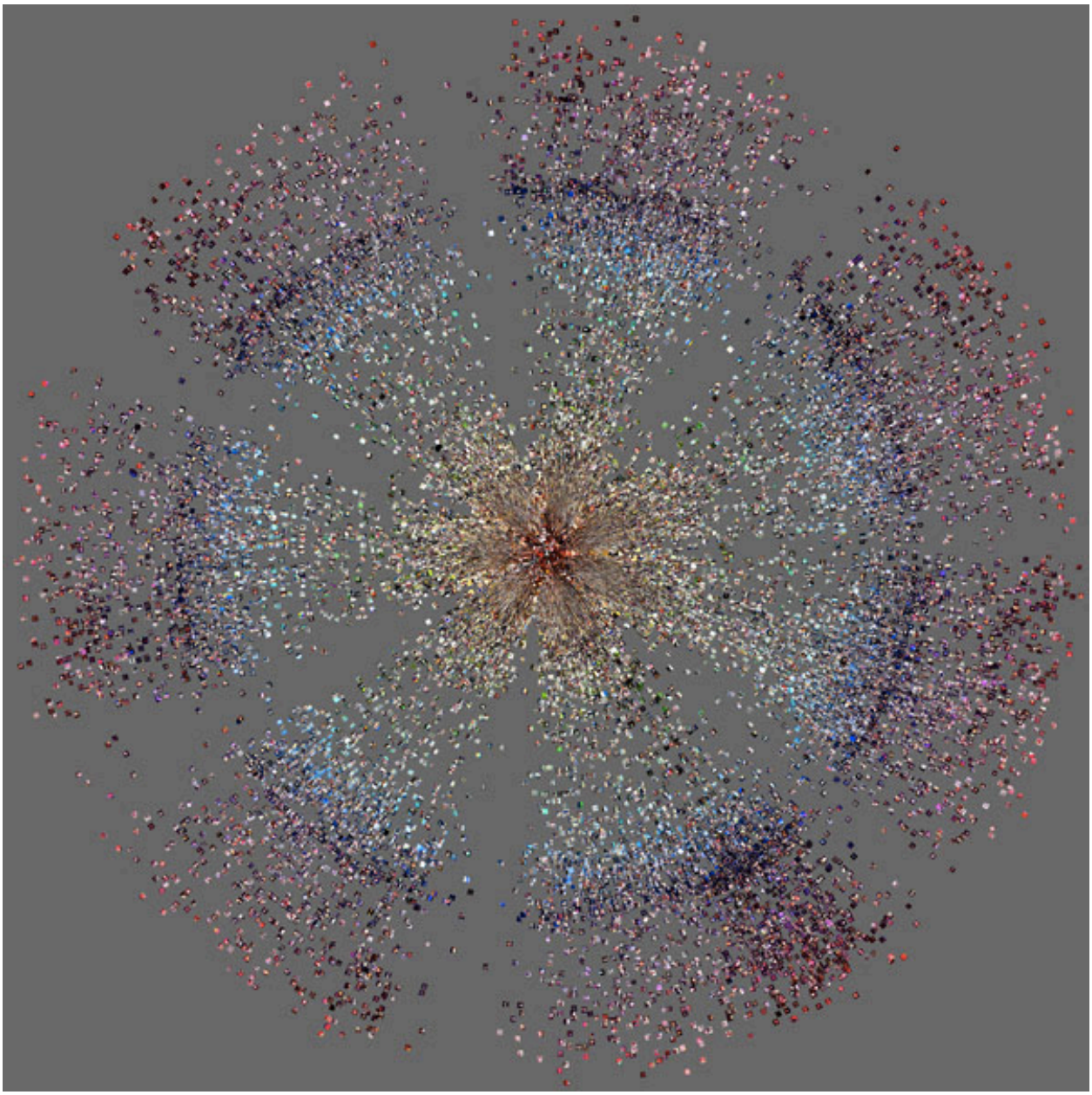

**Figure 1.** Radial image plot visualization of 33,292 photos uploaded to Instagram in Tel Aviv during 20–26 April 2012. The photos are sorted by hue (radius) and upload time (perimeter). The photos are organized by brightness median (perimeter) and hue median (radius). Higher resolution versions of these figures are available at http://phototrails.net/visualizations/radial-visualization/

# 2.0 FROM DATABASE TO DATA STREAM

## 2.1 INTRODUCTION

After the digital image of the 1990s, and the networked image (digital images on the web) of the 2000s, the social media image is the new dominant cultural visual form of the 2010s. In its ever-increasing scales of production across wide geographic zones and temporal scopes, the social media image—produced, manipulated, shared and organized via social media streams—manifests distinct modes of socio-cultural expression. Are these images different in kind from earlier images? What are the ways in which they offer to shape our experience of ourselves and of the world today? How do these images allow us to know the world differently, and how is this knowing different in kind from earlier kinds of understanding?

This chapter discusses the ways in which contemporary large-scale visual materials created within social media platforms suggest changing practices of knowledge production and acquisition. Analyzing core elements in the changing syntax of existing visual software ontology—the ways current social media platforms and aggregators organize and categorize social media visual materials—I trace the levels on which the social media image offers new experiences, conceptions, and interactions within contemporary cultural productions. Doing so requires us to redefine the dynamic processes by which visual knowledge, value and meaning are made in contemporary conditions.

I start by analyzing the organization of visual materials within the social media data stream—a continuous presentation of multiple information units from many users, places, and times. Contrary to a database structure that has no-predefined notions of time, and consequently does not favor the temporal and linear organization of data objects, the data stream presents the temporal element as its core organizational and communicational factor. Using examples from existing social media platforms and aggregators, I show how the data stream re-conceptualizes a new understanding of time and thus suggests a new experiential mode of contemporary history.

Finally, I analyze how these new temporal arrangements are manifested and discussed in three artworks: *"Untitled" (Perfect Lovers)* by Felix Gonzalez-Torres (1991), *The Clock* by Christian Marclay (2010), and *The Last Clock* by Jussi Ängeslevä and Ross Cooper (2003). As I argue, the works situate the contemporary image within a new order of what I call "stream time." I will show how they reflect, poetically, on the experience and symbolic significances of this particular time.

## 2.2 BACKGROUND

What are the material conditions (i.e. structure, implementation, organization) by which the social media image emerges or can be defined today? What are the representational implications of these material conditions? These questions draw upon a long research tradition devoted to uncovering the ways in which representational forms and knowledge practices are intertwined– ranging from the study of esthetic properties as symbolic forms (Panofsky, 1991), through the analysis of historical literacy (Ong, 1982; Goody, 1977), to more recent efforts by software and algorithmic studies (Fuller, 2008; Manovich, 2013; Beer, 2009). While different forms of

materiality have been considered from this perspective, they all explore the particular shapes of information; how these forms influence our experience of it; the types of analyses and interpretations it supports; and how it reflects particular values and hierarchies of particular times and places (Dourish, 2011).

The materiality of information that concerns me here are the ways in which visual information within social media platforms is structured, processed and presented, and the consequences of these forms for the ways we understand and experience these images. Specifically, I situate the social media image within a new order of time, and elaborate on the experience, meaning and analyses of this particular time.

To illustrate this point, I focus on the organization and presentation of visual materials within the social media data stream, contrary to information arrangements in a structured database. While the database designates a rather stable organization of data objects, recent online developments signal a paradigm shift toward the transient data stream (Berry, 2011a, 2011b; Borthwick, 2009; Manovich, 2012). As opposed to the database, where updates and queries are made infrequently (a fact used to define the 'destination web' [Berry, 2011a: 142] or the 'static web' [Searls, 2005a]), the stream is a dynamic, continuous flow of items that keeps updating according to new data that arrives from multiple, time-varying sources.

The data stream has been in use since the beginning of 2000s in an increasing number of applications that require real-time processing of continuous data flows from geographically distributed sources (Aggarwal, 2007; Babcock, 2002; Della Valle et al., 2009; Margara and Cugola, 2011). While examples of such applications come from diverse fields—financial applications, network monitoring, security, sensor networks, and others—it is the incorporation of the stream as the core mechanism in social media platforms that has transformed former

everyday communication patterns and structured new social experiences. Examples such as Twitter, Facebook, Instagram, or Newsfeed, represent a new class of communication technologies, all structured as streams of information (status messages, images, videos and links) contributed by many users from many places (Naaman et al., 2010).

As opposed to previous mechanisms which work on opening and closing server connections, and pulling in information on request, this new type of data processing performs a continuous query for new data units that arrive in the database, and pushes the result into the stream according to the filter being used. The result is thus a persistent, real-time connection between a server and a user (Marz, 2011). These data units appear to us from the current time backwards, and are restricted to the recent now, as older objects quickly disappear from the stream and are only available by searching the application database. What we have here is a continuous, rapid presentation of multiple data units from many users, places, and times—all appear to us almost at the same, synchronous, time.

What is most important to understand is that while the database stores sets of relatively static recodes with no pre-defined notions of time (objects or data values are not necessarily organized by the time of creation or uploaded to the database unless time indications are explicitly added), the data stream is a continuous sequence of items that are organized by their arrival time or by a time stamp that is associated with an object (Golab and Ozsu, 2003). In this way, if the database suppressed traditional linear forms (as it has no pre-defined notions of time), and marked an informational ontology that formed a new way to structure our experience of ourselves and of the world (Manovich, 1999, 2012), the data stream seems to emphasize once again the linearity of a particular data sequence, and thus re-conceptualize new types of contemporary knowledge formations and acquisitions.

What type of linearity is this, and how does it manifest itself in regard to visual materials in the social media data stream? How does the organization of images in the stream structure our understanding of social visual data today? Put differently, if the stream brings back the temporal element as its core organizational and communicational factor, what type of collective relationship with time does it suggest? How does the presentation of the stream construct our understanding of this collective time, and how does this time differ from earlier times encapsulated in former data presentations?

It might be useful to think about the near-simultaneous real-time structure of the data flow within the stream in terms of what historian Francois Hartog has called "presentism": a "regime of historicity" (or a temporal order) in which the present has become the most crucial ordering mechanism of contemporary society (Hartog, 2003). In this new temporal regime—formulated by others as timeless (Castells, 2000), or atemporal time (Sterling, 2012)—the "experience" of the present is one of enervating depthlessness that traps us in an omnipresent present, a withdrawal into the present as an absolute value that absorbs the past and the future and eliminate them. Such a regime signals a disconnection from past historical conceptions—such as the modern order of time, which was marked by the idea of progress and a continues orientation toward the future—and undermines the mere possibility of history (Ross, 2006)

How might this work if applied to the structural logic and presentation of the stream? While the stream seems to take part in Hartog's "presentism", as it is in real-time and continuous updates of recent "presents" appear to us almost at the same time, it also diverges from it by offering a particular form of presentism. As the data stream is a multiplicity of coexisting temporalities or "worldviews" from many people and places, the experience of viewing the stream is a continuous *comparison* of temporal representations: a comparison of the present time

experienced by an individual launching the application to all other presences expressed by other individuals in the same feed, all posting images in temporal proximity to each other.

The effect of this comparison is the resynchronization of our own living bodies' temporality with the temporalities of others, fusing all together in order to make them "one." This does not mean, however, a lack of time, or an "atemporal" or "timeless" state in which we are all at the same time together. Rather, it is a condition in which time becomes *times*; a performance of the contemporary flow of synched and meshed times and the relations between them. In this condition of time, the past, present, and future are constructed in a relationship which is not about the passage of time (as in former modern organizational forms such as the film), but about being at the same time with other users (viewing the stream as it updates), being after users' time (browsing past event), or being before users' time (experiencing an event before it is uploaded to the stream by other people).

In other words, in contrast to Hartog's definition of presentism as an absolute temporal category that is disconnected from the past and the future, the stream actually facilitates their conditions of possibility. The stream enables the present of the viewer/user to break down into the past and the future times of other users. It creates a montage of "temporal dialectical images" (Benjamin, 1968) that coincide with one another ("close" times), or completely incommensurable times ("different" times). By so doing, the stream activates a set of co-occurring temporal relations (before/after/at the same time) and thus brings the past, present and the future of many users closer together as a simultaneous duration of multiple temporalities.

These new temporal relations are best understood in their historical context. As famously discussed by Walter Benjamin, the modern experience of temporality is one of a "homogenous empty time", in which time is conceived as the uniform, "empty" units represented by the

calendar and the clock (Benjamin, 1968: 261). As this idea was later developed by Benedict Anderson, this understanding of time encompassed a new experience of simultaneity, in which unrelated people can feel themselves unified and together by occupying the same homogenous temporal moment (according to Anderson, this understanding of time was mostly derived from the nineteenth century mass-circulation of daily newspapers, through which thousands of people shared the same experiences by reading the daily news). In other words, this new sense of simultaneity enabled us to imagine ourselves as members of the same sociological reality, in which all co-occur at the same, homogenous, time-space (Anderson, 1991: 22-36).

Benjamin borrowed the idea of homogenous empty time from Henri Bergson, who argues that while temporality actually consists of heterogeneous moments of duration that permeate one another, our mental apparatus reconfigures time as homogenous by laying it out in a unified spatial sequence (Bergson, 1910: 237). In this way, as explained by Mitchell, modernity can be characterized as a "form of temporality" with a homogenous spatial expression, in which we are all in the same empty, imagined, time-space. This result of this simultaneity was what made it possible to construct the idea of historical time: history is the story of a civilization, culture, or people whose distinct and detached lives are reimagined and reassembled into one unit in order to create a sense of progress from one simultaneous moment to another (2000: 14-15).

When this becomes clear, it is easier to understand how the data stream activates a new, contemporary form of temporality. If the modern conception of time, epitomized by printing technologies, was an experience of homogeneous empty times that rests on giving temporality a unified spatial expression (the spatialization of time), and if the postmodern, emblemed by the structure of the database, undermined and rejected this time (the annihilation, distraction, and

death of time), the stream mechanism can be thought of as the contemporary temporalization of space, giving spatiality a fragmented temporal expression (the expansion of time).

As time is viewed from many places, and space is viewed from many different yet close times, the stream thickens contemporary views of time and space into a parallel display of multiple temporalities from various spatialities. These extensions of time and place, however, do not unfold as expanded presents in which the visual flow constitutes a continuous or discontinuous chronology. Rather, the informational mechanism of the stream turns temporal synchronization into a new experiential mode of contemporary history, in which the past, present, and future of images from many locations and users temporally coexist without the need to manifest a sense of modern linearity or a historical progression between them.

## 2.3 IMAGE FRAGMENTATION

While the resynchronization of times enabled by the stream velocity, frequency and immediacy offers a new subjective experiential mode of contemporary temporalities, it's expansion into a new condition of contemporary history is facilitated by the projection of this idiosyncratic experience into larger sets of collective data productions and presentations. Each action taken within the stream is fed into a structured database that complies with an archival impulse to fulfill the potential of real-time stream drives (Gehl, 2011: 6) In this reciprocal mechanism, the stream recedes back into a retrievable, structured database that is then (or most often) used to restructure distinct individual streams for specific users according to their historic actions/data (Weltevrede et al, 2014: 6), and aggregate temporal multiplicities from many people, places, and times.

This new condition is enabled by an infrastructural stability of information atomization, fragmentation, and presentation within uniform real-time streams. The organization of streams as nodes of "international styles" (visual, textual, etc.) forces each individual information unit to look, act and speak the same way and supports a relationality that enables the conjoining of different indexical data sets that are diverse in *variety*, *exhaustive* in scope, and fine-grained in *resolution* (Kitchin, 2014). This process permeates the global and the local, the technical and the social,[2] and enables us to move from individual knowledge units to their juxtaposition with countless other near-simultaneous data units, and then move back to graspable forms of knowledge by locating connections and relations, only now on a larger scale and in a broader sense.

How does this work in relation to social media images? The transformation of images within the stream into a retrievable structure is enabled by manual and automatic procedures that "fragment" or "atomize" individual images into small informational units and present them in collections with all other images that share informational proximity in a database. The first, most common, and primarily manual visual classifying systems were based on information annotation using keywords. This type of manual indexing is known as "tagging," and the index terms or keywords are referred to as "tags" (Avery, 2007). The basic principle is that users of social media services do "subject indexing", and the assigned tags are shown immediately on the Web along with the posted image. In some cases, content annotation is performed by outsourced labor using services such as Mechanical Turk (2005), Crowd Flower (2014), etc. In these instances, social media platforms outsource micro tasks such as tagging photos, filtering abusive content, or judging the news relevance of content items (Twitter engineering blog, 2013).

[2] This description follows Star and Ruhleder's classic definition of infrastructure (1996: 114).

The second automatic organization of visual materials in social media platforms is based on "external" annotation of images with metadata (such as location coordinates, a time stamp, a user name, etc.), and on "internal" analysis of visual content. While the former dominates current social media data organization, recent developments in artificial intelligence and computer vision analysis use potential classification systems based on visual content (Impala, 2013; IQ Engines, 2012; Pixlogic, 2012; TinEye, 2014, GoogleGoggles, 2014; Jetpack, 2014; Camfind, 2013). Aiming to transform the way in which people search and browse their and others' photos, these systems automatically analyze and recognize searchable visual contents such as objects, text, or faces, and automatically add searchable tags to images and videos where those items are "seen" by the software (Figure 2).[3]

[3] For example, Flickr and Pinterest recently incorporated visual search mechanisms that automatically recognize visual content in images and enable to search their database by image themes and concepts, or recognize particular items (i.e. the shape of clothing) and show similar items the viewer might be interested in (Constine, 2014; Panzarino, 2014). Moreover, in addition to simple and now most common face identification in digital cameras, face detection has found its way into most consumer-level photo organization packages, such as iPhoto, Picasa, and Windows Live Photo Gallery, Facebook, Instagram, Google+ etc. (Banerjee and Anderson, 2013). In Facebook, for example, faces are not just detected but also automatically tagged and matched as they are uploaded into the stream (Taigman, 2014).

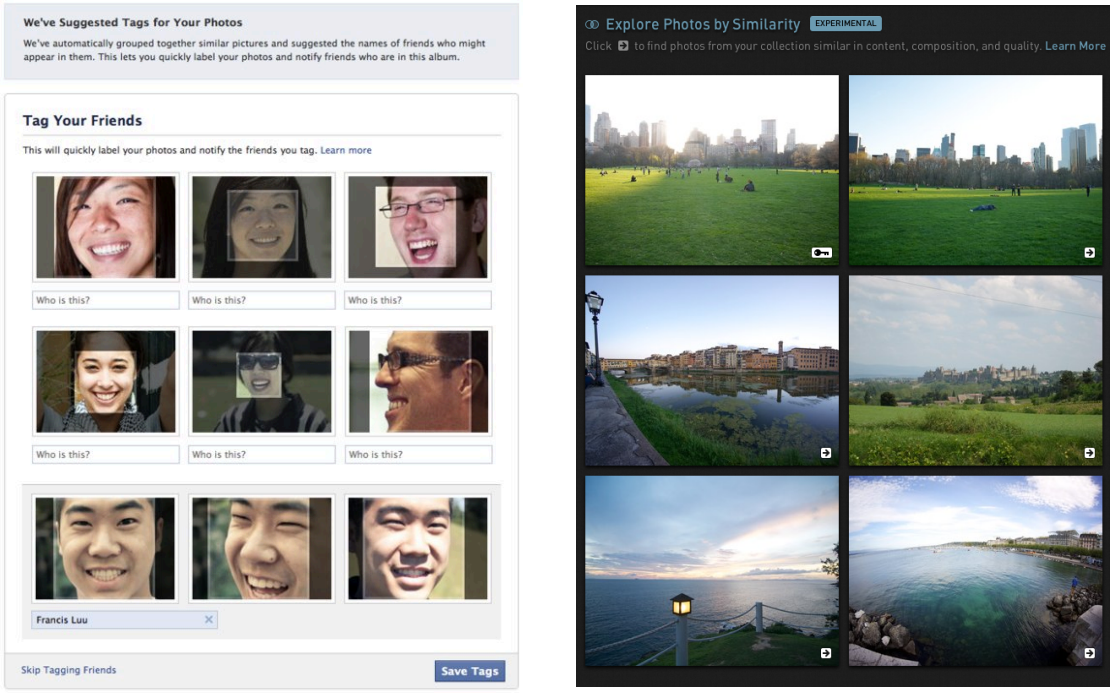


**Figure 2.** Left - Facebook's face detection system that automatically tags friends while posting photos to the stream. Right – A screenshot displaying grouped photos from a larger collection segmented by visual similarity (Everpix, 2013). Available at: http://www.everpix.com/ (accessed 2 October 2013).

These types of visual data management are becoming ever-more synchronous with the act of picture taking within and outside of the stream, and operate both on the level of individual's image collection and over collective datasets from many people. They offer to group small and large sets of images based on inherent content attributes and then divide these visual sets according to various categories.

The result of this twin data-control process (automatic and manual tagging of image segments and other information) re-conditions the terms under which text, images and numbers come together and opens up new relations between them. In these new relations, text, numbers and images are synchronously "born" and dissolved into one another without the precedence of one over the other (i.e. text does not come after the image as means to explicate what is in the

image but rather it is an inherent part of it). This recent transformation of visual, verbal and numerical identities does not reduce an image into language or a number, but rather dissolves their historical borders as fixed boundaries in order to form new relations of the visual to the outside world.

Let's look at a particular example of this process. The visual data stream consists of real-time documented events that appear to us right now, but it also includes photos that were taken hours, days, weeks and sometimes years before they were uploaded to the stream. When uploaded to the stream, these old photographic events are assigned with the elements of a new event and ascribed as a "new" here and now (as their time indication of when it was uploaded to the stream indicates its recentness). But these past events are commonly assigned by users with textual tags that indicate their "original" time (such as the common tags "tbt" which stands for "throw back Thursday", or "latergram"), and together with all other time indications within the stream (1 min ago, 2 weeks ago etc.) they make the gap between the past and the present obvious—and in this way they "thematize" the flow of time within the stream.

But there is more to these changing relations between images and their surrounding texts and numbers. Words and numbers are not meant to explicate an image (as an indexical sign) but rather to group it with all other images that share data similarity. What this atomization process facilitates is that images that once pointed towards themselves (i.e. our interest was first directed to what is going on inside the image and then towards the outside world—what was known as the symbolic aspect of images) now point directly outside, looking for connections, relations and patterns with other items in a collection. Put differently, the social media image directs our attention from the inside toward the outside: towards its potential positioning with all other images in the same "social (media) space and time"; towards its spatial boundaries (i.e. where

similar images with the same tag were taken around the world (See for example Figure 3) and its temporal boundaries, that is, when these images are taken around the world (See Hochman and Manovich, 2013).

**Figure 3.** Top: A visualization of 100,000 Instagram photos with the tag #selfie (yellow) and 100,000 photos withthe tag #me (blue) taken between November 3-9 2013; Green – overlap. Bottom: A close up.

We can articulate these relations in another way. If earlier visual forms such as a work of art, a film, etc. have been discussed and conceived as a representation of an "imagined world", and what was going on inside the image was interpreted as reflecting (or not) larger cultural patterns, for the social media image, these relations are turned once again on their head. The

"imagined" aspects of an image are no longer inherent to the individual pictorial surface and the construction of its various visual elements but rather it is constructed from the relations of these elements with countless other similar pictorial elements in other social media images. Everything that is outside of the image or actively "dissected" from the image (i.e. content units such as people, buildings, etc.) connects it to imagined data communities that only potentially and relationally exist. In other words, while what is going on inside the image shows us what the world *is right now* (derived from the immediate registration and the shared space of everyday life), everything that is going on outside that image considers the *what if or what might be,* or how we might think about what the world is through the lens of aggregated, simultaneous representations of particular data units. In short: the "real" is everything that is going on inside an image (images of particular subjects in the world), while the symbolic is everything that is outside of that image and connected to it via similar fragmented data units (Figure 4).

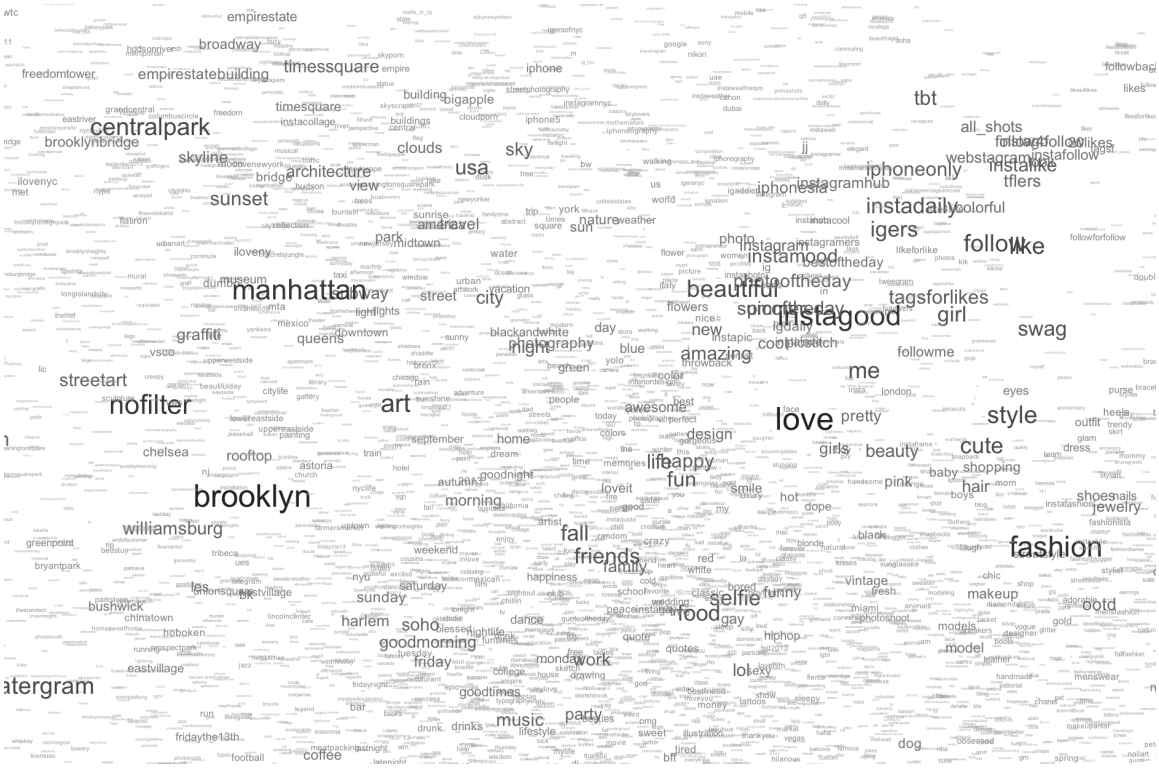


**Figure 4.** Moritz Stefaner (2013) Co-occurrence tags visualization in NYC. Closer tags are mentioned in images' descriptions more frequently than other tags.

In this way, if the computer—or the "meta-medium" (Kay, 1977)—felicitated the conditions for the rise of "meta-media"—software tools that allow the user to manipulate and change the original structure of a media object (Manovich, 2005)—the rise of visual social media platforms facilitated the conditions for the rise of what we can call the "meta-image": a visual media interface that offers both the original object (i.e. image; video) and software tools that allow users to manipulate and change this object, add descriptions, and also share, organize and store the image in distinct ways. In turn, each of these image's textual and numerical descriptions (filters, tags, location) becomes the "DNA" of an image, or its unique "signature", and is then used as metadata to group this image with countless other images that share similar data units.

As such, the social media image is a meta-image since it is always an image about and within larger groups of images, associated to them by shared identical data units (such as location, time, filter, tags, content, etc).

Due to this process of continuous fragmentation—derived from the need to "control" and order massive amounts of visual materials—the social media image is emerging as a significant cultural form not only in terms of the structure of an individual image within a media interface, but also in terms of its organization within complete image collections. It is this type of collective image organization that opens new creative possibilities to organize, present and interface large visual data within and outside of the stream, and it is the ways in which these images are grouped, when, and why, that determine the significance of their organization and the meaning of each image in relation to all other images in that group.[4]

## 2.4 HORIZON OF TEMPORALITIES

Within the social media domain, recent "collective" organizational forms of social media data act as aggregators which collect data streams from existing social information sources through API calls and act as "live stream readers" that pull together data from various social networks and known as "social network aggregators" (Wikipedia, 2014), or as "analytics dashboards" that provide a synthesized and often algorithmically summarized views of data streams to extract meaningful insights known as "social media control center" (HootSuite, 2013). In regard to the

[4] This organizing principle of images as a 'group' is a specific choice, but one of many. Other perspectives could equally highlight, for example, the potential within big datasets to trace the circulation of a single image across collections, platforms, time and space.

visual stream, the former currently includes applications that offer, for example, to follow all social media data images that are produced in a confined area in real time (see for example: geofeedia, 2014; coeverywhere, 2013; getnowapp, 2013), while the latter offers to automatically recreate live events and summarize insights about them by crawling the web for relevant photos, videos, and first person accounts (Seen, 2014) or detect live events in the city according to social media data (images and texts) that are produced within it (CityBeat, 2014).

What is unique about these visual aggregators is that they replicate the individual experience of viewing a near-simultaneous personalized visual stream consisting of only people you follow, and turn it into a summarized view of recent social media chronologies produced by all other "worldviews" that are shared within the stream in confined areas, particular places or specified events. In other words, if the individual stream is a "curated" presentation of only people we follow and with whom we choose to synchronize ourselves, or of performances of time we want to compare ourselves against, the aggregated stream acts in an opposite way: it allows us to bring all other people from a particular location into our own flow of time.

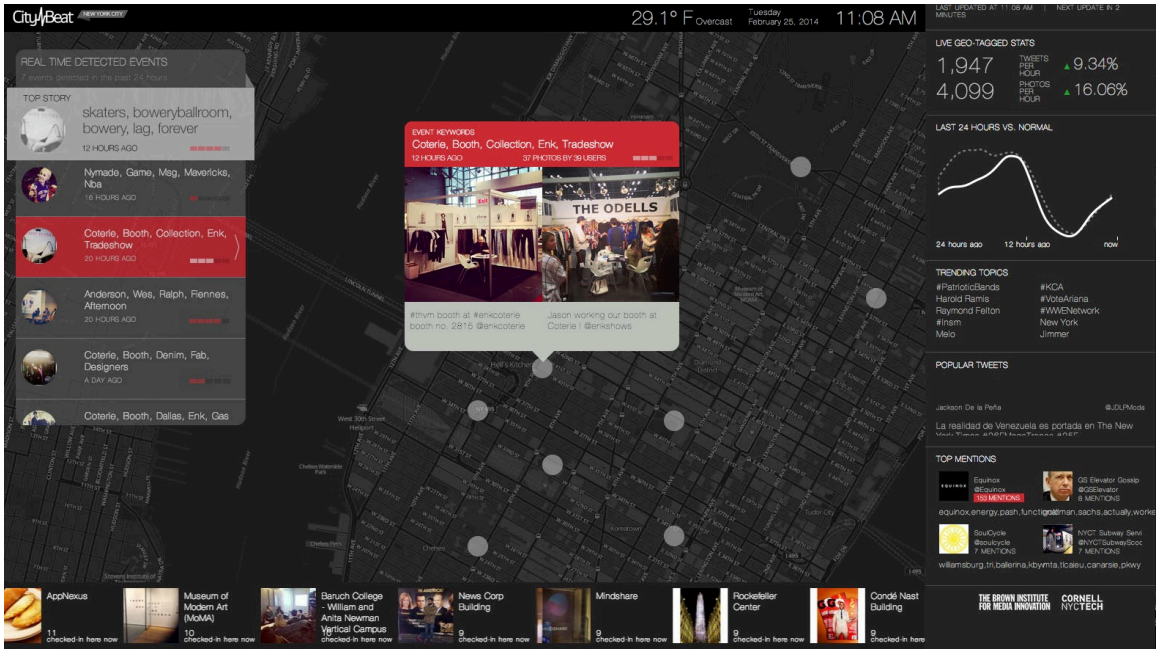


**Figure 5.** A screenshot from CityBeat (2014), a real-time event-detection system utilizing multiple feeds of geo-tagged social media data.

The CityBeat aggregation system is particularly interesting case in point (Figure 5). The system segments the city into a grid of small squares (1500x1500 feet) and measures real-time social media production rates within each square (Xia et al., 2014). In this way, each square acquires a "temporality rate" according to the number of images and other social media data produced within it at different times of the day and over long durations in order to detect abnormalities in an area (the system measures higher or lower production rates compared to average rates at different times of the day over time). The result is a presentation of simultaneous "abnormal temporalities" or "events" in the city that allows you to zoom in and examine the particular social media manifestations that report various visual and textual aspects of what is going on in this area in real-time.

Since what we see are multiple representations of data abnormalities in the city, the system activates the present as an organizing principle of the past (every image posted in an area

is measured to all other past images posted in this area), and this present is also a measuring tool that prefigures near future images from the same area. Put differently, and more in line with our former discussion, the linear structure and presentation of the aggregated stream is unique since it systematically both synchronizes all present temporal passings in a confined place, and also reactivates recent historicities in that place that are derived from the aggregation and synchronization of these temporalities over time. In other words, present simultaneous temporalities in a particular location are compared to all other past synchronous temporalities in this location, and are also compared to simultaneous temporalities in other locations in order to reveal historical relations between these temporalities.

In this way, these aggregators suggest an alternative regime of historicity that automatically generates simultaneous larger wholes while bringing the recent past into the present to prefigure the near future. The stream is thus a new temporal condition that shifts away from modern conceptualizations of time as a continuous unified sequence towards a "presentifying" aesthetics of multiple temporalities and their relations in time and space. What these aggregators do is to bring together diverse temporal segments of particular events or geographical areas into the recent present. They intensify the temporal experience of the present and blow it up into multiple scales (specific events, places or individuals, the entire city, the country or the earth), while segmenting it into what might be called a "horizon" of simultaneous temporalities.[5] It turns the older *spatial* organization of the horizon (think for example of an image where the sky meets the earth and construct a straight horizontal line) into a *temporalized*

[5] This follows Heidegger's understanding of time as "the horizon of the understanding of being in terms of temporality…" (Heidegger, 1996: 15).

one, which is now constructed from us viewing the co-linearity of a synchronized time that has now become times (Figure 6).

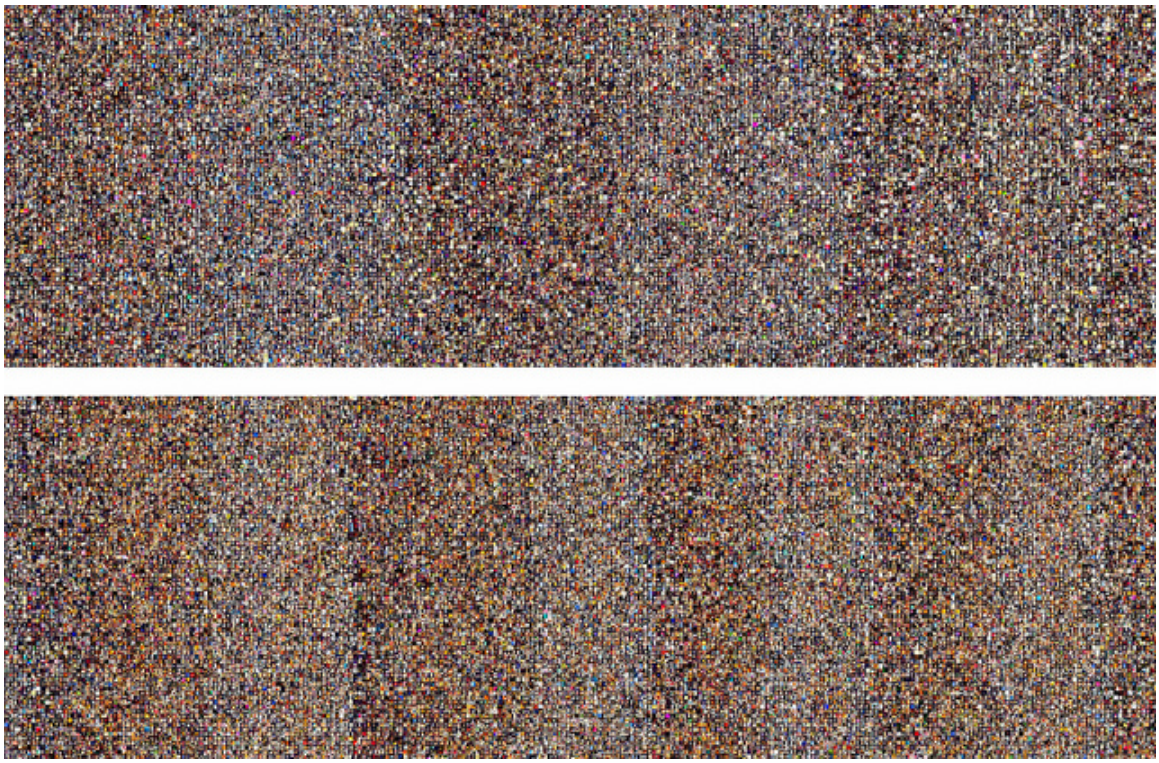

**Figure 6.** Montage visualizations comparing Instagram photos shared over four consecutive 24-hour periods in two cities. Top: 57,983 images from NYC. Bottom: 53,498 images from Tokyo. Photos are sorted by upload date and time (top to bottom, left to right). Available at: http://phototrails.net/visualizations/montage-visualizations/ (accessed 2 April 2014).

## 2.5 THIS IS NOW

This description of some aspects of the conditions of visual materials within the stream points towards the ways in which the social media image might offer new experiences, conceptions, and interactions in regard to contemporary visual productions. As I have shown, the structure of the

social media image shapes the questions that we can ask of it, and determines how it can be used to understand and view the world.

These new worldviews—constructed from particular visual arrangements and temporal principles—also have consequences for particular kinds of creative and poetic representational practices. In what follows, I discuss three such examples. Each in its own distinct way, the works *"Untitled" (Perfect Lovers)* by Felix Gonzalez-Torres (1991), *The Clock* by Christian Marclay (2011), and *Last Clock* by Jussi Ängeslevä and Ross Cooper (2003), poetically reflect on the experience and symbolic significances of our new "order of stream time." By doing so, the works illuminate some of the challenges, conditions and tensions between former visual structures and contemporary (emerging) ones, while drawing our attention to the material conditions of big visual data today and to the symbolic cultural significations emerging within it.

**Figure 7.** Felix Gonzalez-Torres (1991) "Untitle" (Perfect Lovers), Wall clocks, 13 1/2 x 27 x 1 1/4 in. Overall Two parts: 13 1/2 in. diameter each Edition of 3, 1 AP © The Felix Gonzalez-Torres Foundation. Courtesy of Andrea Rosen Gallery, New York

*"Untitled" (Perfect Lovers)* by Felix Gonzalez-Torres from 1991 consists of two identical clocks placed side by side, and presents analogous times. They are set to show exactly the same time, yet due to batteries running down at different rates in each of the two clocks they are slightly out of synch. It is a juxtaposition of two perfectly aligned times that gradually run down and advance at differing rates; a metaphorical unfulfilled desire of two nearly identical and symmetrical beings to become one–and thus: "Perfect Lovers" (Figure 7).

The work is also a poetic manifestation of particular principles of contemporary temporal expressions. Coupled with the viewer's time, the experience of the work is one of a continuous comparison of three different times, a set of near-simultaneous temporal relations that will never be unified (the time of the viewer's clock is always before/after/at the same time with the other

two clocks). As I explained before, this is also the experience of the stream, which offers the resynchronization of temporalities that could never be completely synched.

However, the work tells us something more refined in relation to these new temporal conditions. The differences between the two clocks are shrink to their minimum, and the temporal gaps between them remain roughly the same as they keep presenting similar or close times. This is an acute observation if applied to the temporal mechanism of the stream. As real-time information units from many users, places, and times keep flowing into the stream, past events quickly disappear in favor of new events, and thus the presentation of information is always from the recent past, present or near future (i.e. 1 second ago, 10 minute ago, or 1 day ago, but usually not past that time span).

However metaphorical *"Untitled"* (*Perfect Lovers)* might be, its material structure forces the viewer to be *within* different times, and most importantly, in close proximity to these unique times. By so doing, the work prefigures a fundamental condition in the experience of our current "stream time," underscoring its structure as a continuous comparison of temporalities: *their distance from each other (and us) remains always roughly equal and close.* This temporal experience, as meticulously visualized by Gonzalez-Torres, is not about the passage of time as a succession of events laid out on a unified spatial sequence such as the timeline (a la Bergson), but one of being in relations to others who are always in a similar, short temporal distance from us.[6]

[6] Terry Smith (2013: 281) characterizes this as the "temporal paradox" of contemporary artistic compositions: "Past times or imagined futures are no longer events strung along history's chain or thread, but are actions that occurred, or might be imagined to have occurred, at a roughly equal temporal distance from us."

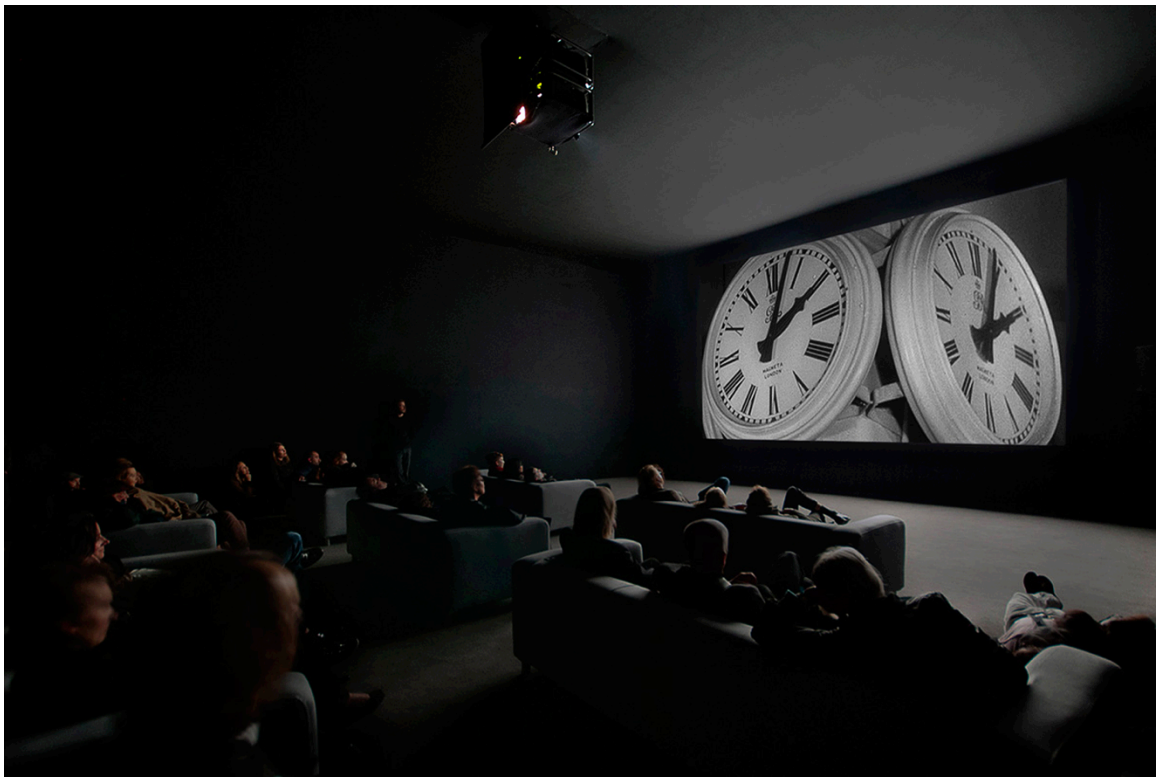

**Figure 8.** Christian Marclay (2010) The Clock, Single channel video. Duration: 24 hours. Photo: Ben Westoby. Courtesy White Cube

While *"Untitled" (Perfect Lovers)* is an early metaphorical articulation of core principles in the structure and experience of contemporary stream time, more recent works elaborate on the complexities of current time representations. Christian Marcaly's *The Clock* is a 24 hour video projection that assembles, samples, edits and remixes together thousands of short film clips–all feature clocks, watches or people announcing or referring to time. These short cinematic time indications are then organized chronologically to represent the progression of a full day, and synchronized with the actual time of the viewer. The result is a 24 hours timepiece, which meticulously ticks the time (minutes and sometime the seconds) of a full day, while confronting the viewer with short historical cinematic moments that are synchronized and timed with the outside world (Figure 8).

By creating "a sort of homemade Web engine" (Smith, 2011), a fabricated algorithmic aggregation system that seems to automatically search and cross-reference countless cinematic materials that refer to time in one way or another,[7] Marclay poetically signifies the problem of scale itself: it is not only about how to deal with the exponential growth of data, but rather how to generate a significant cultural object (be it a work of art, an historical account, cultural theory, etc.) based on this data. In fact, in the case of *The Clock*, the problem is how to say something about the changing nature of our current time, while the acute problem is that you have countless, different, expressions of this time; Or more precisely, how do we encapsulate the meaning of contemporary *time* on a planetary scale and in a planetary sense?

Marclay's solution here is to organize his large-scale dataset according to real-world time, to synchronize the screen time (the time presented in each clip) with the real time of the viewer. The result is a database of cinematic segments that are decontextualized, devoid of meaning, can be replaced by others, and are equal in their importance, relevance and contribution to the overall meaning of the collection. It is a continuous, artificially constructed, fragmented stream of time-stamped images (both with the original cinematic time and a real-world time indications); a fictional hybrid of historical cinematic moments that appear to us as if they are accruing right now.

Within these new temporal conditions, the experience of the work is of a continuous tension between the linear and the cyclical. The cyclical in the form of particular time indications

[7] Note that the potential for the work to always be different is not at the core of the actual experience of it in an art gallery. The specifications for showing the work are only in the sequence that Marclay selected and always in "real time." This potential is fulfilled in the work Whiteonwhite: algorithmicnoir by Eve Sussman and the Rufus Corporation (http://www.rufuscorporation.com/wowpr.htm), which assembles thousands of film clips, film scores and, and voice-overs in an ever-changing succession. The repetitive structure of *The Clock* is emphasized by Terry Smith (2013:265-281).

that repeat themselves potentially forever (the actual time of the viewer synchronized with screen time), and the linear, in the form of constantly disturbed autonomous film fragments (the construction of meaning by conventions of causality within the image or a sequence of images). In this way, the work overrides the symbolic nature of the original film clip, its distance and distinction from the world, in favor of a more direct association with larger networks of meaning that are happening to us right now.

What we get here is a mixture of old and new, a paradoxical timeline of negated times that, are, surprisingly, completely synchronized. This is not a traditional timeline as its historical axes are not parallel but conjoined to each other. Each image is not organized and perceived according to its original cinematic or creation time, but by multiple other real and potential times that operate within it. We can call it a relational timeline, a timeline that is interested not in the organization of information according to its substantial features (in terms of a fixed content, creation date, etc.) but rather in potential relations, connections and continuities among its countless fragments.[8] Very much like social media stream time, the work presents us with a timeline which forces you to be *within* time (the present time) but also inherently *against* it (as you're constantly occupied by the juxtaposition of different times together).

[8] I should mention in this context the earlier (2007) interactive work T_Visionarium co-directed by Dennis Del Favero, Jeffrey Shaw, Peter Weibel and Neil Brown. The installation allows viewers to explore and edit multiple temporal TV episodes simultaneously. See: http://en.wikipedia.org/wiki/T_Visionarium (Accessed 14 May 2014).

In light of my earlier discussion of current visual informational processes within the stream, it is useful to think about *The Clock* as an expression of the desire for a film to become a contemporary image. It articulates a tension between a cinematic modern linearity that is controlled by a singular worldview of a filmmaker to the arbitrary organization of many worldviews by constantly changing equally important data attributes. By so doing, it juxtaposes and confronts two inherently different pictorial logics and draws our attention to the material configurations and cultural significations of contemporary visual stream productions.

Similar informational and representational processes take place and are intensified in the work *The Last Clock* by Jussi Ängeslevä and Ross Cooper (the work was first released as an interactive installation in 2003, and was later adapted to mobile phones in 2011). While *The Clock* still carries the identification of a singular modernist artwork that remains the same every time you watch it, in *The Last Clock* the cinematic database is replaced or eliminated with a continuous stream of image-slices that are captured live by a mobile phone camera. Each of the clock's hands, as they rotate around, leaves a trace or a "slice" of what has been captured by the mobile camera phone. In this way, what seems at first as a traditional analog clock with second, minute, and hour hands showing the current time quickly transforms into a visual representation of the temporal nature or "rhythm" of individuals in a particular space. In other words, the software of *The Last Clock* captures "slices" of reality trough the mobile phone camera and stitches them together in such a way that every change in position, perspective, or environments of the camera phone directs *the shape of time*.

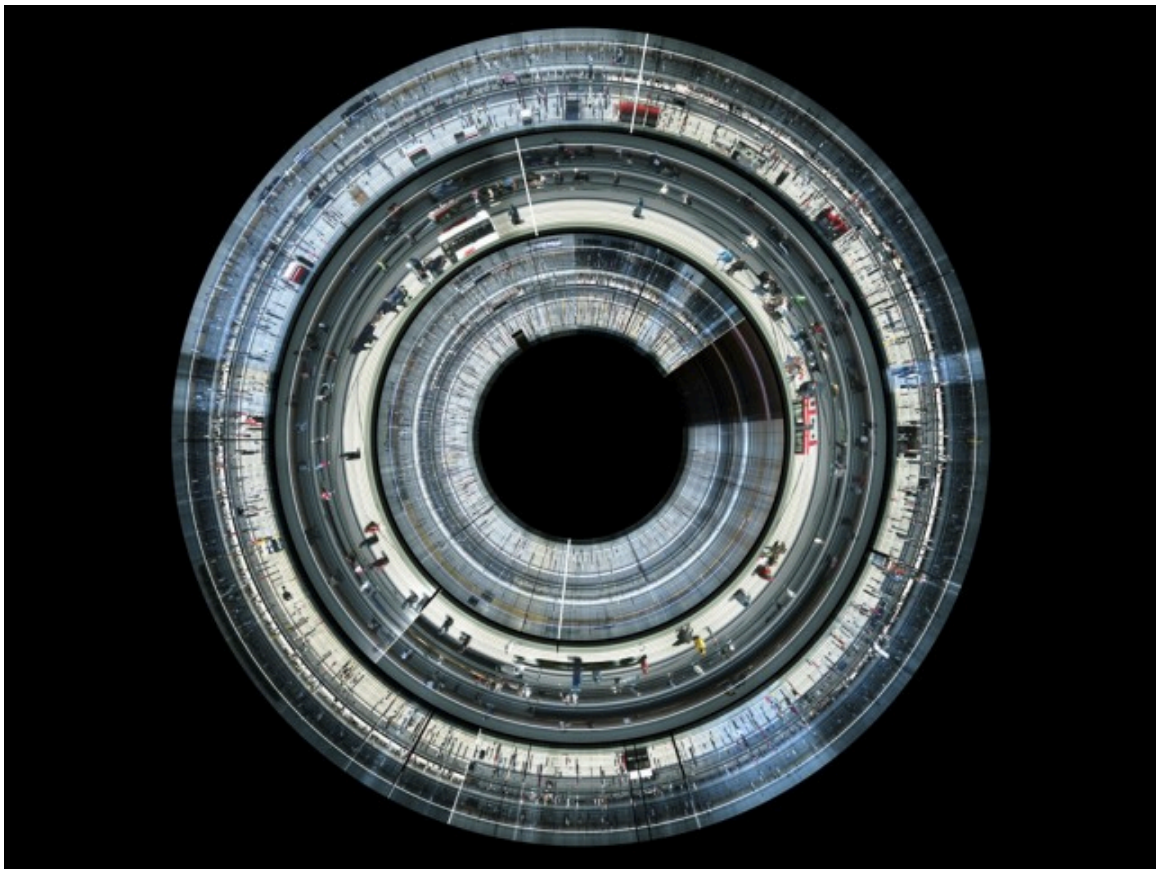

**Figure 9.** Jussi Ängeslevä and Ross Cooper (2003) The Last Clock. A screenshot of the work taken at 13:56:02 Kulturhuset, Stockholm, Sweden. Available at: http://www.lastclock.newmediology.org/ (accessed 2 April 2014).

Instead of a fixed representational "universal" time that is being determined a priori like in all other regular clocks, time here is "personalized" by capturing momentary slices of space and positioning them on the screen both *in* time and *as* time itself. The result is a monitoring clock that detects the changing nature of a space or movement in space, and forces an individual to understand herself as a point in that time and place. Like *The Clock*, the work connects a former representational time to an individual time. The result is a multi-scale representation of different scales of visual time (minute, hours or seconds) that moves from the universal, global time to the local, idiosyncratic time, while not reducing the latter in favor of the former.

As the hands of the clock rotate at different rates, displaying the last minute, hour, and 12 hours as its history, they continually overwrite the past with the present. While this speaks to stream mechanisms discussed before (such as the close distance between different temporalities that remains roughly equal and close), *The Last Clock* also elaborates on the question of the representational *pace of time*. Even though the same slice of the video feeds all three hands of the clock, the fact that the hands move at different rates means that each ring shows a different algorithmically constructed representation of the same time.

As opposed to *The Clock*, where the viewer was confronted with the multiplicity of temporalities at the same time, *The Last Clock* manipulates and juxtaposes the same *singular* temporality but places it within three different temporal rates. This points directly to the fabrication of stream time and its medium-specificity. A stream is not only the flow and convergence of the multiplicity of different yet close times, but it is also a manipulated representational mechanism of time determined by the mesh of algorithms, content and users actions. (Weltevrede et al, 2014: 18). In this new state of matter, an actionable, malleable, informational stream feeds an archival database that constantly constructs and reconstructs the form and pace of our own representational stream time.

## 2.6 CONCLUSION

In this chapter I addressed a key question of temporality that arises in the shift from database to data stream in relation to social media images. I analyzed the structure of social media images within the stream, charted some of the current ways these images are organized and categorized, and theorized the representational implications of these new structures for the ways in which we

might "know" and understand these images. Additionally, I showed how these visual arrangements and temporal principals facilitated by the stream are poetically manifested and explored in three artworks that position contemporary time as their main subject of inquiry.

Both the visual stream and our discussed artworks situate the contemporary (social media) image within a new order of time, and elaborate on the experience, meaning and analyses of this particular time. By emphasizing technical and poetic ways in which social media platforms and aggregators situate the present as a "thick" historical unit that embodies multiple and synchronous temporalities, I tried to illuminate some of the conditions, challenges, and tensions between former visual structures and current ones, and unfold the cultural significations of contemporary big visual data.

As opposed to prevalent conceptions of contemporary time as trapped within a paralyzing, presentism of simultaneous flows with no past or future (Castells; 2000; Hartog, 2003; Sterling, 2010), and in reaction to recent attempts to undermine the study of this eternal "plastic" present (Uprichard, 2012)—this chapter insists that this "now" is actually just one temporal aspect of many, facilitated by the stream. As such, my goal was to start pointing to the distinctive qualities in which the visual stream facilitates a complex multiplicity of ways of *being in real-time(s) today*. In particular, I tried to emphasize how crucial it is to be in stream time that promotes the awareness for the "presence" of other kinds of times, including, algorithmic times.

This is for me what is truly inscribed into recent notions of "velocity." It highlights the main challenge for research interested in the experience of big data streams presentism: recognizing, characterizing and analyzing the variety of presence(s) in each platform, for different groups of users, and for different geographies, and the ways in which these presence(s) are constructed by larger (cultural, social, political and technological) forces.

It is only in these circumstances—to bring us back to our original stating point of the image within a new regime of time—that we may say that image-taking is shifting from being "of the world" and is becoming "for the world."[9] The social media image thus demands that we trace, visualize and analyze its encounters, coherence and negation with other images across different times, following the circumstances that give shape to its existence and operation within particular stream time(s).

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The following chapter illustrates how this can be done in practice. I analyze the presentation of social media images in a particular social media platform, and examine some of the ways in which time is mediated through the interface of the application. I then use media visualizations techniques to explore spatio-temporal visual patterns across large sets of photos.

[9] A similar transition in regard to contemporary art productions is identified by Terry Smith (2011: 325).

# 3.0 IMAGINED DATA COMMUNITIES

## 3.1 INTRODUCTION

How are users' experiences of production, sharing, and interaction with the media they create mediated by the interfaces of particular social media platforms? How can we use computational analysis and visualizations of the content of visual social media (e.g., user photos, as opposed to uploaded dates, locations, tags and other metadata) to study social and cultural patterns? How can we visualize this media on multiple spatial and temporal scales?

This chapter examines these questions through the analysis of the popular mobile photo–sharing application Instagram, a social network that offers its users a way to upload photos, apply different manipulation tools ('filters') in order to transform the appearance of an image, and share them instantly with the user's friends (using Instagram's application or other social networking sites such as Facebook, Foursquare, Twitter, etc.)[10]. As of June 2013, only three years after its launch, the application already had over 130 million registered users who had shared nearly sixteen billion photos from all over the globe.[11]

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[10] Originally the application was only available for mobile phones. As of February 2013 Instagram added a Web interface to allow people explore photos using Web browsers. In addition, on June 2013, Instagram added a new feature that allows users to shoot and share 15-seconds videos.

[11] Official usage statistics around the world are not yet available. The most recent report mentions 130 million monthly active users, 16 billion shared photos, 40 million photos per day, 8500 likes per second, and 1000

In the first part of this chapter we analyze Instagram's core features and examine some of the ways in which users interact with the application. We then use "media visualization" techniques to explore visual patterns across large sets of Instagram photos (starting with 2,353,017 Instagram photos from 13 cities around the world, and then looking in more detail at 212,242 photos uploaded by users in Tel Aviv, Israel, over a three–month period). Next, we examine photos taken over two weeks during national events in this city, and finally focus on individual days during this period.

The goal of this exploration is to show how globally shared media and metadata can be used to study patterns on multiple scales. While many social media visualizations and computer science papers focus on large data sets aggregated in space and time (for instance, visualizations of movements of people in a city over a long period of time, or Twitter activity across the world [Fischer, 2010; Ernewein, 2013]), we suggest that social media can also be used for the reading of local social and cultural events. In other words, we do not necessarily have to aggregate user generated content and digital traces for the purpose of Durkheim–like mapping of society where individual people and their particular data trajectories and media diaries become invisible. The individual and the particular do not have to be sacrificed for the sake of data aggregation, or "large scale patterns." Instead, we can perform "thick visualization" (or, to use Todd Presner's phrase, "thick mapping"[12]) of the data, practicing "data ethnography", and follow individuals rather than only "society." To illustrate how this can be done in practice, we use a sample set of Instagram photos and their metadata uploaded by users in Tel Aviv during selected days corresponding to important national events. We visualize these photos in multiple ways, and

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comments per second. see: http://mashable.com/2013/06/20/instagram-130-million-users/; http://blog.instagram.com/post/44078783561/100-million; http://instagram.com/press/, accessed 21 June 2013.

[12] Presner, forthcoming.

demonstrate how such visualizations can lead to cultural, social, and political insights about particular local places during particular time periods.

Computer science researchers typically identify general patterns and regularities in the data, and work on models that fit this data. After the explosion of social media in 2004–2005, many researchers used this standard approach to study massive social data from Flickr, Twitter, YouTube, and other social networks (Zheng and Hong, 2012). On the other hand, digital humanities and digital history scholars so far only use computational and/or visualization techniques with sets of historical artifacts, and do not analyze contemporary social media.[13] In addition, current investigations of both historical collections and contemporary social media typically use standard information visualization techniques (i.e., bar graphs, scatter plots, timelines, network diagrams, etc.), which can only show patterns in metadata (such as image tags), and are not ideal for the exploration of visual characteristics of image sets and their content.

In contrast, this chapter explores a different approach that we think is appropriate for the humanistic analysis of user–generated content and data. We use high–resolution visualizations that show complete image sets to enable the exploration of both photos' metadata (upload dates, filters used, spatial coordinates), the patterns created by the content of their photographs, and the examination of individual photographs (see Figure 1 for an example of such visualization). We render these visualizations at the maximum size possible: 10,000 x 10,000 pixels, 20,000 x

[13] See for example: "Mapping the Republic of Letters, Stanford University," at http://shc.stanford.edu/collaborations/supported-projects/mapping-republic-letters; "Cultures of Knowledge," Oxford University, at http://www.history.ox.ac.uk/cofk/; "Mapping Gothic France," Columbia University, at http://mappinggothic.org/; "HyperCities," UCLA, at http://hypercities.com/, accessed 19 February 2013; Currid and Williams, 2010, pp. 423–451.

20,000 pixels, or even larger. High–resolution versions of most visualizations appearing in this chapter are available at www.phototrails.net.

Such visualizations fit well with our strategy which we call "multi–scale reading." They work equally well with massive sets of photos taken in different cities, all photos taken in a single city, or all photos shared by particular users. This ability to visualize photographic content at multiple scales allows us to start asking questions such as: How can we compare millions of photos taken in London, Bangkok and Tel Aviv in such a way that cultural differences between these cities can be revealed? Or, how can we visualize the "stories" made up by the individual users' sequences of photos? In other words, we can study both large scale patterns and the particular unique trajectories, without sacrificing one for another.

In summary, this chapter combines perspectives from social computing, digital humanities, and software studies in order to "read" and analyze visual social media data. Similar to researchers in the field of social computing, we study large sets of contemporary user generated social media, and use computational approaches in our analysis. We respond to the key question of digital humanities—how to combine "distant reading" of patterns with "close reading" of particular artifacts—by proposing a multi–scale reading. To accomplish this in practice, we use special visualization techniques (radial image plot, and image montage), which show all images in a large set organized by metadata and/or visual properties. Finally, we follow software studies paradigm by looking very closely at the interfaces, tools and affordances of the software (in this case Instagram) that enable the practice of social media.

## 3.2 BACKGROUND

First launched in October 2010, Instagram did not seem to offer anything genuinely new compared to existing media sharing services that had similar features, such as image manipulation tools, location annotation of photos, and instant sharing. However, it is the congruent operation of these elements within a single mobile application and the presentation—*i.e.*, how the application allowed users to create, share, and organize information—that might provide a plausible explanation for Instagram's widespread adoption, and how it meshes with current cultural trends.

The most prominent element that underlies Instagram's structure is its reliance on geo–temporal tagging: the geographical and temporal identification of a media artifact.[14] This is, of course, a fixed definition, but its data presentation in a specific media environment is what gives it its cultural meanings and ramifications.

For instance, Instagram's interface suppresses temporal, vertical structures in favor of spatial connectivities. Although each image taken by the application is stamped with a specific time and place,[15] the photos are not organized according to the Gregorian calendar but rather by a dynamic time span. The time element is always user–centric and its measurement is relative between the present moment of launching the application and the original date of creation.

This means that although the specific time in which a photo was taken exists in the software's database, its timestamp is dynamic as each image shows a constantly changing representation of time. For example, if I currently see a photo that was taken by a friend "4 days

[14] http://en.wikipedia.org/wiki/Geotagging, accessed 2 November 2012.
[15] Notice that users can choose to disable their geo-tagging feature on their personal mobile devices.

ago", when I open the application tomorrow the time indication will be "5 days ago". In this way, the representation of time in relation to each image becomes elusive and remains in flux as time passes, changing from 53 seconds to 5 days, to 12 weeks, and one year ago.

While Instagram eliminates static timestamps, its interface strongly emphasizes physical place and users' locations. The application gives a user the option to publicly share a photo's location in two ways. Users can tag a photo to a specific venue, and then view all other photos that were taken and tagged there. If users do not choose to tag a photo to a venue, they can publically share their photos' location information on a personal "photo–map", displaying all photos on a zoomable world map (Figure 10).

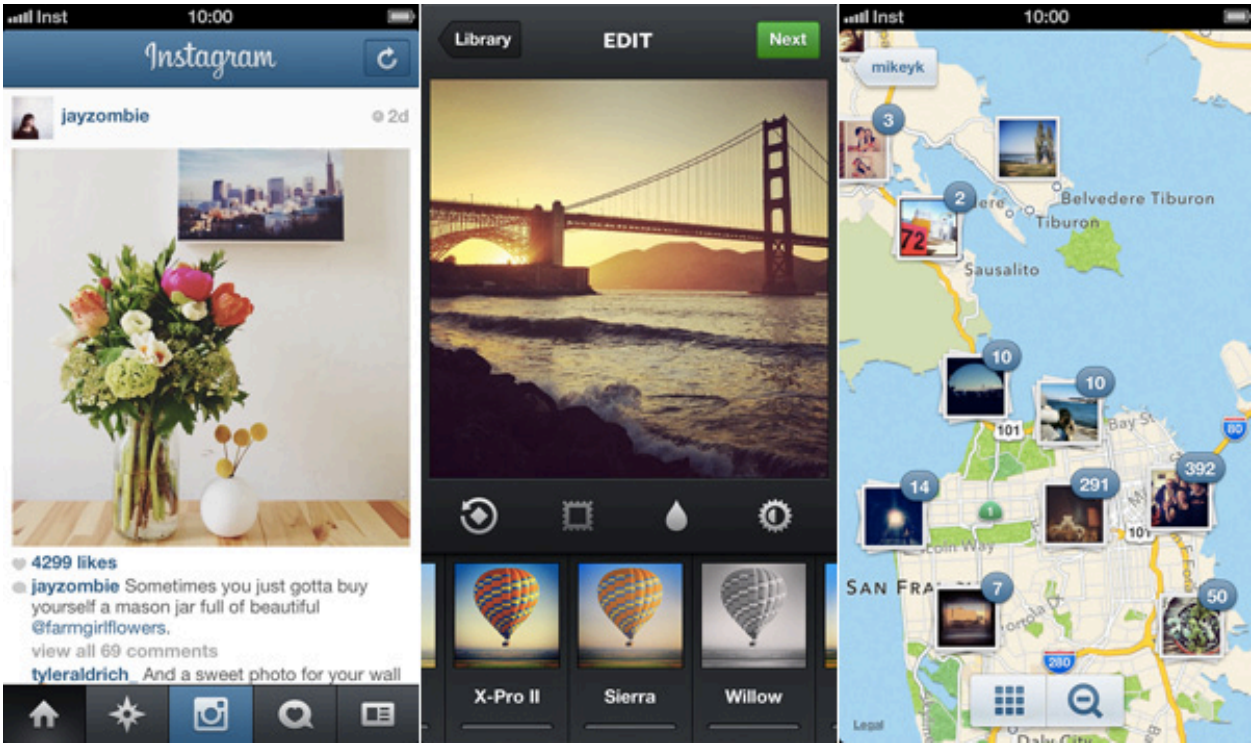


**Figure 10.** Left to right: Instagram's timeline, filters page, and photo map. Source: Instagram official screenshots, http://instagram.com/press/, accessed 5 June 2013.

This privileging of space over time is reinforced by the organization of photos within the application. The default presentation of images does not employ groups of documented events (or private albums), which may contain each user's photos and create a cohesive narrative. Instead, photographs are presented as a continuous stream of images from various users. Users perceive a montage of images taken by people they follow, thus eliminating notions of "traditional" time or event presentations and cataloging.[16]

This notion is strengthened once again when we consider Instagram's filter functions. While (or after) taking a photo, the application allows its users to apply different manipulation tools. By adding hues, grain, contrast, etc., each filter evokes a different "feel" changing the message communicated by an image. In this way, while taking a photo of a specific time and place, we apply a filter to it to suggest a different time or atmosphere (some of the filters are even named to suggest particular time, such as the filter called "1979").

The result is a multi–temporal image which suggests at least three different temporal references: the actual time when the picture was taken, the time evoked by a certain filter, and the time span indicated by the application when viewing the photo. Ironically, while a geo-temporal tagged image connotes the precision of time and space coordinates (we know the exact longitude/latitude coordinates together with the exact time it was taken) the software subverts this message by displaying multiple users' photostreams in a single feed, a relative time indication, and a distorted, filtered photographic image.[17]

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[16] Note that users can view their photos or isolate other users' photos by launching their private pages within the application. However, this is not the default way of viewing the application. Compare with Flickr, the largest image and video hosting website to date, where photos are organized in personal photostreams with clear time indications. See: Flickr at http://www.flickr.com, accessed 2 November 2012.

[17] Note that you can choose not to use a filter on an image by applying a filter titled "normal". In any case, the image still conforms to other manipulation tools such as size, lens etc.

As a result of this distorted structure and presentation of time within the application (there is no specific time or "history" for each image) what we get is a coexistence or contemporaneous state in which all photos occur to us at the same time, no matter how different they are, when or where they were taken. In a paradoxical way, the temporal image becomes atemporal.[18] And as images become "timeless" (or better, as explained in the previous chapter, time–thickened), we are all in the same time(s) together.

This sense of atemporality is established not only by Instagram's filters or time presentation, but also by its instant photo sharing function. What underlies this structure is an emerging operative cultural logic in which an individual photo is being related to a whole that potentially promises any image from any vantage point. If we follow a similar logic we can think of Instagram's users' extensive documentation efforts as comparable to the planetary documentation endeavors, taken, for example, by Google Earth or Bing Maps.[19] This hypothesis might also partially explain Instagram's extensive filter usage. While Google Earth's documentation efforts are presented as objective and detached since the service uses satellite photography (or in the case of Google Street View, captured from specially equipped cars and stitched into continuous panoramas[20]), Instagram's photos resonate with more personal, "authentic" experiences that chronicle the world in a way that resists the time and place represented by larger impersonal corporate documentation efforts.

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[18] This aligns well with what several writers identified as the new state of 'atemporality.' See for example: Sterling, 2010.

[19] This cultural logic becomes even clearer if we consider other recent technological efforts that utilize a similar mechanism. Think for example of the Recapcha, an anti-spam technology in which users are required to decipher texts as part of a validation process and thus protect websites from automated programs written to generate spam. These texts are taken from digitized books and newspapers that optical character recognition (OCR) software has been unable to read. The deciphered results are then returned to the reCAPTCHA service, which sends them to the digitization projects. This new logic underlies various software that force users (even if not yet fully aware of) to actively participate and contribute to world knowledge. See: http://en.wikipedia.org/wiki/ReCAPTCHA, accessed 2 November 2012.

[20] http://en.wikipedia.org/wiki/Google_earth, accessed 2 November 2012.

These two inherently different pictorial logics can be related to an earlier similar development in visual culture: the development of Impressionism in the 1870s, shortly after the invention and spread of photography. As this historical relationship is usually described, Impressionist artists rejected the high "photographic" realism associated with the academic style, and the pursuit of visual details offered by dispassionate recordings of photographic plates. Impressionists were more concerned with the way in which the eye and intellect perceive the changing qualities of light, movements and objects. In a very similar way, Google Earth/Bing and Instagram's two very different pictorial logics confront us with two distinct ways of seeing: an objective, elevated and fixed form versus grassroots documentation efforts that present spontaneous and highly personal sentiments that inherently reject the technological pursuit of fine details and accuracy of a "mechanical" (now digital) eye.

These two "logics" have been recently merged in certain ways, as Google now enables users to add their own geospatial data to the default Google Earth representation, creating complex and media rich projects on top of existing geographical information. In this way, users can now negate or complement the maps of Google Earth rendered in General Perspective Projection by uploading new layers of geoinformation.[21] In its most recent development, Google Earth now includes publicly sourced aerial images from balloons and kites, a grassroots mapping project in which anyone with a digital camera can attach it to a balloon or a kite and capture images that are then stitched together into a geo-referenced image.[22]

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[21] http://en.wikipedia.org/wiki/Google_earth#Technical_specifications, accessed 2 November 2012.

[22] "Google Earth now includes publicly–sourced aerial images from balloons and kites," at http://www.theverge.com/2012/4/18/2957154/google-earth-balloon-kite-sourced-imagery, accessed 2 November 2012. Other software tools exhibit similar logic. An earlier prominent example is the service Mappr! (2005), a Web mashup service that combines a geographic map and photos from Flickr. See: Mappr! at http://stamen.com/projects/mappr, accessed 2 November 2012. For a more recent example, see also: Historypin at http://www.historypin.com/, accessed 2 November 2012.

The change in Google Earth's structure into a platform for users to build upon, to compete with, to complicate and elaborate on, presents us with images that seek to pin down current changes in time, place, media (how they were taken), and mood (why they were taken). This is also the operative logic of Instagram, encouraging people to understand themselves as time and place (due to the very nature of the geo-temporal image) while offering a profound immersion in planetary documentation mechanisms. However, despite these changes, Instagram experience remains fundamentally different from that of Google Earth/Bing Maps. In the latter, images, videos, and additional data layers are secondary to the primary representation: the zoomable maps, presented as objective data. In the former, the stream of photos taken by people from a human point of view and height remains primary, with the map showing photo location delegated to a secondary function.

## 3.3 FUNCTION WITHIN RELATION

Thus far we have been tracking an operative software logic in which an individual is always being related to a documentary whole (for example, the tags and hashtags of a particular user are related to the tags and hashtags by all other users; a user's photos are related to all other photos via a shared coordinate system). But while Instagram's primary goal is similar to larger organizational documentation efforts, its user interface also has a secondary goal: to represent our collective visual experience differently from the ways it was represented before. Instagram signifies a new desire to creatively place together *old and new—local and global—parts and wholes*—in various combinations. If this is indeed true, and Instagram's photo universe and its presentation addresses all these interests, how can we gain insights from the study of this large–

scale global cultural dataset? What are the ways in which Instagram photos operate in relation to each other, and how can we trace these connections, relations and functions on a global and local scale?

### 3.3.1 Data

Our work takes advantage of the particular characteristics of Instagram's software. Instagram automatically adds geospatial coordinates and time stamps to all photos taken within the application. All photos have the same square format and resolution (612 x 612 pixels). Users apply Instagram filters to large proportion of photos that give them an overall defined and standardized appearance (in our sample of 2.3 million photos, the proportions of filtered photos varied between 68 and 81 percent depending on the city).

Using Instagram's official API and the latitude and longitude data it provides, we crawled Instagram photos, and their metadata (user ID, location, comments, number of 'likes', date and timestamp, type of filter applied, and user–assigned tags) from 13 cities around the world. Table 1 shows the number of photos in our data set for each city, the number of unique users who uploaded these photos, and the dates for every city.

**Table 1.** The table shows information about the Instagram data set we collected. Columns (left to right): cities, number of collected photos, number of users, collection dates, number of users who shared more than 30 photos.

| City | Number of photos | Number of users | Dates | Users with > 30 photos |
|---|---|---|---|---|
| San Francisco | 344,070 | 49,129 | 7 Dec 2011 — 21 Apr 2012 | 4.3% |
| Tokyo | 298,484 | 38,704 | 11 Oct 2011 — 20 Jun 2012 | 4.7% |
| London | 236,262 | 33,837 | 23 Dec 2011 — 10 Apr 2012 | 4.1% |
| Moscow | 234,289 | 23,716 | 3 Feb 2012 — 14 Apr 2012 | 6.7% |
| Tel Aviv | 212,242 | 15,773 | 24 Jan 2012 — 26 Apr 2012 | 10.9% |
| New York | 245,248 | 40,673 | 28 Dec 2011 — 6 May 2012 | 2% |

| | | | | |
|---|---|---|---|---|
| Bangkok | 146,272 | 33,612 | 27 Feb 2012 — 12 Apr 2012 | 1.6% |
| Sydney | 136,057 | 20,414 | 27 Oct 2011 — 16 Apr 2012 | 3.7% |
| Istanbul | 134,338 | 13,903 | 26 Jan 2012 — 24 Apr 2012 | 6.8% |
| Singapore | 128,509 | 19,642 | 27 Feb 2012 — 18 Apr 2012 | 3.7% |
| Paris | 93,135 | 17,555 | 6 Jan 2012 — 16 Apr 2012 | 2.5% |
| Berlin | 78,979 | 9,736 | 12 Feb 2012 — 27 Apr 2012 | 5.3% |
| Rio | 64,952 | 11,361 | 27 Jan 2012 — 26 Apr 2012 | 3.1% |
| **Total** | 2,353,017 | 312,694 | | |

It is important to note that over the course of our data collection, Instagram's popularity increased, new features were added, and the perception of the service was also changing. For example, Facebook acquired Instagram in April 2012, and on April 12 Instagram for Android was released. During the same period competing and complementary media sharing services were also evolving. Therefore, some of our findings may refer only to a particular period in Instagram history exemplified by the sample we collected.

It should also be emphasized that in contrast to Web users, the people who were likely to use Instagram during the period of our data collection reflected a more limited demographic. According to a 2012 Pew Internet survey of users of popular social network services, 16 percent of women and 10 percent of men using the Internet were also using Instagram; among Internet users aged 18–29, 29 percent were using Instagram (Duggan and Brenner, 2013).[23] Thus, as a reflection of social reality or, more precisely, as a giant photograph of social reality, Instagram only captures the curated lives of some members of society and not others.

[23] Note that Pew Internet only surveyed users in the U.S., so we do not know exact proportions in other countries.

### 3.3.2 Related work

Social media is studied in many disciplines from many different perspectives. Since our study focuses on the analysis and visualization of large sets of Instagram photos and their geo-spatial and temporal metadata, two research areas are particularly relevant. The first area is computer science and the subfield of social computing, which explores the possibilities of algorithmic analysis of large sets of digital images created by users of popular social media services and companies such as Flickr, Picasa, Geograph or Google Street View. These studies examine text tags and geo–spatial visual data, and offer algorithms to carry out enhanced search or scene summarization in large visual corpora (Jaffe, et al., 2006; Simon, et al., 2007); trace behavioral patterns and spatial trajectories by mapping geo-tagged visual data (Crandall, et al., 2009; Kisilevich, et al., 2010; Kennedy and Naaman, 2008; Hays and Efros, 2008; Li,et al., 2009; Antoniou, et al., 2010; Li, et al., 2009; Vrotsou, et al., 2011); or estimate ecological phenomena using geo-temporal tagged photos (Haipeng, et al., 2012). Other studies examine the level of "attractiveness" of photos (San Pedro and Siersdorfer, 2009), or automatically locate distinctive visual elements for a certain geo-spatial area (Doersch, et al., 2012).

The second related research area (also in computer science/social computing) is analyses of spatial data in location-based applications, such as check-in data gathered from social networks such as Foursquare (for example see Cranshaw,et al., 2012). In this case, the bias which may result from the clustering of locations of Flickr photos around famous landmarks is resolved by the myriad of venues into which people check-in. Although these studies aim to depict the "true" dynamic of a city by tracing social and place proximities (where people check-in in defined areas), they typically ignore the temporal nature of the data (when people check-in). Existing studies that do take into account temporal variations of spatial situations do not consider

social media data (Andrienko, et al., 2012). Some relevant work on temporal aspects of social media data includes sentiment analysis of Twitter data (Dodds, et al., 2011; Leetaru, 2012), variations of keyword use on Twitter daily patterns across geographical locations (Naaman, et al., 2012), and extracting references to "real world" activities from text-based social media data (Grinberg, et al., 2013).

The extensive spatial coverage of Instagram's data, together with the availability of precise location and temporal information, enables us to combine these research strategies over three levels: spatial, temporal and visual. As opposed to a more standard approach in social networks research, we do not begin with predetermined problems that need to be solved or with desired applications, but rather perform an "open–ended" exploration on various levels, moving from a comparative examination of visual proximities between cities around the world to a detailed study of a specific city and its users during particular time periods. By applying a variety of visualization techniques (some developed specifically for this project), we show how the volume, spatial coordinates and visual features of Instagram photos over time can reveal local cultural and social patterns.

## 3.4 SOCIAL TIMESPACE

Existing representations of space using social media data emphasize the fact that space does not stand on its own as a fixed entity but rather that it is a social product, bound up with specific social realities. For example, a map that compares photos taken by tourists versus photos taken by residents visualizes individual movement around a city while illustrating different experiences of a place by various social groups (Fischer, 2010; see Figure 10). In another case, a map that

uses “check-in” data characterizes different areas in a city not according to municipal borders, but by a collection of individual activities and movements (Cranshaw, et al., 2012). In each of these cases, the representation of the data constructs an imaginary “social space” that is derived from the nature of the data and from the ways it is being processed and presented.

If, as previously suggested, Instagram indeed offers a particular social experience, how then does this experience construct a space? In other words, how can we grasp, visualize, and analyze the production of such a social space within the “Instagram medium” in ways that reveal its uniqueness as a cultural form?

On the one hand, we can follow Instagram’s “objective” or intended affordances and its emphasis on a sense of “presentness” in specific time and place (derived from the immediate registration and sharing options of everyday life moments). However, this presentness is complicated by the fact that Instagram photos are typically carefully curated and edited, sparsely uploaded, and are not always shared immediately (users often upload photos at a later date that were taken hours, days and sometimes even years earlier). Given these practices, can we consider individual momentary “presentness” and Instagram’s emphasis on the “now” as a key experience of this platform? And if so, how is this space different from existing social spaces offered by other forms of social media data (tweets, messages, check-ins, etc.)?

On the other hand, we can negate existing software affordances and re-introduce dimensions that are currently concealed from Instagram’s software interface. Continuing a line of thought we discussed earlier—the ways Instagram’s interface suppresses temporal, vertical structures in favor of spatial connectivities—we can bring back to forefront the temporal dimensions of our data. As opposed to maps that show social media activity aggregated over time, and in complete opposition to Instagram’s own interface, our visualizations take into

account not only the spatial aggregated forms of Instagram photos, but also their temporal organization.

Drawing on Henri Lefebvre's rhythm analysis and his temporal understanding of place and space, we introduce two types of time that exist within Instagram photos: cyclical time and linear time.[24] Cyclical time represents the diachronic order of multiple individual photographs, combined from accurate time stamps that indicate specific date and time of day of each photo. When visualized, cyclical time represents the historic process of collective social, visual production that potentially repeats itself infinitely. For example, in our temporal image montages (grids of photographs organized by their upload time) we can identify the "rhythm" of a collective social visual production (how many photos are taken in a specific time and place) and how this rhythm unfurls over time from day to night. We can then identify deviations in cyclical times, or compare different "visual rhythms" (Hochman and Schwartz, 2012) from different places (Figure 11).

[24] Lefebvre, 2004. See also Hägerstrand's earlier work on time–geography (1975) that emphasized the time component in geographical representations and aimed to frame space and time together, without prioritizing one over the other.

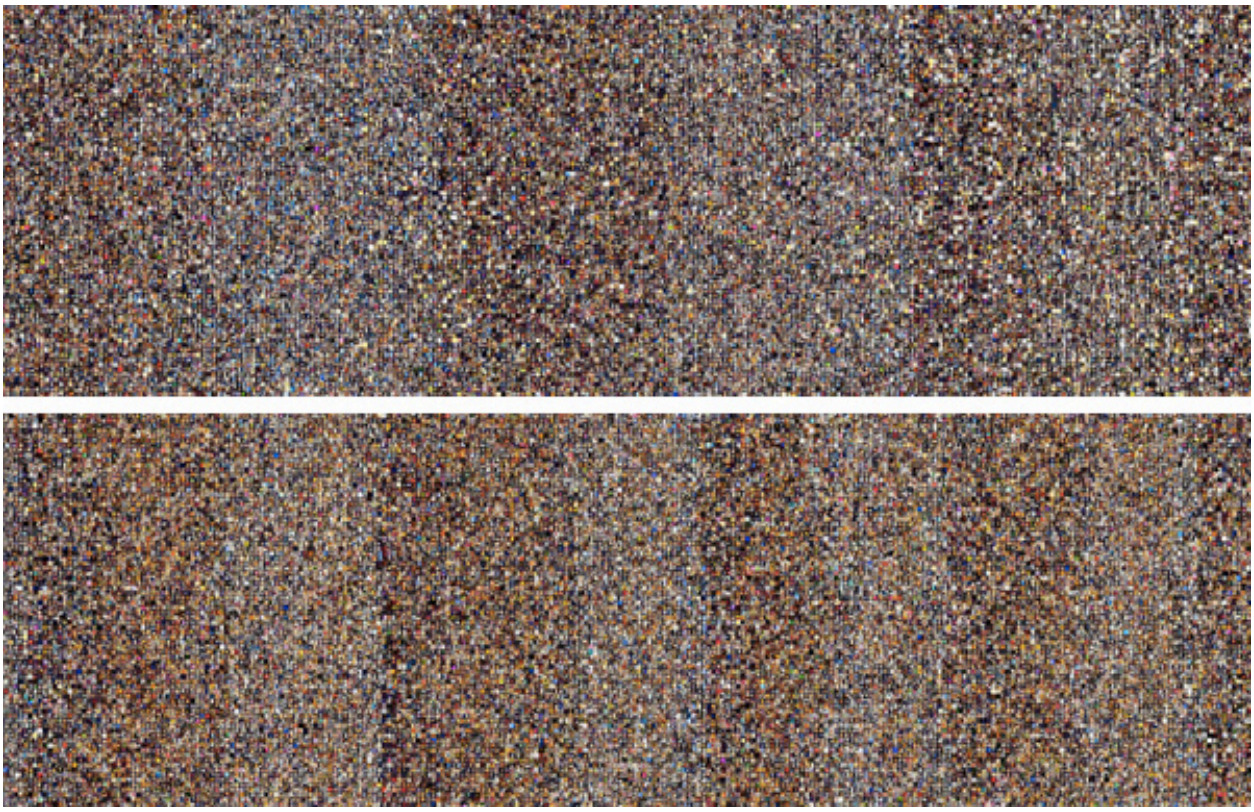


**Figure 11.** Montage visualizations comparing Instagram photos shared over four consecutive 24-hour periods in two cities. Top: 57,983 images from NYC. Bottom: 53,498 images from Tokyo. Photos are sorted by upload date and time (top to bottom, left to right). A higher resolution version of this figure is available at: http://phototrails.net/visualizations/montage-visualizations/.

Linear time, on the other hand, is the synchronic order of all images from a particular place and time organized according to multiple visual attributes. For example, an image montage may organize all images from a specific time and place according to average brightness or average hue of each photo, thus revealing a "signature" of dominant visual preferences that might indicate a shared experience by multiple users (Figure 12).

**Figure 12.** 4,000 random photo samples from Bangkok (top) and Berlin (bottom). In each montage, photos are sorted by average hue (left to right, top to bottom). A higher resolution version of this figure is available at: http://phototrails.net/visualizations/montage-visualizations/.

However, the meaning or function of such a space does not stem from the representation of each of these elements alone (the spatial organization, or the cyclical and linear times), and they cannot be examined separately.[25] It is only by the integration of the spatial, the cyclical, and the linear that we can actually measure the production and examine the function of a social

[25] Ibid., p.163.

timespace: the representation of space through social media data according to its spatial and temporal organization (see for example Figure 13). Social time and space—as the combination of the cyclical and the linear times in our visualizations—are not only relational (linear) but also historical (cyclical). Our visualized social timespace is thus a representation of an active web of affinities that is constantly shaped and reshaped by users.

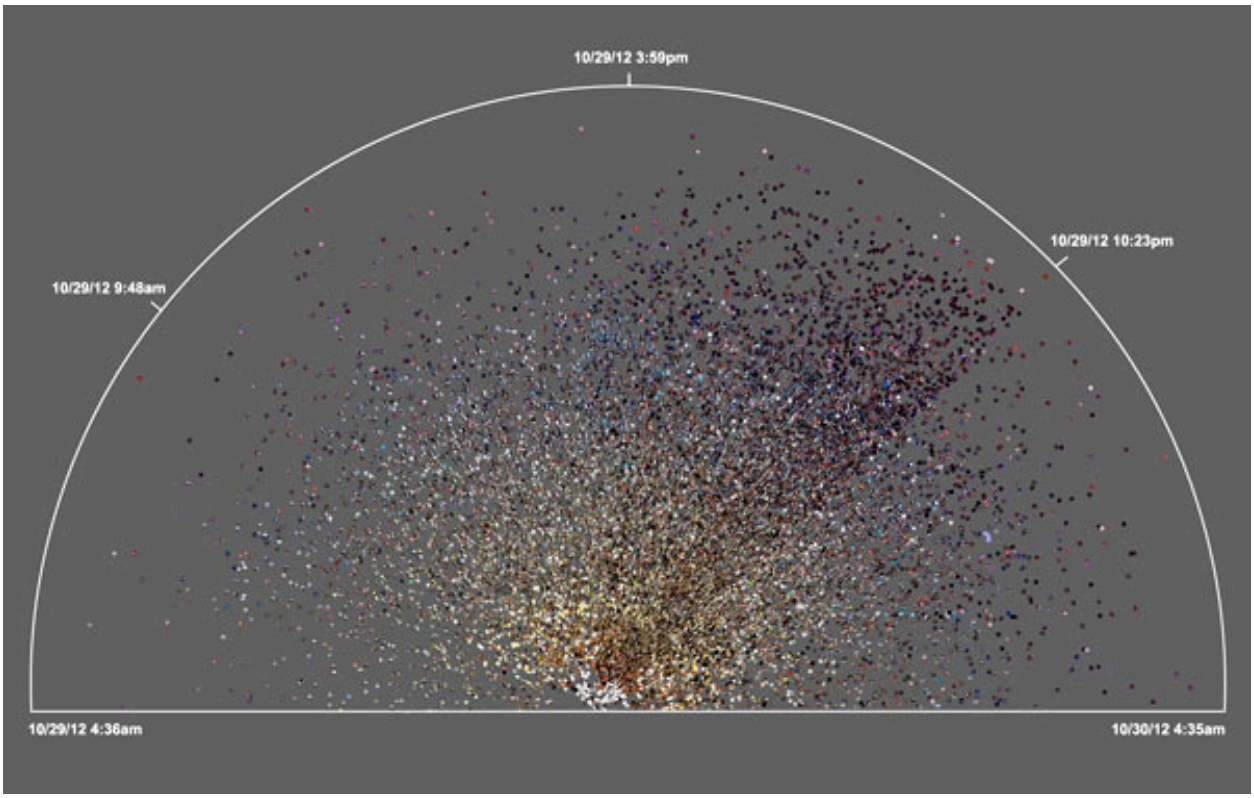



**Figure 13.** A radial plot visualization showing 23,581 photos uploaded to Instagram in Brooklyn area during Hurricane Sandy (29–30 November 2012). Photo's distance from the center (radius) corresponds to its mean hue; photo's angle (i.e. the position along the perimeter) corresponds to its time stamp. Note the demarcation line that reveals the moment of a power outage in the area and indicates the intensity of the shared experience (dramatic decrease in the number of photos, and their darker colors to the right of the line). A higher resolution version of this figure is available at: http://phototrails.net/radial_sandy_hue_created/.

Ironically, this representation—derived from the combination of the cyclical and the linear times—is not available in the application itself. Instagram's affordances blur specific time indications and enforce uniform appearances on its photos, thus creating a sense of atemporality and shared aesthetics. Our analysis shows how Instagram's interface superimposes its strong "message" (or "interface signature") on its users, shaping what and how they communicate. For example, Figure 14 compares filter use across six cities in our data set and shows how the proportions between photos with different filters are remarkably similar for all cities.

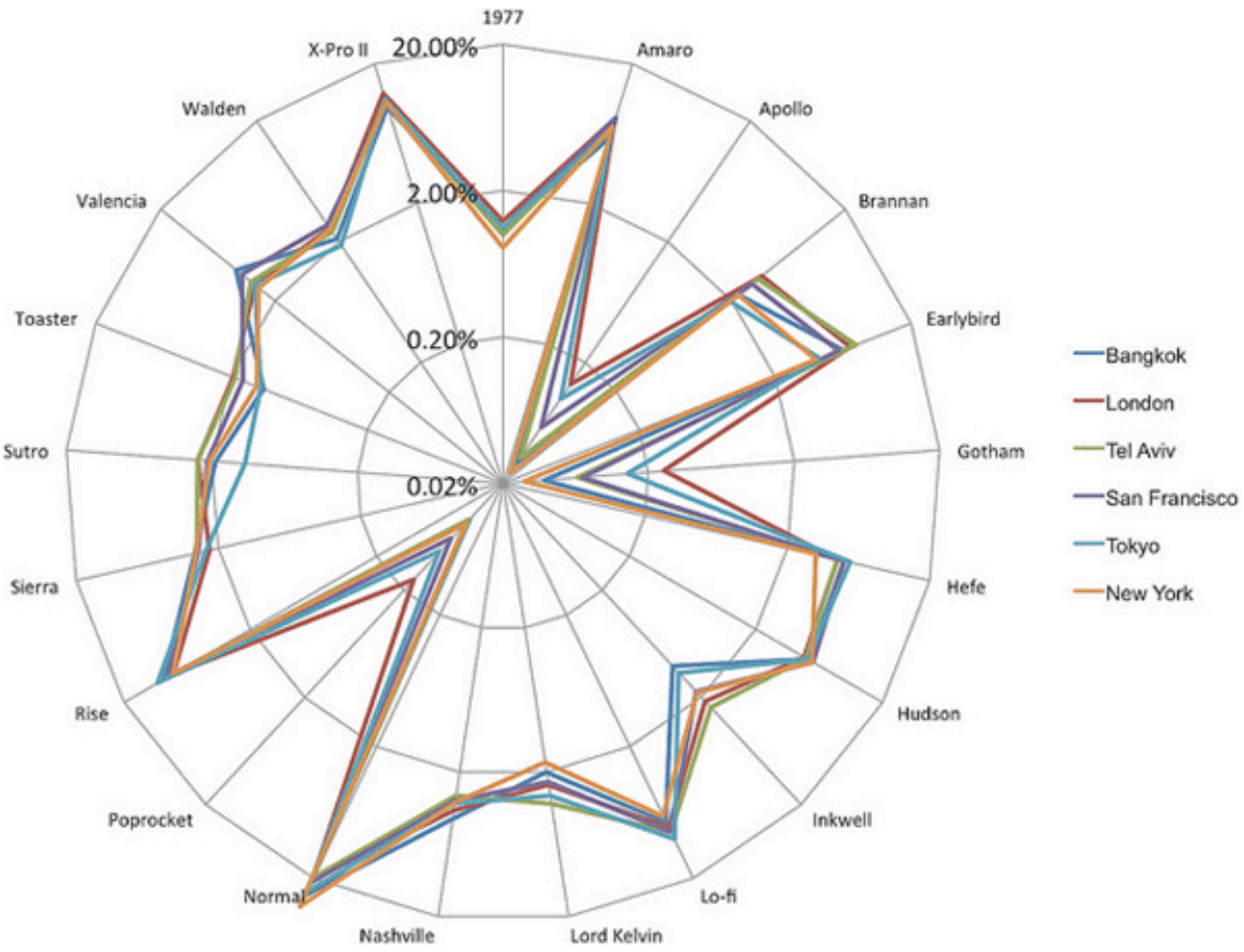



**Figure 14.** The use of Instagram filters in six cities. The filter names appear on the perimeter. Additional radial plot visualizations illustrating filter use are available at: http://phototrails.net/filterusage/.

However, when examined on a large scale we can see that social timespace is not universal. As opposed to Instagram's interface uniformity imposed on all application users in all places—in terms of time representation, photo dimensions, same set of filters etc.—we found small but systematic visual differences between photos shared on Instagram in different cities.[26]

To study differences between cities, we first selected random samples of 50,000 photos from our larger photo sets from various cities, and extracted a number of visual features from these photos.[27] The features include basic statistics (mean, median, standard deviation, histograms, etc.) for brightness, hue, and saturation, number of edges, contrast, and texture measurements. We created radial plot visualizations which show 50,0000 image samples from different cities organized by some of these features. For example, in Figure 15 we compare NYC and Bangkok images organized by brightness mean (radius) and hue mean (perimeter) as well as San Francisco and Tokyo images organized by hue median (radius) and brightness mean (perimeter).

[26] Note that this conclusion only holds for general visual characteristics of photos like brightness, hue, saturation and texture.

[27] In addition to studying the differences between Instagram cities using visual features of the photos, we also compared the metadata for these photos. This analysis also shows that each city has its own character. For example, the proportions of "active users" (people who shared more than 30 photos during the period for which we collected data) varies significantly between the cities (Table 1).

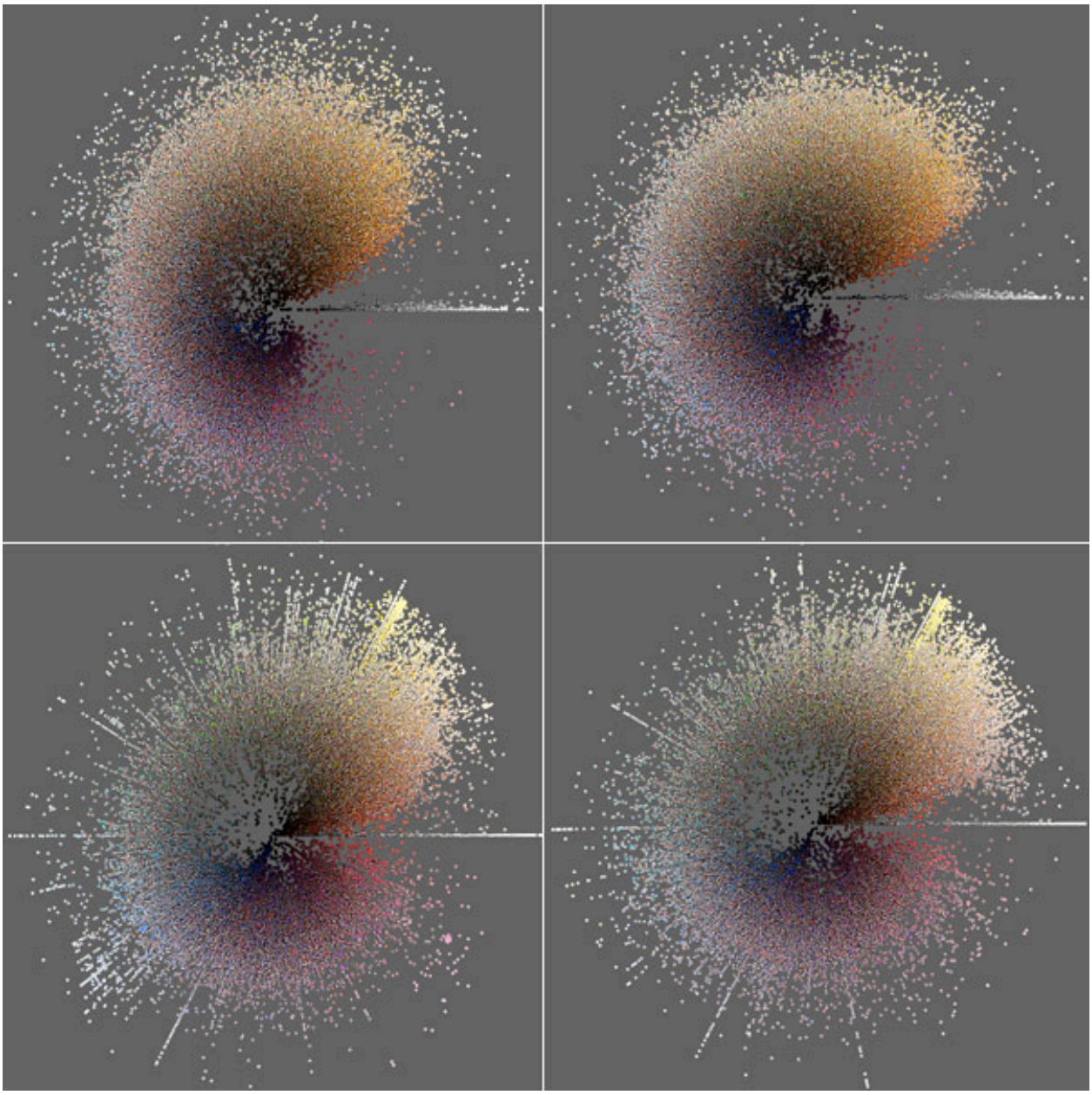


**Figure 15.** Radial plot visualizations of 50,0000 image samples organized by visual attributes. Top left: San Francisco—brightness mean (radius) and hue mean (perimeter). Top right: Tokyo—brightness mean (radius) and hue mean (perimeter). Bottom left: NYC—hue median (radius) and brightness mean (perimeter). Bottom right: Bangkok—hue median (radius) and brightness mean (perimeter). Higher resolution versions of these visualizations are available at: http://phototrails.net/instagram-cities/

Next, we selected random samples of 4,000 photos for each of the 13 cities in our data set, and similarly extracted a number of features for all photos in every city. Figure 16 shows the results of multidimensional scaling (MDS) with two different sets of these features. One set contains only nine color features; the other set adds brightness and texture measurements (16 features total). While the details differ depending on which features are used, the overall pattern is the same: Bangkok, Singapore and Tokyo are situated apart from other cities. Within the cluster formed by the remaining cities, each also occupies a different position.

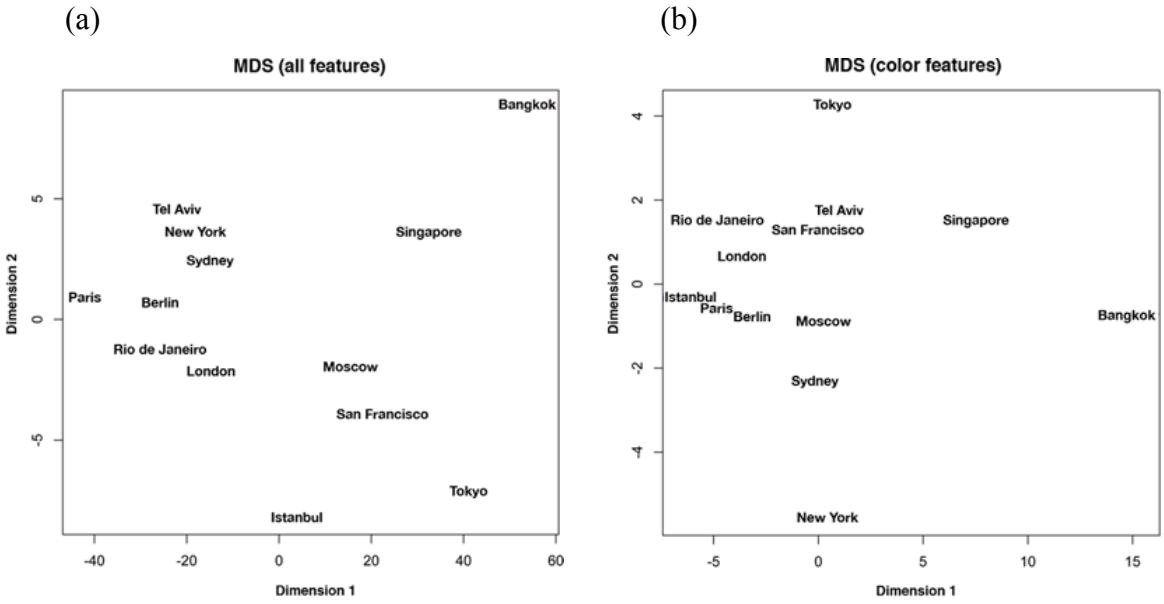



**Figure 16.** MDS (multidimensional scaling) using selected visual features for 4,000 random samples of Instagram photos from 13 cities. (a) MDS of 16 visual features including color; (b) MDS of nine color features only. Notice that while the results depend on the visual features being used in each case, in both cases we see the same pattern: Bangkok, Singapore and Tokyo are situated apart from the rest of the cities.

This analysis of visual features of large photo samples suggests that within Instagram's global shared photo universe, each city has a distinct "visual signature." Thus, if Instagram's

affordances indeed offer a new global style, its universality possesses distinctive characteristics in different social timespaces. As our visualizations illustrate, to various degrees of different visual measures, all of our cities exhibit at the same time local, regional and universal character.

These alternative strategies illustrate just some of the ways to compare "Instagram Cities." But how can we explore our data on a smaller scale, to better see the formation of social timespace and its multiple modalities (spatial, cyclical, linear, and temporal)? In other words, how can the active process of production of a social timespace be visualized and analyzed? This will be addressed in the next section.

## 3.5 DATA VISUALIZATION AND IMAGINARY COMMUNITIES

The recent proliferation of visualization techniques (which show locations, check-ins, routes, and other social media and physical information) aggregate large amounts of data into a single condensed representation of a city, country or the Earth (Figure 17). These condensed representations usually neglect the specificity of the particular images, check-ins, and other details; privileging instead an aggregation of countless other similar forms. Most often, they do not represent a whole that emerges in specific times, but rather a whole that exists *outside of time*—a representational form that tells us something about the nature of a place but which rarely has the power to explain the nature of the specific time when these aggregated actions occurred. Involuntarily, they construct "imaginary communities"—visions of the whole that do not actually exist.

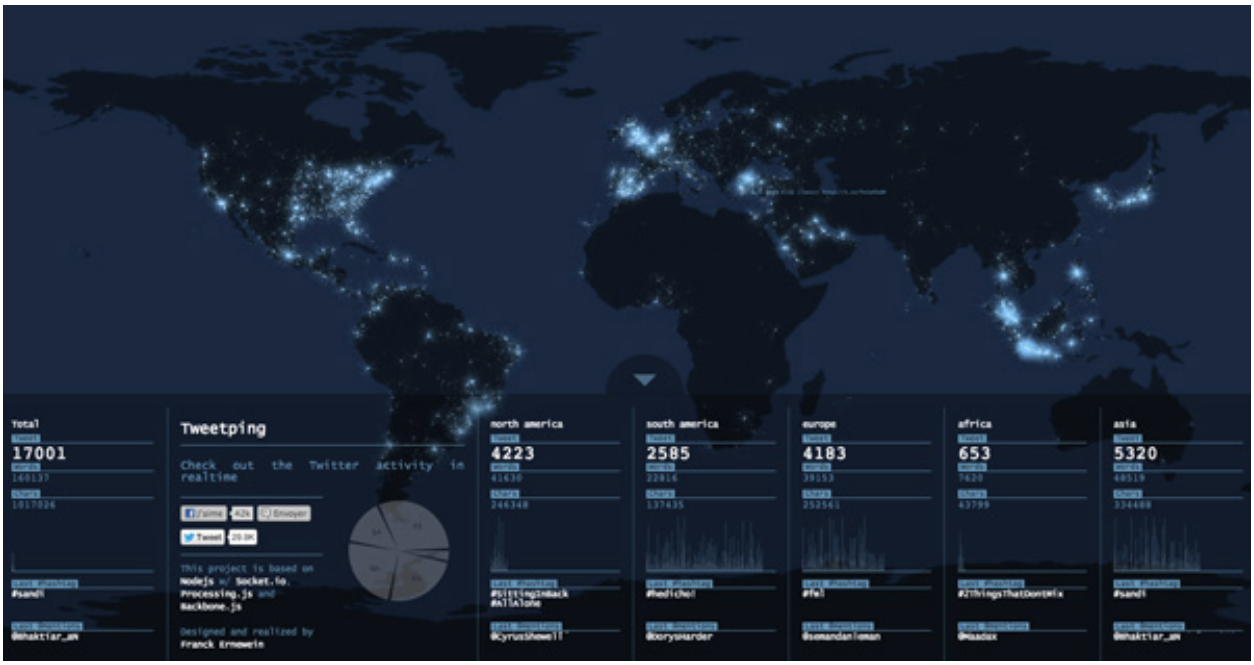



**Figure 17.** A screenshot from a real-time visualization by Franck Ernewein showing Twitter activity around the world. http://tweetping.net/, accessed 5 June 2013.

These imaginary communities do not trace or encapsulate real-life temporal changes. For instance, a visualization made up of routes of millions of people aggregated over months or years creates a convincing map of a city, with its major streets alight. But this "city" does not exist, because the individual traces that compose it do not temporally coexist. These traces do not correspond to any social reality actually experienced by people. As we move through a city, we do not see traces made by other people in earlier times, we do not even see our own trajectory, and others do not see our paths (Figure 18).

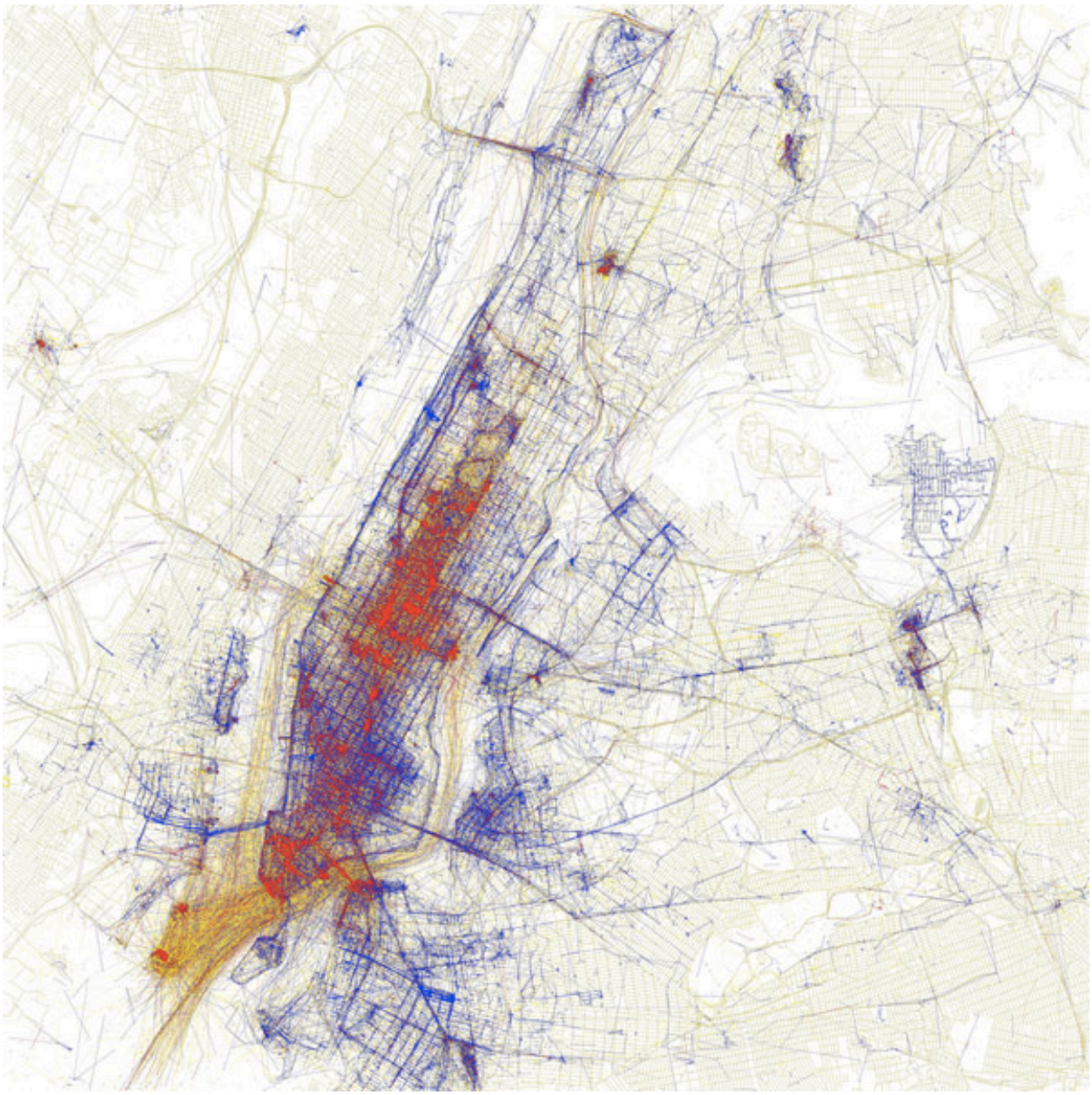


**Figure 18:** Eric Fischer (2010), "Locals and Tourists #2 (GTWA #1): New York." The visualization compares locations of photos uploaded to Flickr and Picasa. Blue pictures are by locals. Red pictures are by tourists. Yellow pictures might be by either.http://www.flickr.com/photos/walkingsf/4671594023/in/set-72157624209158632, accessed 5 June 2013.

Our visualizations, which display locations of Instagram photos taken by individuals over time, illustrate exactly that. When aggregated into a single visualization, an image of a city emerges (Figure 19). This image constructs an illusion of many people congregating in particular places at the same time (as captured by their Instagram actions), but in reality, most users have taken only a few photos over a specific time period and these are widely distributed in time and space. Even if we only look at several avid users, their time/space coordinates almost never intersect (Figure 20). How are we then to better trace, characterize and visualize the multitudes of users' trajectories and photos, each following its own pattern?

**Figure 19.** Locations of photos shared on Instagram in Tel Aviv over a three month period (24 January-26 April 2012). 212,242 photos were shared by 15,773 different users. The points are colored using a green to red gradient (green: morning, yellow: afternoon, red: evening). A higher resolution version of this figure is available at: http://phototrails.net/dots-visualization-by-hour/.

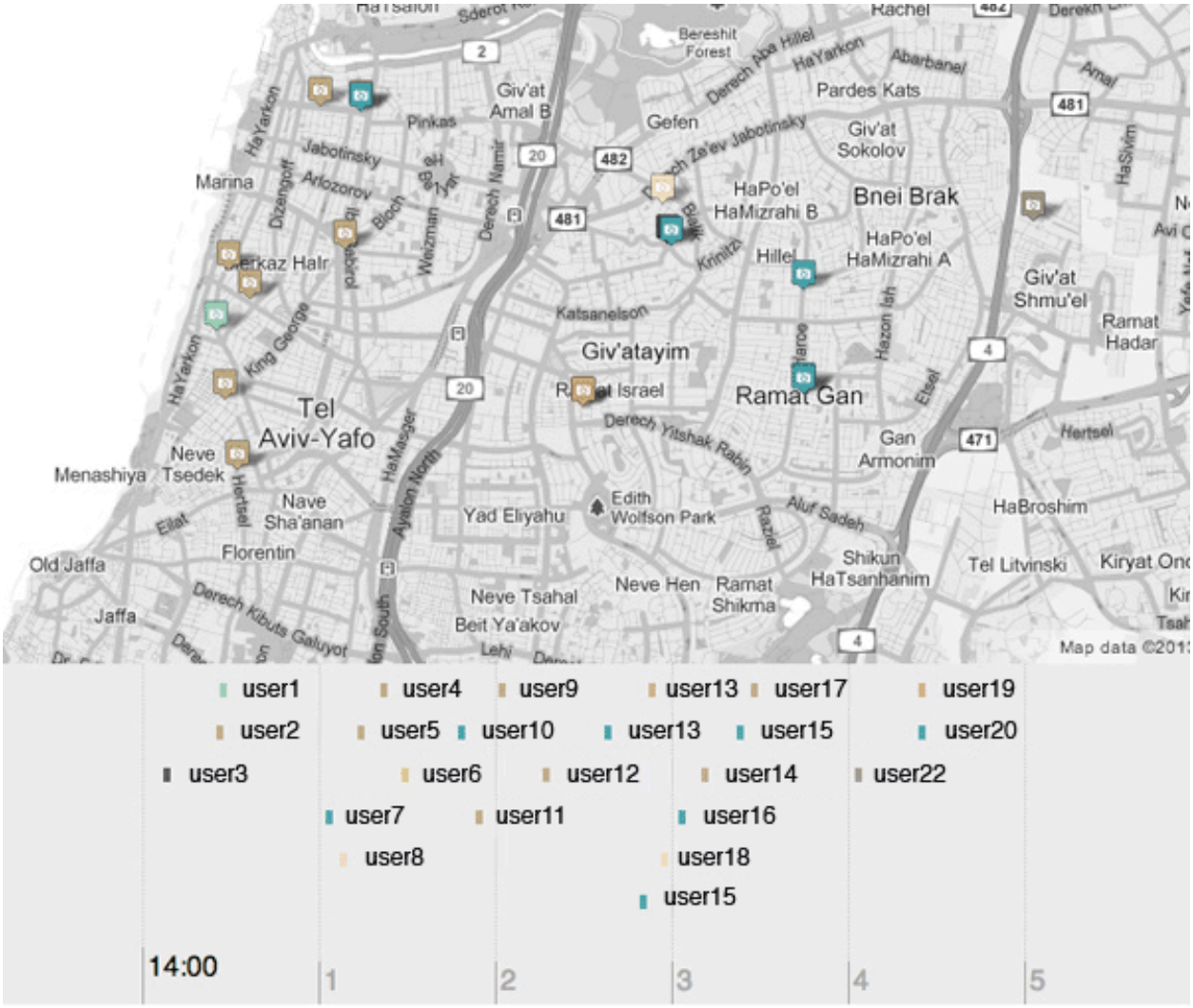



**Figure 20.** In order to examine space and time trajectories of most active Instagram users in Tel Aviv, we developed an interactive Web application. This application screenshot shows information about users and their shared photos during a 5 minute period. It illustrates that even the most active users rarely share photos at the same place at the same time.

### 3.5.1 Collective memory routines

A possible thread to follow is to look at exceptional times in specific places. We chose to examine, what are arguably, three of the most emotionally, culturally, and politically charged days in Israeli society, and the ways in which these days were experienced in Tel Aviv in 2012:

Holocaust and Heroism Remembrance Day (18–19 April 2012), Israeli Fallen Soldiers and Victims of Terrorism Remembrance Day (24–25 April), and Israeli Independence Day (25–26 April).

We start with a comparison of the two memorial days. On both days, most events begin at sunset and include numerous ceremonies on the national and regional levels, with countless services performed in schools, city centers, and cultural hubs. Both days include sirens that sound throughout the country for a few minutes at a time, with people standing still while remembering the dead (a two-minute siren during the Holocaust day on 10:00am, and two sirens during the Fallen Soldiers' Day, one at 8:00pm and the other one at 11:00am the next day).

The Israeli Memorial Day is significantly different than those in other countries such as Memorial Day in the U.S. For example, on Isreal's Memorial eve, places of public entertainment are legally closed. During these days, all cable channels go dark, Israeli television channels only air special documentaries about war victims and the fallen soldiers, and solemn songs are played on the radio (Figure 21).

What can we learn from Instagram's data about the structures of these emotionally charged days? Can we see differences in the ways these days are treated in contemporary Israeli society? What type of insights can we extract from the ways individual users choose to spend their remembrance days? Or in other words, what kind of stories do their "photo trails" tell us about the nature of these days and their cultural significance?

**Figure 21.** Israelis stand still during a two-minute siren for Soldiers Memorial Day. Source: Dan Bar Dov (2008), http://www.flickr.com/photos/danb2007/2472660237/, accessed 5 March 2013.

### 3.5.2 The Spread of Sorrow

Although both of these memorial days are of similar cultural magnitude and are accompanied by similar ceremonial routines, our results illustrate behavioral differences in the way Instagram users perceive and experience them. Interestingly, we did not find very significant differences between the Holocaust Memorial Day and other days during that week. As for the Fallen Soldiers Memorial Day, however, our data shows significant differences from regular daily patterns on every dimension: geospatial coverage (spatial distribution of the locations where

photos were taken), the volumes of photos being shared, and their content. Below we discuss our findings in more detail.

#### 3.5.2.1 Holocaust and Heroism Remembrance Day

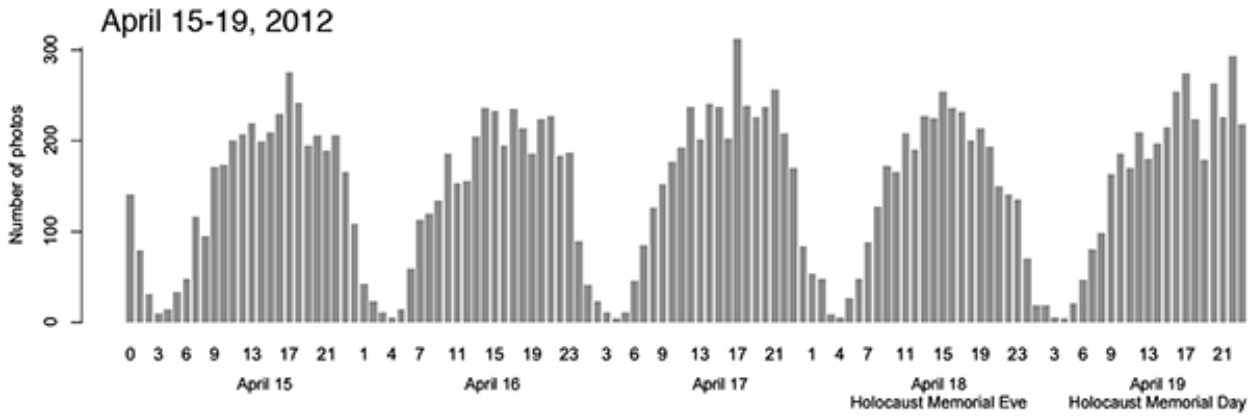
Given the historical and emotional significance of the national and private memorial routines observed during Holocaust Memorial Day eve (and the following day) all around the country, one might expect to see deviations in photo-taking habits compared with regular days. However, as our results show, Tel Aviv Instagram users remain indifferent overall and do not share a significantly different number of photos during Memorial Day than on any other day (Figure 22a).

Holocaust Memorial Day eve (18 April) was accompanied by a slight decline in the number of photos (25 percent less than the average amount of photos in the previous three evenings, between 8pm and midnight). This might be explained by the fact that many entertainment venues and businesses such as bars and restaurants are closed during the evening. During Holocaust Memorial Day (19 April), however, Instagram photo-sharing patterns remain similar to other days. We do note an unusual decline in the number of pictures around 18:00pm, as well as a peak around 22:00pm. These correspond to activities that mark the end of Memorial Day and the return to everyday routines (*i.e.*, going out, socializing, etc.) (see Figure 22c).

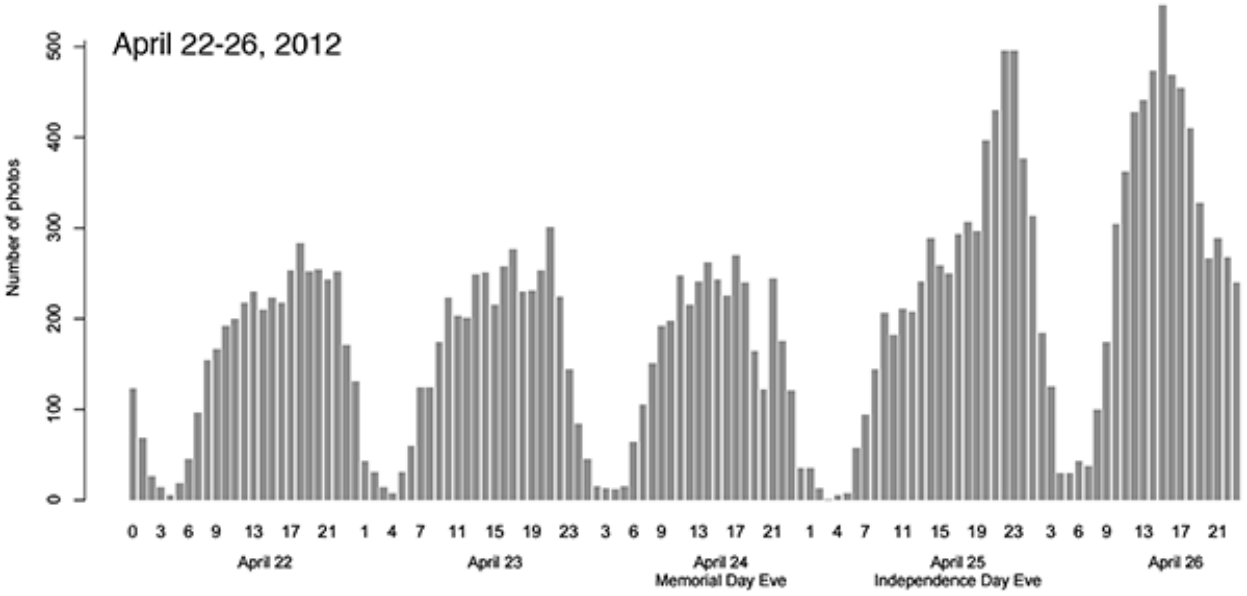
If we only compare Holocaust Memorial Day to other days of the week, the photo-taking volume on that day does not show notable differences. Thus, it appears at first glance that Instagram activity on that day does not reflect its national significance. However, when compared with the Israeli Fallen Soldiers Memorial Day, which takes place exactly a week after,

the difference in the socio-cultural significance of these two memorial days as well as the differences between them and other days become dramatically visible.

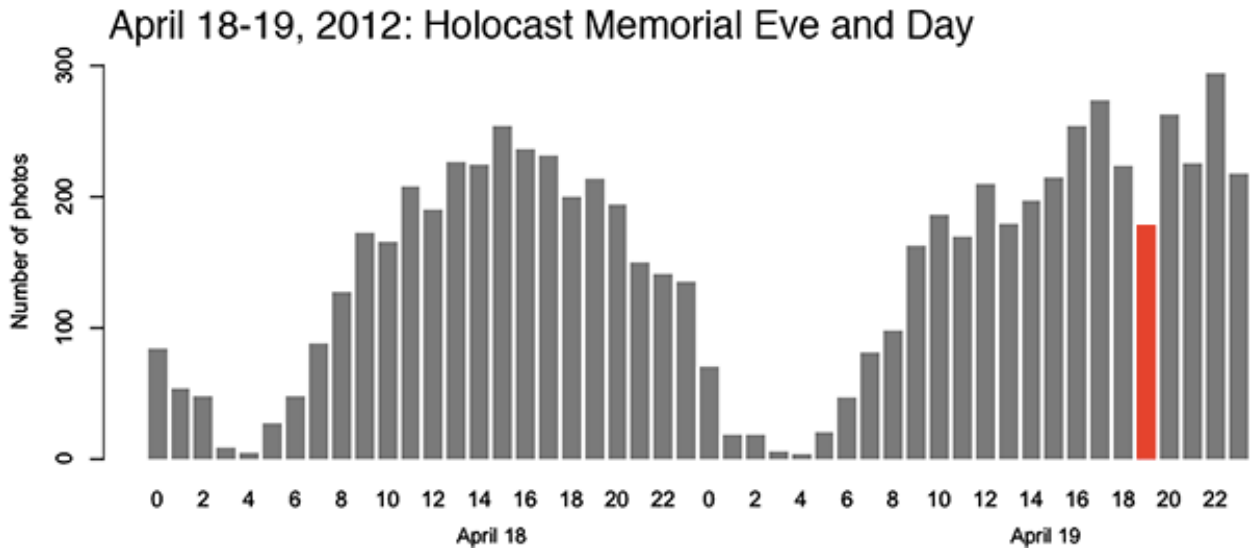
(a)




(b)



(c)


April 18-19, 2012: Holocast Memorial Eve and Day
Number of photos
0
100
200
300
0 2 4 6 8 10 12 14 16 18 20 22 0 2 4 6 8 10 12 14 16 18 20 22
April 18
April 19

(d)

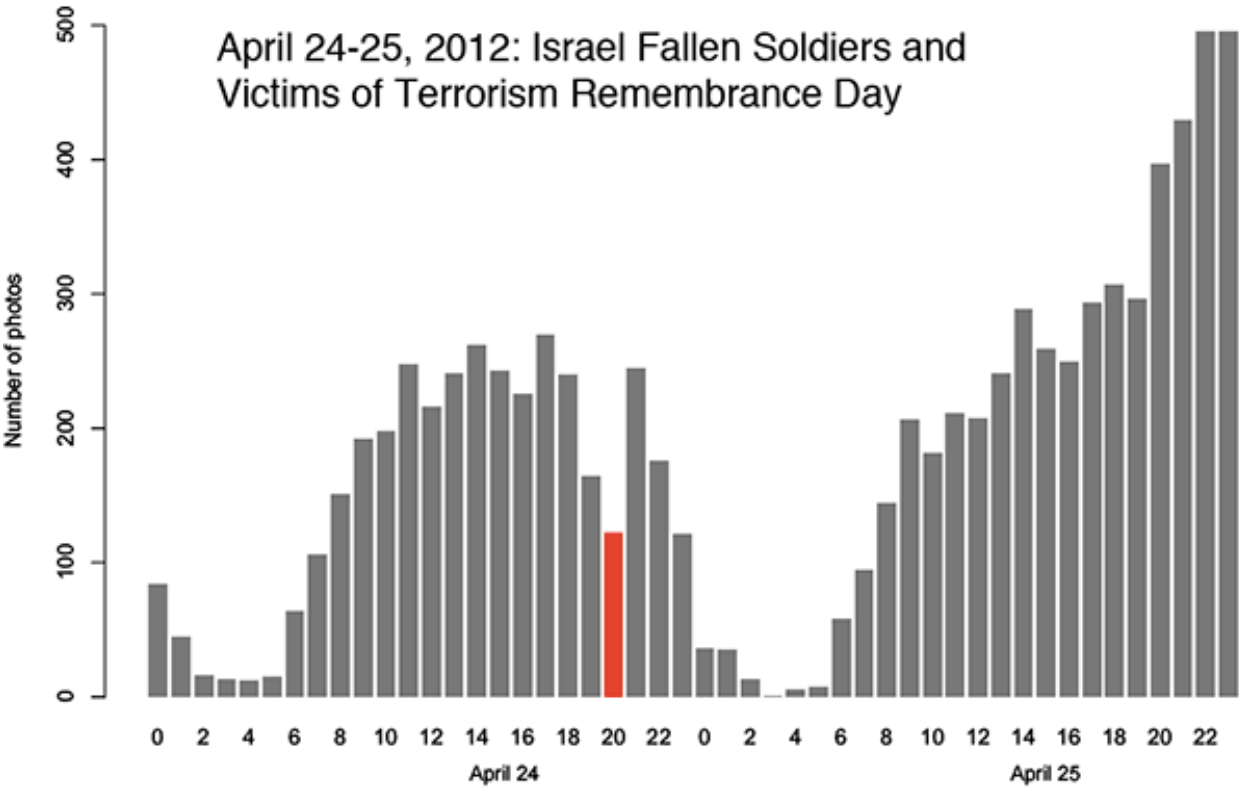

April 24-25, 2012: Israel Fallen Soldiers and Victims of Terrorism Remembrance Day
Number of photos
0
100
200
300
400
500
0 2 4 6 8 10 12 14 16 18 20 22 0 2 4 6 8 10 12 14 16 18 20 22
April 24
April 25

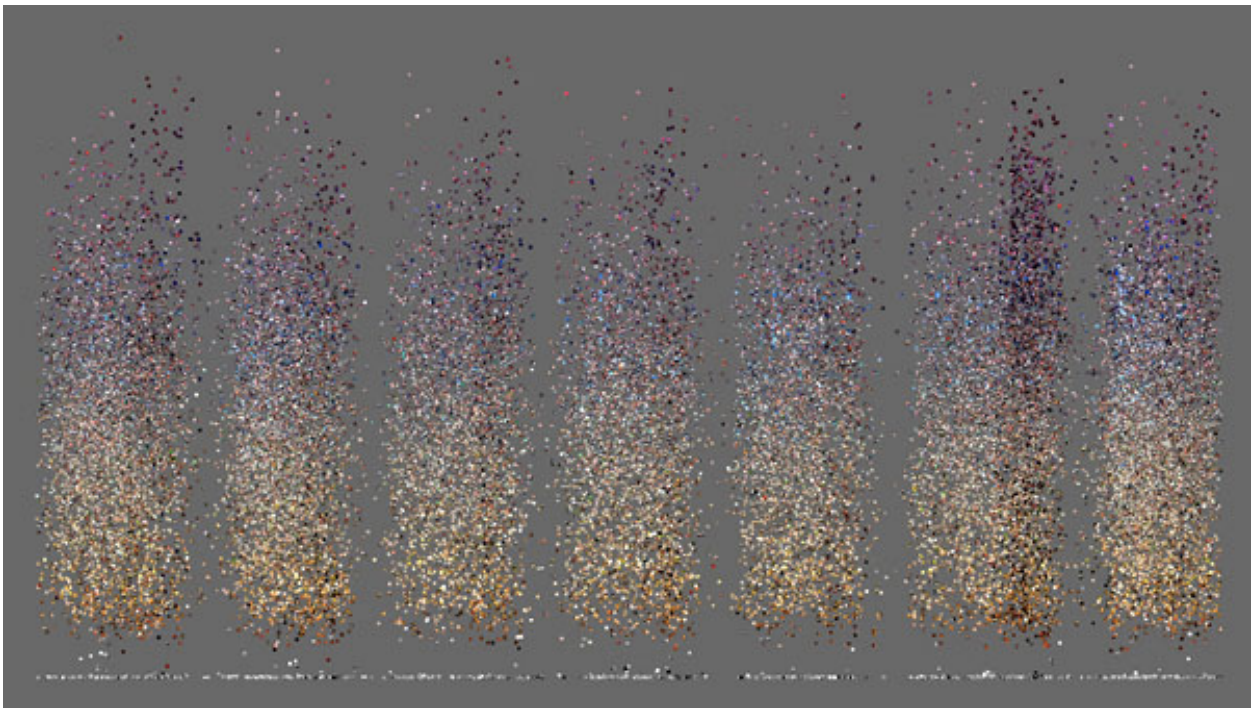
**Figure 22.** Numbers of photographs captured and shared on Instagram during exceptional events in the Tel Aviv area between 15-19 April and 22–26 April 2012. (a) 15-19 April 2012: 17,923 photos, 5,095 users. (b) 22-26 April 2012: 23, 257 photos, 6,333 users. (c) Holocaust Memorial Eve and Day, 18-19 April 2012: 7,055 photos, 2,993 users. (d) Israeli Fallen Soldiers and Victims of Terrorism Remembrance Day, 24-25 April 2012: 8,631 photos, 3,519 users. Red Bars indicate decrease in number of pictures taken (see text for discussion).

#### 3.5.2.2 Israeli Fallen Soldiers and Victims of Terrorism Remembrance Day

In the second Memorial Day (24-25 April), we see a significant decrease in the numbers of shared photographs after the siren is sounded across the country. Between 20:00pm and 21:00pm, 50 percent fewer photos were uploaded when compared with the average number of photos in the same time period during the previous five days (see Figure 22b). When the second siren sounded the next morning, the volume of shared photos increased due to the many ceremonies taking place around the city immediately after (Figure 22d).

Although both memorial days play a similar role in national memorial practices, our data reveals significant deviations between them. While behavioral patterns during Holocaust Memorial Day do not show exceptional deviations from regular daily patterns, the Fallen Soldiers Memorial Day exhibits a completely different behavioral profile. In this way, the results exemplify an "affect rate" which reflects the significance and effect of specific times (two memorial days) on cultural production patterns (as measured by Instagram activity) in a specific place.

(a)



(b)

(c)

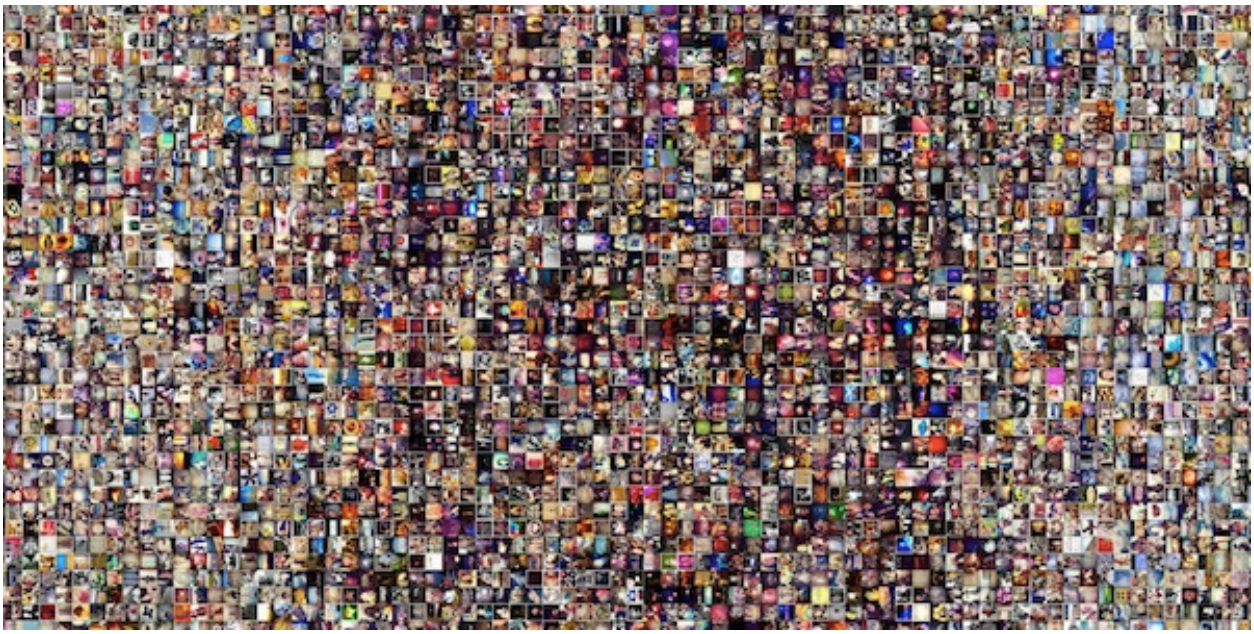
**Figure 23.** (a) Image plot of 33,292 photos from Tel Aviv uploaded to Instagram between 20-26 April 2012. The photos are organized by upload time (x axis) and hue (y axis) (b) A close-up of the visualization (c) A further close-up of the visualization showing visually similar photos which document the air show during Independence Day morning. A higher resolution version of this figure is available at: http://phototrails.net/TLV-week-plot-created-hue/.

### 3.5.3 In transition

Israel's Independence Day celebrations begin directly after the end of the Fallen Soldiers Remembrance Day. This is an abrupt moment of transition in which the Israelis are asked to quickly switch from practicing memorial rituals to celebratory routines. We can see this drastic change in our results. While during regular days the number of photos uploaded every hour increases into late afternoon and then gradually decreases into the evening, Independence Day eve (25 April) exhibits a unique pattern: the number of photos continuously increases until 11pm. The cultural production rate continues to be significantly higher in later hours as people stay out later to celebrate. During Independence Day itself, there is a constant increase in cultural production until a peak around 2pm (Figure 22b).

(a)

(b)



(c)

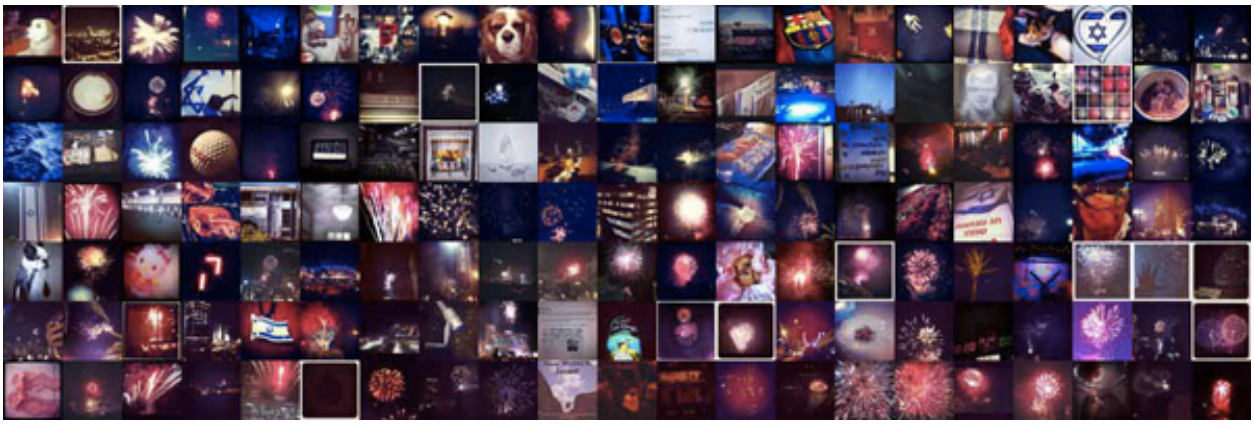


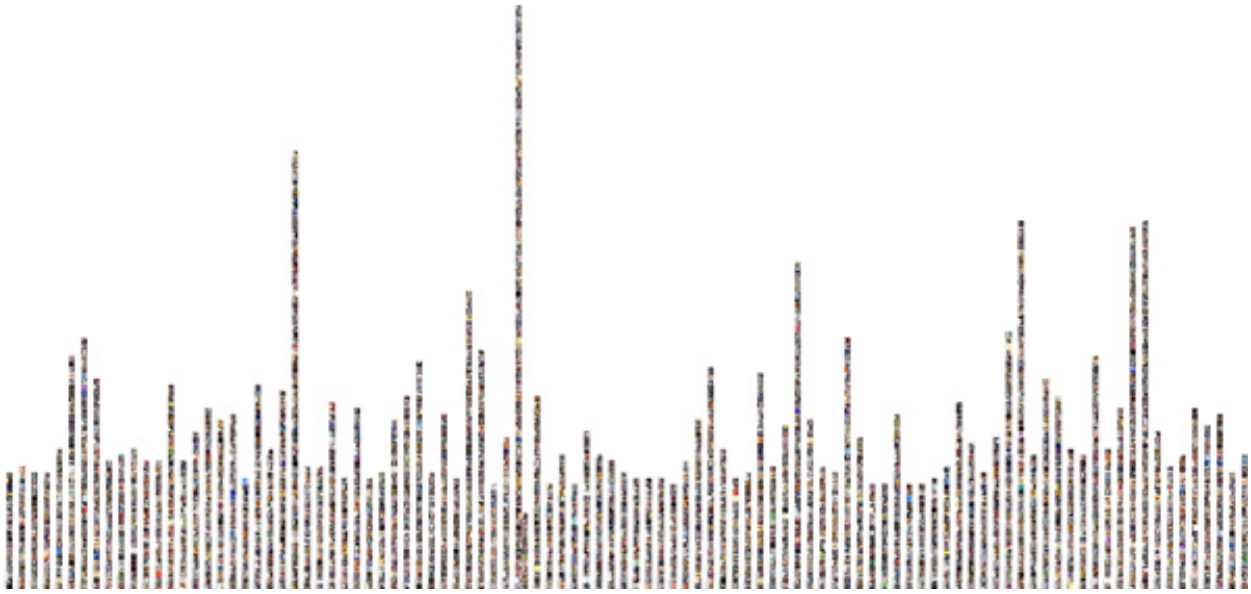
**Figure 24.** (a) Montage visualization of 33,292 photos taken in Tel Aviv during April 20-26 2012, sorted by upload date (left to right, top to bottom). (b) A close-up of the visualization (c) A further close-up of the visualization that

shows photographs of fireworks taken during Independence Day eve celebrations. A higher resolution version of this figure is available at: http://phototrails.net/tlv-weekapril-21-26/.

### 3.5.4 Time–based affinities

As these results show, and as we will discuss hereunder, our imaginary communities (Instagram users situated within Tel Aviv) take different forms and shapes not only in terms of their aggregated dispersed or condensed spatial patterns, but also in their specific times (when the pictures were taken) and specific places (where they were taken). As opposed to many other maps of social media data that show social and spatial proximities in the form of aggregated location information from many moments and many people—thus producing singular maps where the different temporal origins of the data points are erased—we use visualization techniques which allow us to compare patterns between days, hours, locations and particular users, and see how the social status and function of a place change over "regular" and exceptional times. There are a number of such visualizations in this chapter. These visualizations show all locations data for every date over three months, colored by hour (Figure 19); Two weeks data shown as bar graphs indicating volume—as shown in the graphs above; or use the actual photos in a plot or montage, sorted by users (Figure 25) or various other visual attributes (Figures 1, 23, 24).

(a)



(b)

**Figure 25**. (a) Montage visualization of 100 Instagram users in Tel Aviv area who uploaded most photos during 18–26 April 2012. Each user's photos appear in a single row sorted by upload date. (b) A close-up of the visualization (Visualizations were rotated by 90 degrees).

We can also combine some of these techniques into a *singular visualization* that will allow us to explore particular photos in specific locations and times. For example, Figure 26 uses image format and incorporates the location of photos (y axis), the time of creation (x axis) and the photos themselves, and allows us to explore photo-taking patterns in specific places in the city over time. As we can see, some places appear time and again as centers of concentration (*i.e.*, Rabin square) while others perform as *ad hoc* cultural production centers on exceptional occasions.

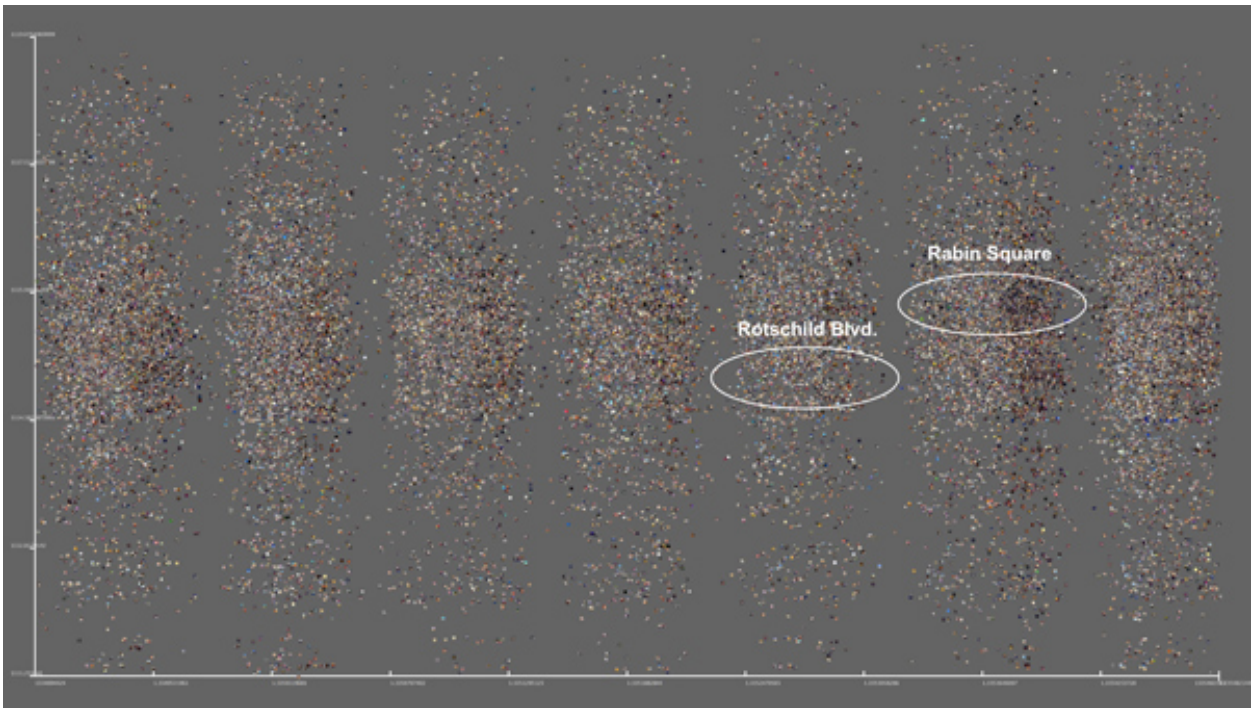
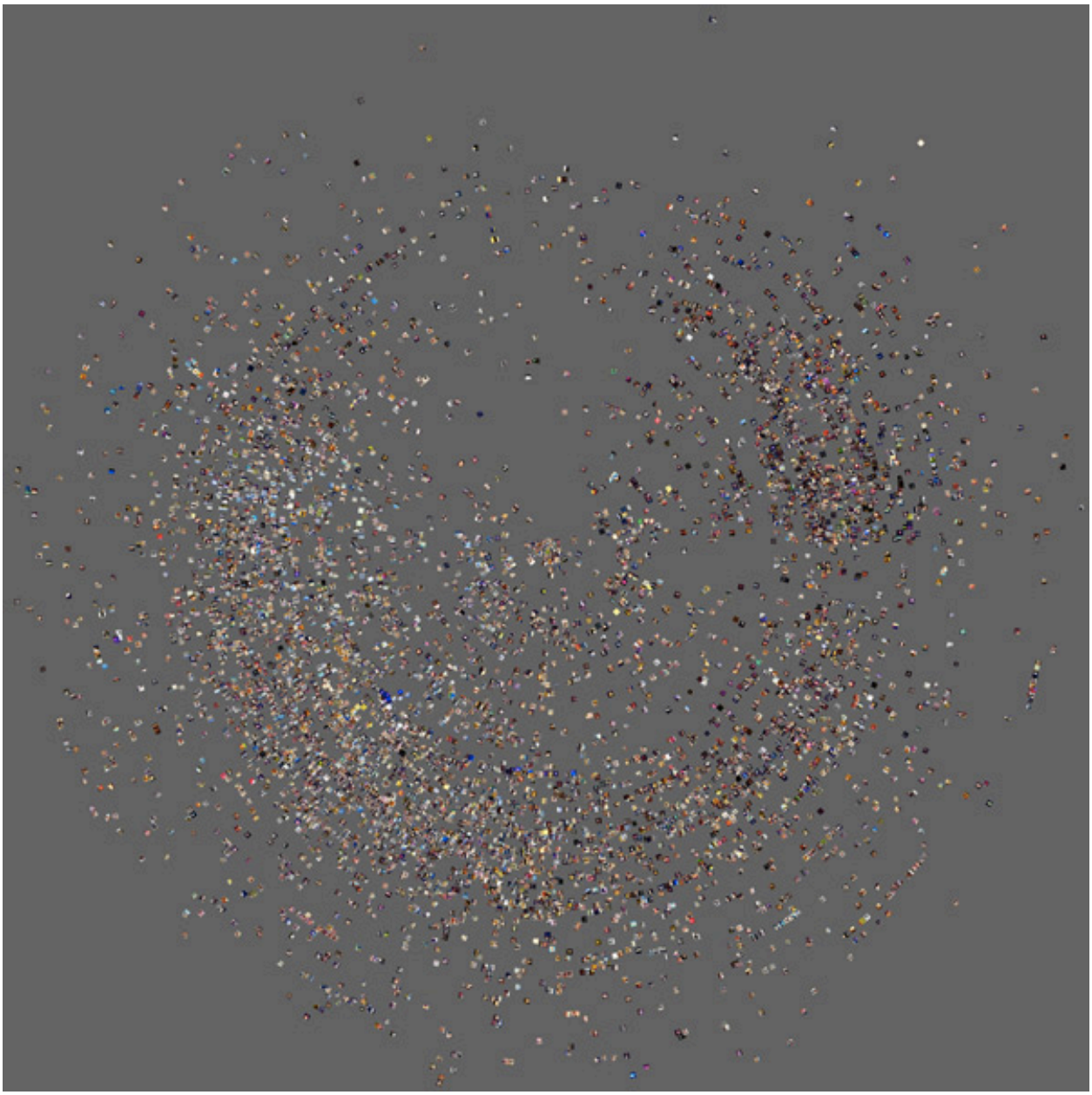



**Figure 26**. Image plot visualization of 33,292 photos taken Tel Aviv during 20-26 April 2012, sorted by time (x axis) and location (y axis). Notice the significant changes in photo taking patterns around the city in exceptional vs.

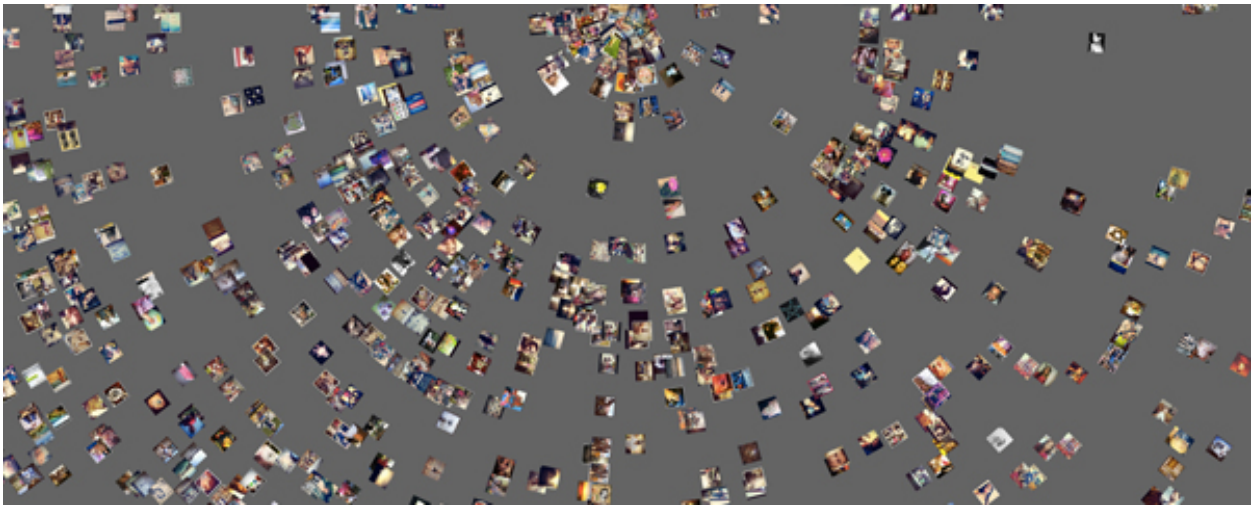
regular days, especially around Rabin square during Independence Day eve (increase in volume) and around Rothschild Blvd during Memorial Day eve (decrease in volume).

In a similar way, Figure 27 is a radial visualization that organizes the images according to their upload dates and locations. These new visualization forms combine *the spatial, the temporal and the visual* into a condensed representation. They allow us to better detect constantly changing sets of relations between Instagram photos across time, or during exceptional times and in specific places. They show how depending on the time of day, users tend to take pictures in different places, and how the nature of these places changes throughout the day and over longer time periods. We can then articulate these visualized relationships as "time-based affinities": a set of relations between places or users at a specific point of time.

(a)



(b)



(c)

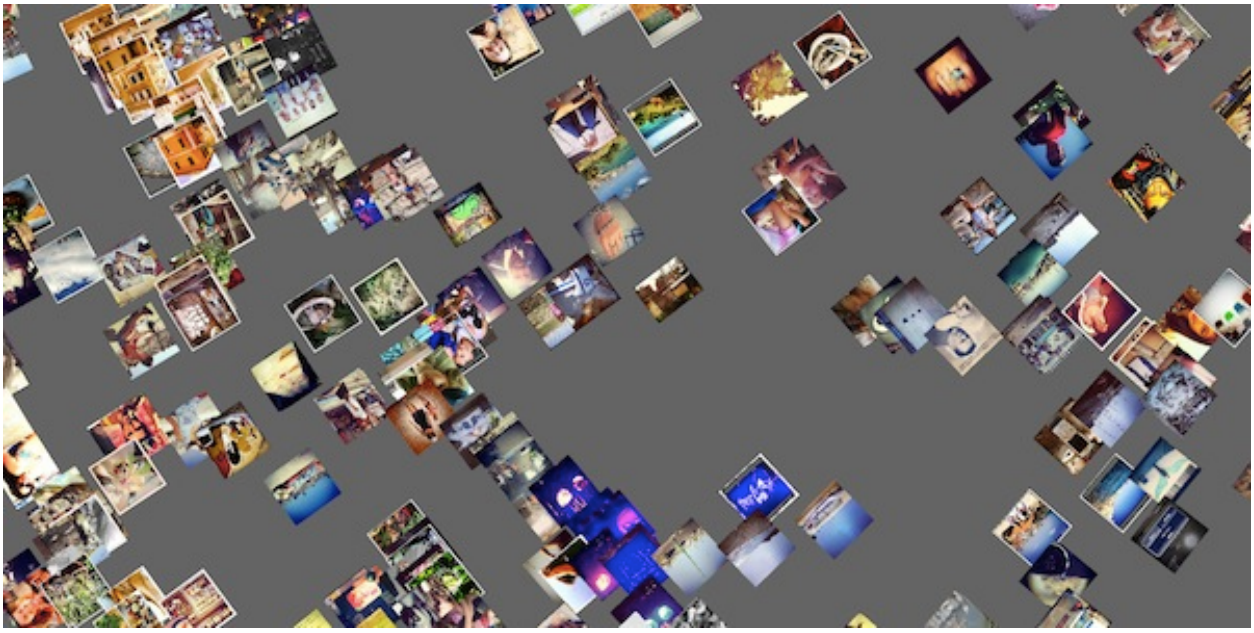


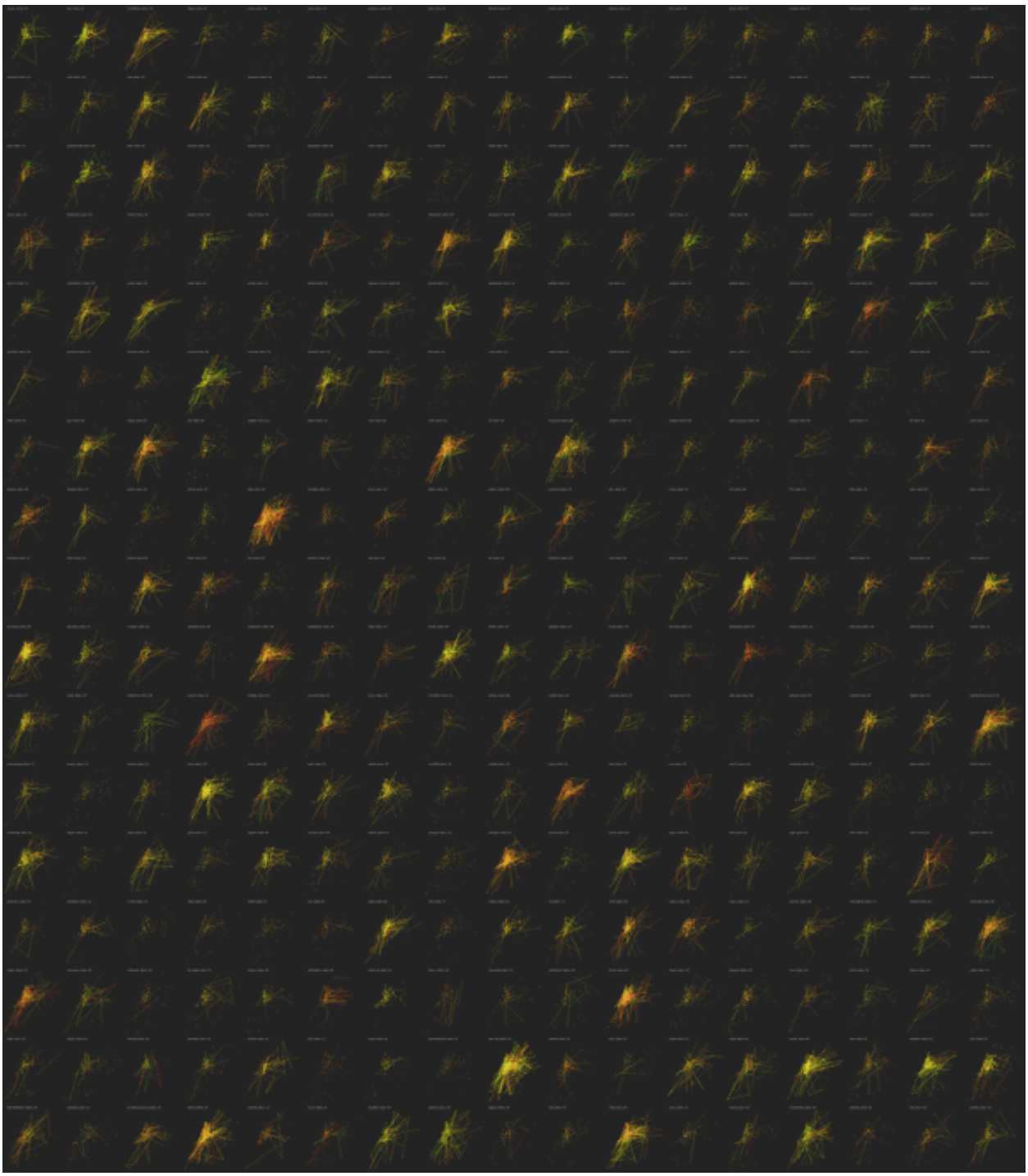
**Figure 27.** (a) Radial image plot visualization of 11,758 photos shared on Instagram in Tel Aviv during 25-26 April 2012. The photos are organized by date and time (angle) and location (radius). (b) (c) Close-ups of the visualization. The location position is obtained by multiplying latitude and longitude coordinates together. This allows us to visualize two spatial dimensions and the time dimension together in 2D plot. A higher resolution version of this figure is available at: http://phototrails.net/TLV-week-radial-time-location/.

#### 3.5.4.1 Complementary affinity

The most typical time-affinity that we identify in our visualizations can be called a complementary affinity: a set of relations between places that "complement" each other or relations between places that operate in a similar way during different times of the day. We then find groups of morning places, evening places, and so on, each group representing different characteristics and functions during various times of the day.

These fairly stable patterns also appear in relation to users' affinities and the variety of ways in which we can typify and categorize people's behavior (Figure 28). As we can clearly see, a few users take many photos in one area, others move rapidly across the city. Several users never take more than one photo per hour, while others take many photos over short periods of time. Some take more photos during early mornings, while others only take photos during the late evening.

(a)



(b)

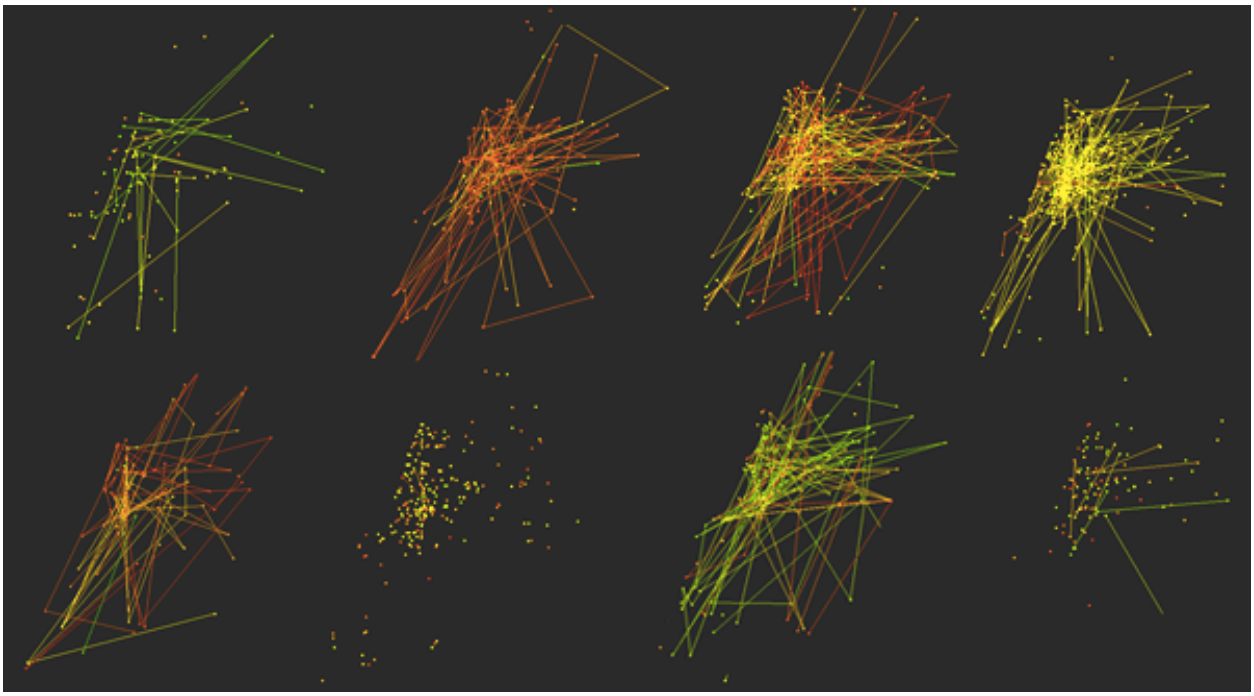


**Figure 28:** (a) Matrix plot comparing activity of 289 most active Instagram users in Tel Aviv. Each plot in the matrix shows locations of photos shared on Instagram in Tel Aviv area over three months. The green to red color gradient indicates the time when a photograph was shared (green: morning, yellow: afternoon, red: evening). A line is drawn between two photos/dots that were taken within the same hour. (b) A detail of the matrix plot showing eight users. A higher resolution version of this figure is available at: http://phototrails.net/lines-users-matrix/.

However, as illustrated in our study of Israeli memorial and independence days, this type of constant or stable network of affinities breaks during exceptional dates. During these times, we notice how the network of relations and connections changes, and the nature of this change can reflect the character of the time in which it occurs. During Independence Day eve, for example, we see many concentrations of small groups that gather in various places according to a similar interest in the specific nature of the celebration. This type of complementary affinity

operates as a dispersed celebratory network that happens at the same time, but each node operates independently and exhibits different characteristics (Figure 29).

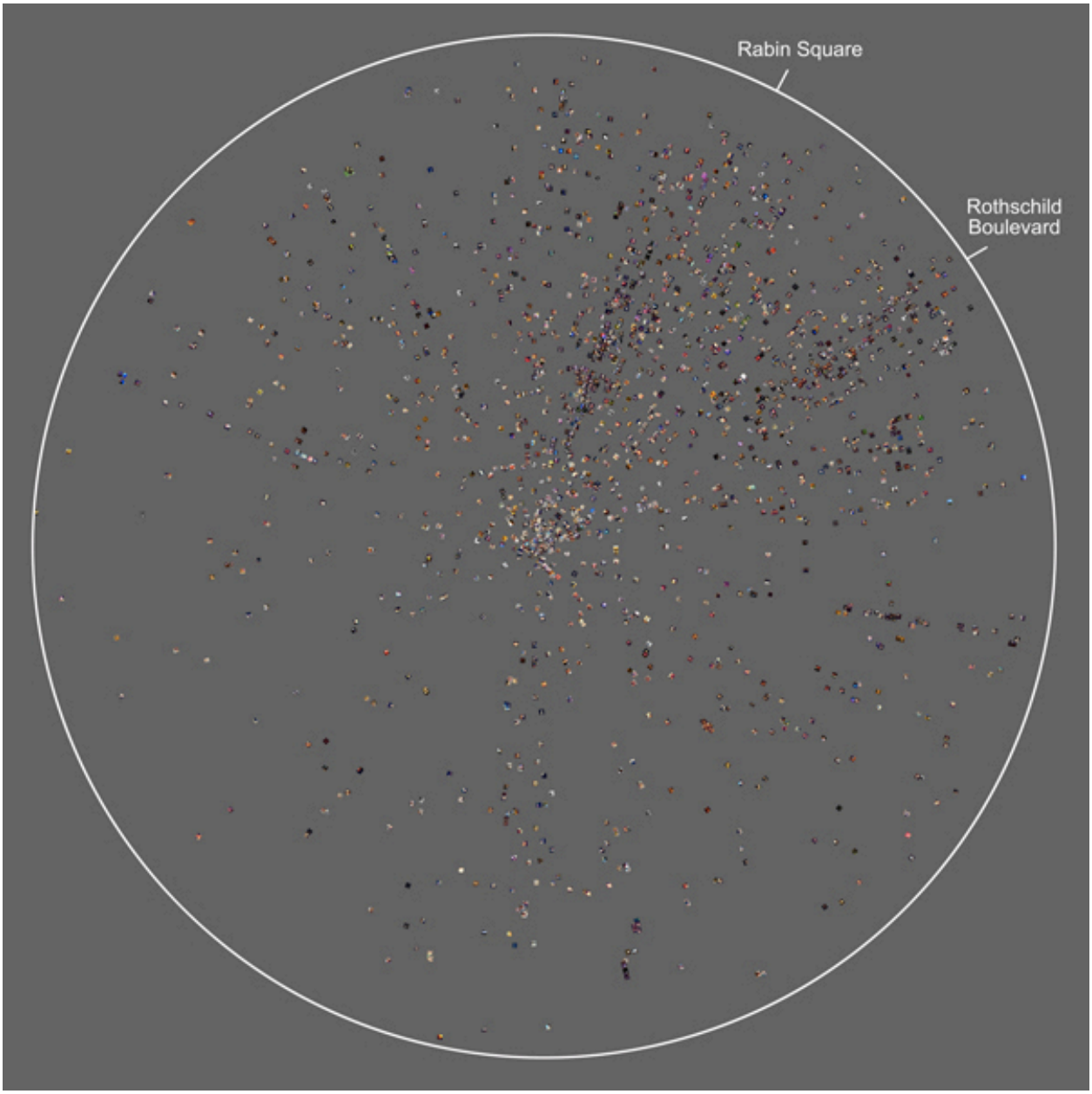



**Figure 29.** Radial plot visualization showing a subset of photos taken by Instagram users in Tel Aviv between 4pm on 25 April and 2am on 26 April 2012. We used Amazon's Mechanical Turk to separate photos that show people from photos with other subjects. This visualization includes only 2,268 photos with people (63 percent of all photos shared during this period). The photos are organized by location (angle) and upload date/time (radius). Location coordinates are obtained using the same method as figure 27. The visualization shows concentrations of photos in

celebration locations around the city during Independence Day eve. Notice how the celebrations around Rothschild Blvd. begin significantly later and last longer than the celebrations around Rabin Square.

Memorial Day eve, however, exhibits a counter pattern to Independence Day eve activities. During these hours we see how our dispersed imaginary communities display similar low activity rate in picture-taking during the entire evening. In this case, the imaginary community of that day presents itself as a unified "unproductive" whole, organized around a singular cultural hub (Rabin Square) (see Figures 30, 31).

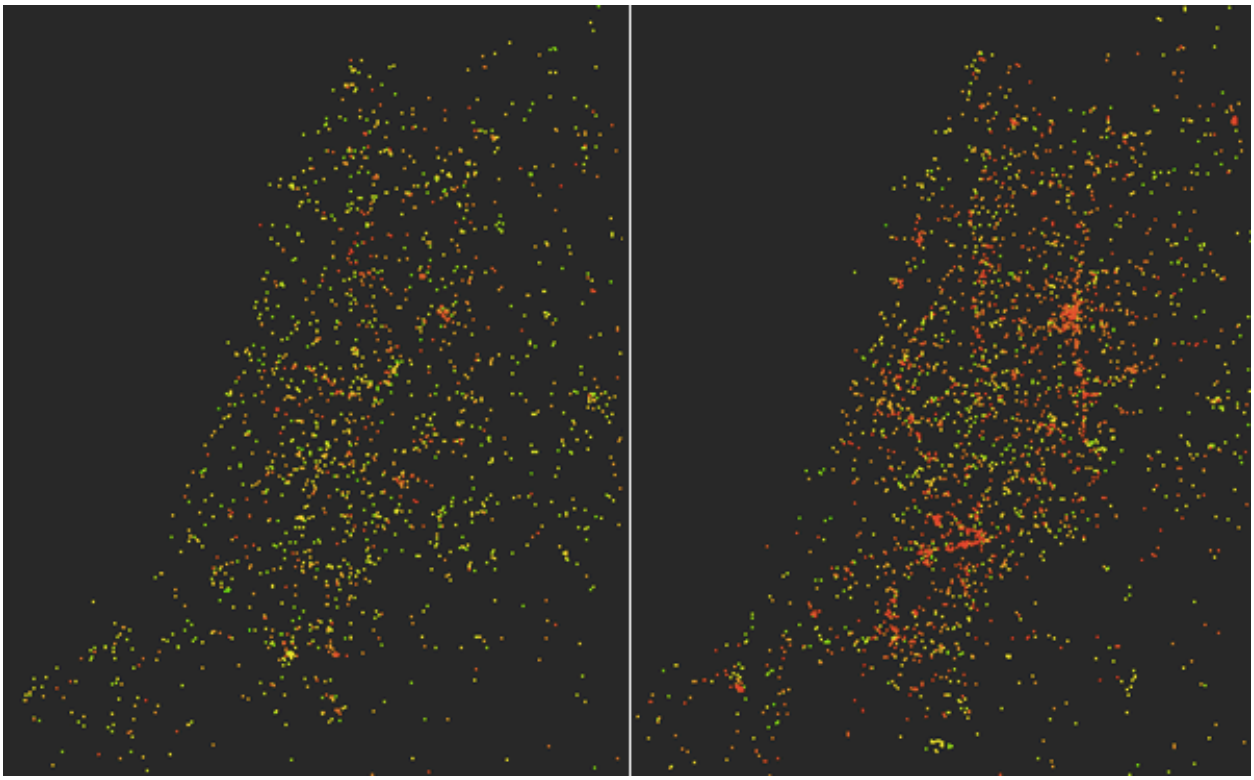


**Figure 30.** Scatter plots showing locations and photo-sharing times. Left: 24 April (Memorial Day eve). Right: 25 April (Independence Day eve). The green to red gradient indicates the time (green: morning; yellow: noon; red: evening).

### 3.5.4.2 Contradictory affinity

This set of complementary relational affinities is complicated when examined both on the micro and the macro scales. On the micro scale, for example, during Soldiers' Memorial Eve we can locate two places that operate in complete contradiction to each other and which represent, each in its own way, a different political affiliation. Two central ceremonial events are performed at the same time in Tel Aviv during that evening: a conservative memorial ceremony that is identified with more nationalist ideas (around Rabin Square area), and an alternative memorial ceremony that explicitly disassociates from the traditional, national one, and carries a different political affiliation (Hangar 11).

What type of "affinity" do these two events create? In our data, we can see how the national ceremony is depicted with a concentration of photos taken during the performance of the ceremony. On the other hand, within the spatial boundaries of the alternative ceremony almost no pictures were taken during that evening (Figure 31). While one place/event manifests a high cultural production rate as part of its memorial routine, the other place/event leads to a state of complete silence in remembering the dead.[28] We can call this a state of "contradictory affinity", where two or more places are in a state of friction with each other (as opposed to the state of accordance we find on regular days).

[28] It should be emphasized that there are significant differences in the number of people that attended each event. While the national ceremony attracts many thousands of people, the alternative ceremony is smaller and attracts just a few thousand people. In addition, while the national ceremony is preformed in an open square the alternative ceremony is conducted in an enclosed building. However, since we can see photos from the alternative ceremony location (Hangar 11) in earlier days, the lack of images on that date bears cultural significance.

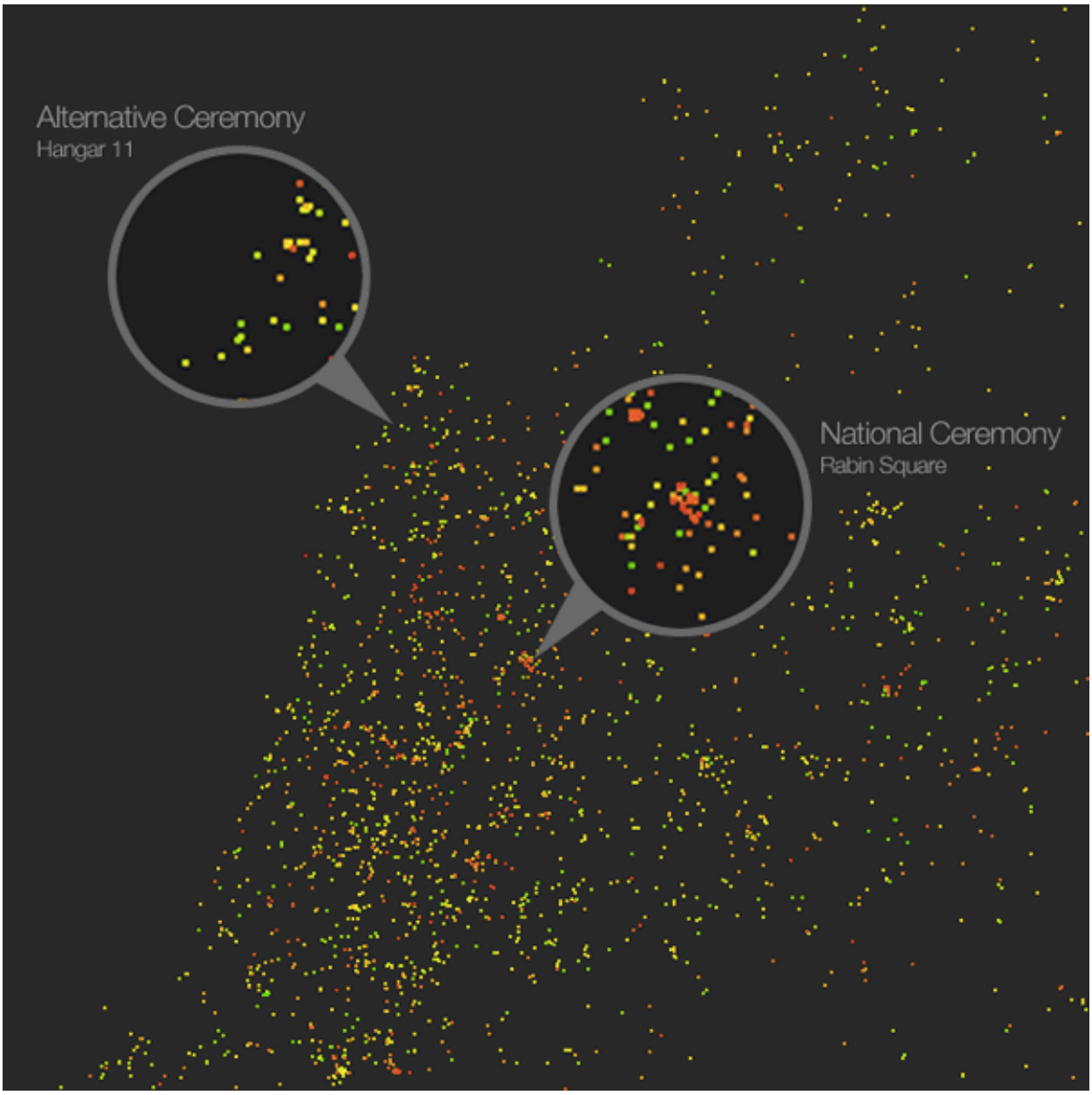



**Figure 31:** In this scatter plot, we highlighted two memorial event locations during Memorial Day eve (24 April). The same color gradient as in Figure 30 is used.

This same type of affinity also appears on the macro level, when we examine the most dramatic shift from Memorial Day to Independence Day. In less than 48 hours our visualizations exhibit two counter-representations that operate in complete opposition to each other (Figure 32).

These contradictory representations show a 48 hour time span in which the routine patterns of earlier days are completely disrupted. These are representations of *loud* affinity (Independence Day) versus *quiet* affinity (Memorial Day)—each representing the changing nature of "city saturation" levels, indicating the rate and spread of images the city produces. In this way, during Memorial Eve many users choose not to take photos, and those who do, tend to concentrate around a unified location in the city. Independence Eve and Independence Day, however, show opposite patterns where larger numbers of users take photos, and a large proportion of these users take photos at various places at the same time of the day as well.

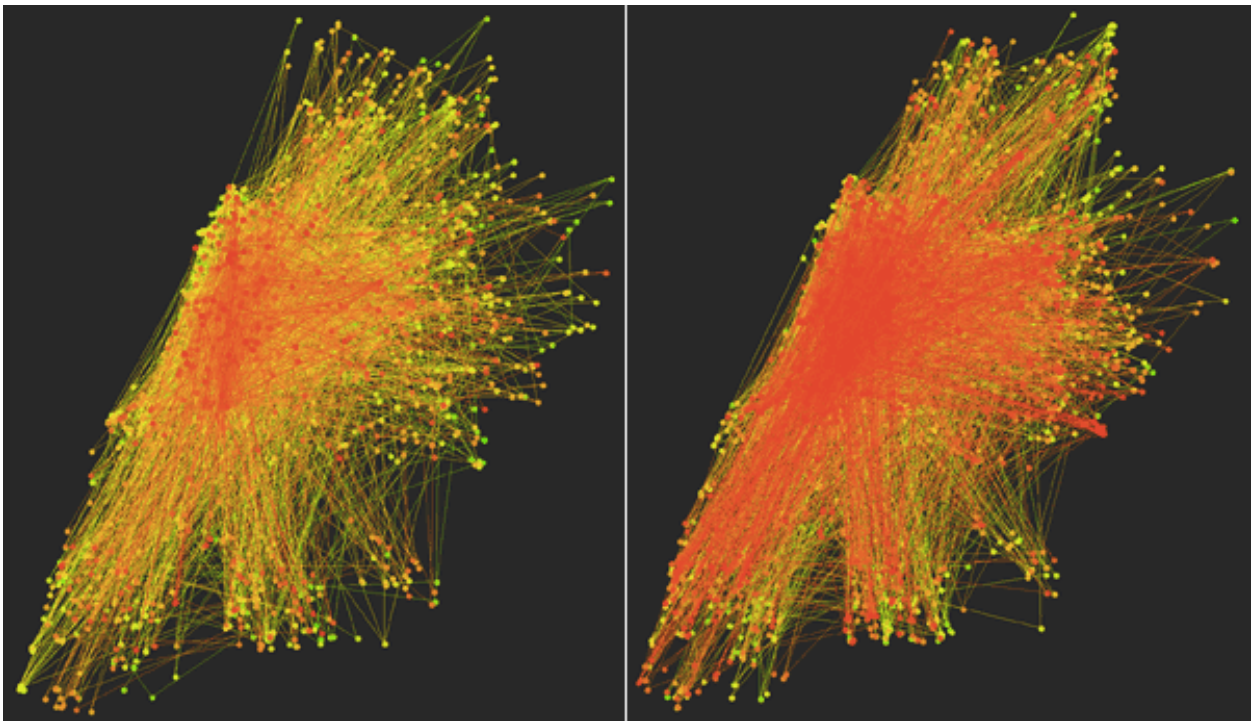


**Figure 32:** Scatter plot visualizations, with lines connecting the points (to highlight the difference in the patterns between the two days). The same color gradient as in Figures 30 and 31 is used. Left: Memorial Day eve (24 April). Right: Independence Day eve (25 April).

When this becomes clear, a more general operational principle emerges: as the level of affinity rises (quiet, loud, complementary, contradictory etc.), the city moves from a state of "normality" to "abnormality". This latter state, as already mentioned, enables us to better visualize a cohesive whole. Indeed, as one might argue, the state of low or loud co-presence of Instagram users in the same space and in the same time does not necessarily create a "true" community. However, by tracing the changing nature of aggregated patterns in specific times and places, our visualizations produce imaginary communities that represent social realities in ways unavailable before.

## 3.6 CONCLUSION

I began this chapter with an analysis of the Instagram interface, and the ways in which its affordances structure users' particular cultural experiences. I then explored possible ways to visualize and analyze the visual content of social media data on a variety of scales. Starting at the global scale, we compared "visual signatures" of 13 global cities as they are represented in Instagram photos. Zooming into our data, we analyzed spatio-temporal patterns of over 200,000 Instagram photos uploaded in Tel Aviv, Israel over a three-month period. Finally, zooming further into the data, I focused on two weeks in Tel Aviv in order to show how temporal changes in numbers of shared photos, their locations, and visual characteristics can offer social, cultural and political insights about people's activity during these dates.

Affordances of Instagram's software, as I have analyzed them, and our methods for exploring Instagram photos via multi-scale visualizations may signal a conceptual cultural shift in the ways we experience, analyze and use cultural data from the Internet. Recent cultural software tools and services (Instagram as well as our visualization tools) are less focused on organizing information and media into pre-existing structures and distinct categories. Instead, they enable the exploration of a diversity of spatio-temporal and visual knowledge productions, and chart transitions and functions of particulars in relation to wholes (for example, exploring photos using tags, hashtags, locations, or follow particular users, as opposed to only using hierarchical subject categories). Imagine, for example, browsing through Instagram's particular photos using its default application, then quickly visualizing millions of images from various locations, shifting constantly from the particular to the general, positioning oneself in multiple contexts and scales, moving from one location to another, all the while noting differences, similarities and intriguing relations and patterns (Figure 33).

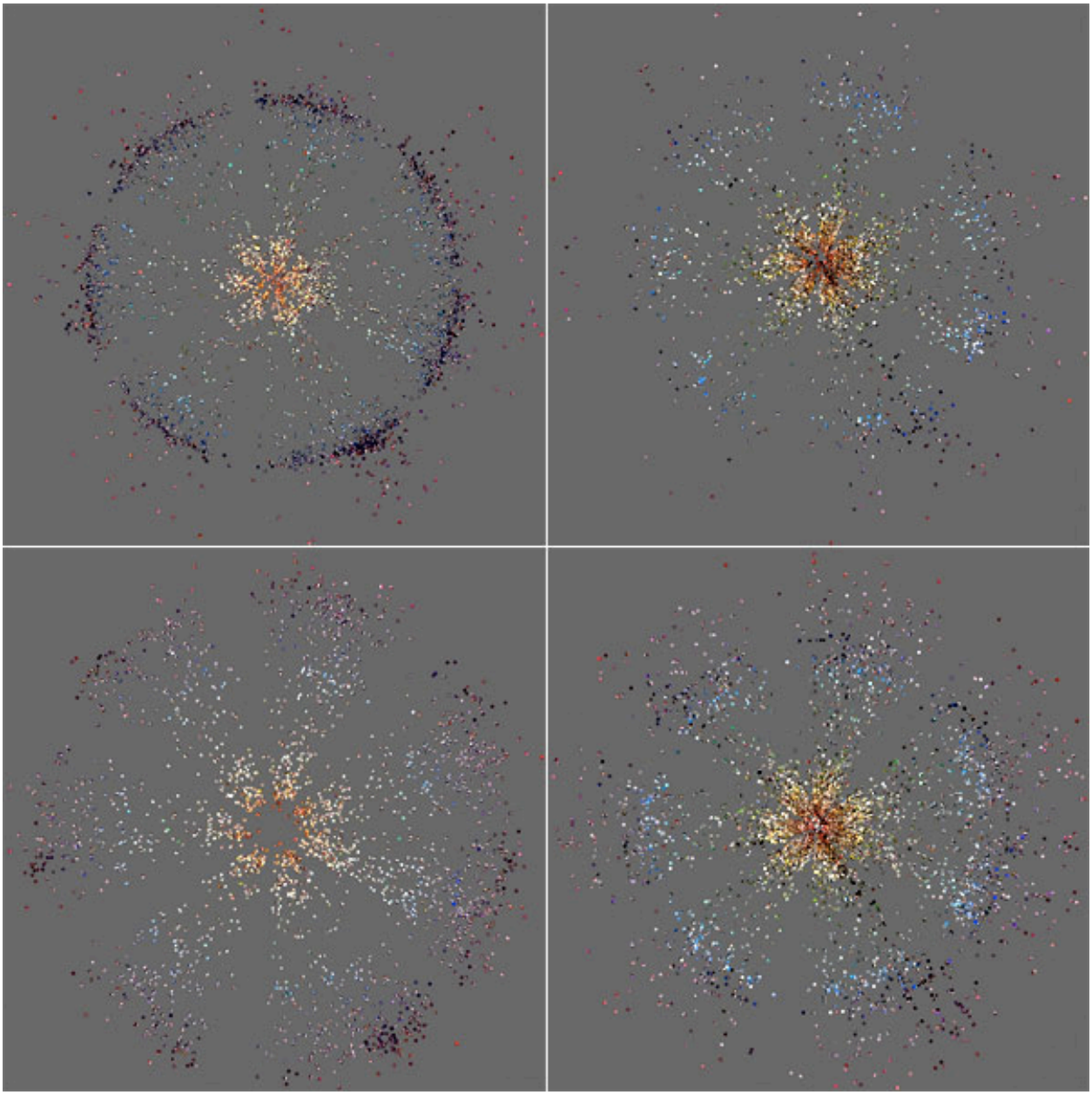


**Figure 33.** Use of different filters in photos uploaded in Tel Aviv during April 2012. Each radial visualization includes photos with a particular filter. Radius: hue. Perimeter: upload time. Top left: X-Pro II. Top right: Lo-Fi. Bottom left: Amaro. Bottom right: Normal. Higher resolution versions of these visualizations are available at: http://phototrails.net/filterusage/

While the most recent media transition known as Web 2.0 can be described in terms of a shift "from messages (made by other people) to platforms" where users can share, comment and tag their own media,[29] we are now moving "from platforms to aggregators" that collect data streams from existing social information sources through API calls and organize it according to multiple attributes such as keywords, time, location, hashtags, etc. These aggregation systems present different data streams and act as "live stream readers" that pull together data from various social networks (known as 'social network aggregators'[30]), or as "analytics dashboards" that provide a synthesized and often algorithmically summarized views of data streams to extract meaningful insights (known as 'social media control center'[31]).

In this sense, our media visualizations participate in this media shift and illustrate a potential way in which collective social data activities turn into dynamic configurable patterns; they provide the ability to think of ways in which users can browse through non-(or less) hierarchical information based on intrinsic attributes (such as time, place, color, composition, presence or absences of faces, etc.) while re-arranging it in multiple contexts and scales (Figure 33).

If functions and relations are now more important than purposes, and we are, as previously suggested, encouraged to see ourselves as specific points of time and place, then we are also prompted to think of ourselves as singularities which are part of various wholes, each contributing to a constantly growing database that then needs to be visualized and explored. This is the essence of this new "media paradigm": exploring diversities of singularities not through

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[29] Manovich, 2012.
[30] http://en.wikipedia.org/wiki/Social_network_aggregation, accessed 22 June 2013.
[31] http://blogs.salesforce.com/company/2012/12/examples-of-social-media-command-centers-for-the-worlds-largest-brands.html, accessed 22 June 2013.

hierarchies and categories but rather through relations, transition and sequences, while moving from the singular to the plural, from the close to the distant.

*

The next chapter continues to explore the mechanisms that structure this recent media paradigmatic transition, but turns away from temporal representations and focuses on *spatial organizations* of large sets of social media photos.

Using examples of existing, emerging and experimental forms of information orderings of large sets of social media images, the next chapter reviews, analyzes and theorizes three spatial approaches for the organization of large-scale visual materials produced over social media platforms, and chronicles the ways in which each method constructs a particular spatial functionality for these images.

# 4.0 IMAGE SPACE

## 4.1 INTRODUCTION

**Figure 34.** Leviathan (2012) Lucien Castaing-Taylor and Verena Paravel.

One of the most immersive, disorienting, even claustrophobic moments in recent years occurs as we experience an experimental documentary film about an object: a fishing trawler. The documentary *Leviathan* (2012), directed by Lucien Castaing-Taylor and Véréna Paravel, plunges the viewer into a sensory experience of the complex operations of a single boat, taking us "from the clank of mechanical winders to the thud of netted fish on the deck, from the slashing and

ripping of blades upon silver flesh to the piercing cries of greedy gulls overhead" (Howell, 2013). (Figure 34)

The movie unfolds to its viewer as a documented spatial multiplicity that is enabled by the positioning of miniature GoPro cameras installed around numerous locations around the boat, its crew and its surroundings. The principle here is simple: turning physical bodies (i.e. humans, objects, animals) into "documenting eyes" in order to get a glimpse of the wealth of idiosyncratic and synchronic spaces that operate within the boat and enable its functioning operation. It is a documentary vision that seeks to expand space in every direction, to tear it apart and then stich it back into a cohesive whole that now contains all, or at least a significant portion of the boat's spatial possibilities. Viewed this way, the movie is about the definition of the boat's "objectness" via the intricacy of spaces that operate within it. It is a representation enabled by a documantational mechanism in which (potentially) every spatial possibility is chronicled, and then reorganized with all other spatialities in order to represent a functional whole.

It is this type of representational spatial multiplicity and its modes of organization that are the subject of this chapter. The recent proliferation of self-documentation mechanisms—images and videos taken and recorded via devices such as mobile and wearable cameras—resulted with an unparalleled increase in the volumes and availability of documented representational spatialites. In turn, new ways to organize these large sets of visual materials have been developed, aiming to reconfigure some version of these expanded documentational spaces.

In what follows I use the example of large sets of social media photos to show how each of these organizational mechanisms carries distinctive modes of spatial thinking and produces different types of spaces from the aggregation and reorganization of large sets of visual materials. I ask: What are the current ways to organize large sets of social media images? What

is the operational logic underlying each of these organizational modalities? What types of spaces (or spatial typologies) are enacted via each organizational mode, and how each of these spaces defines a different functionality for these images?

These questions stem from a general definition of space as a relation defined on a set of objects, and assume that depending on how this relation is defined, different types of space may be created (Gatrell, 1991). My focus is on what I call the production of an "image space": the organization of large sets of social media photos as new types of spaces with varying kinds of spatial relations; the material conditions under which these spaces take place; the representations that result from such spatial relations; and finally their implications for the function of images that participate in the production of these spaces.

I trace the construction of three different typologies or proximities within large sets of photos and the spatial structure established in each case. I start by analyzing images as 'networks' and as 'layers' in regions. The organization of images as a network enables the "participation" or the inclusion of images within large-scale information organization and experiences, and signifies a relational distance between elements within a dataset. Images as region indicates the clustering and positioning of images over a map in order to reconfigure a sense of mobilization within a physical space and visualize its spatial possibilities. Next, I consider the treatment of images as 'concepts'. In this mode the organization of images does not depend on physical boundaries or confined by the rigidity of a small number of elements in the network, but rather activates a "fluid spatiality," a performance of multiple visual content continuities.

As I show, each of the three modalities relies on a different conception of image function, experiences and visual knowledge production practices, and thus establishes itself as the primary axis of contemporary large-scale visual understanding.

## 4.2 STRUCTURES, NETWORKS AND REGIONS

The first visual organizational mode that sets up the conditions for all other possible spatial modes is the treatment of images as a network, which enables the organization of images as structures within a relational space. In this modality, large social media image repositories are organized and retrieved according to their structural metadata (such as users, time, location, tags etc. [Hochman, 2014]). This metadata also provides access to multiple systems with different platforms and interfaces to process large sets of photos. Through API (Application Programming Interface) calls, different software component can interact with particular application, have access to its content, and call for its image metadata according to changing criteria.[32] In addition, this image structure enables the tracking of social network ties between large sets of photos (Claudiu, 2010; Golder, 2008; Kumar, 2006; Lerman, 2007; Leskovec, 2008; Welser, 2007, Hochman & Manovich, 2013). In this case, the structure of the network depends on the proximity of similar set of elements and relations between them within the network and the way they are organized (Figure 35).

[32] See for example Instagram API: http://instagram.com/developer/realtime/ which allows to crawl image information in four ways: by location, geographies, time and users.

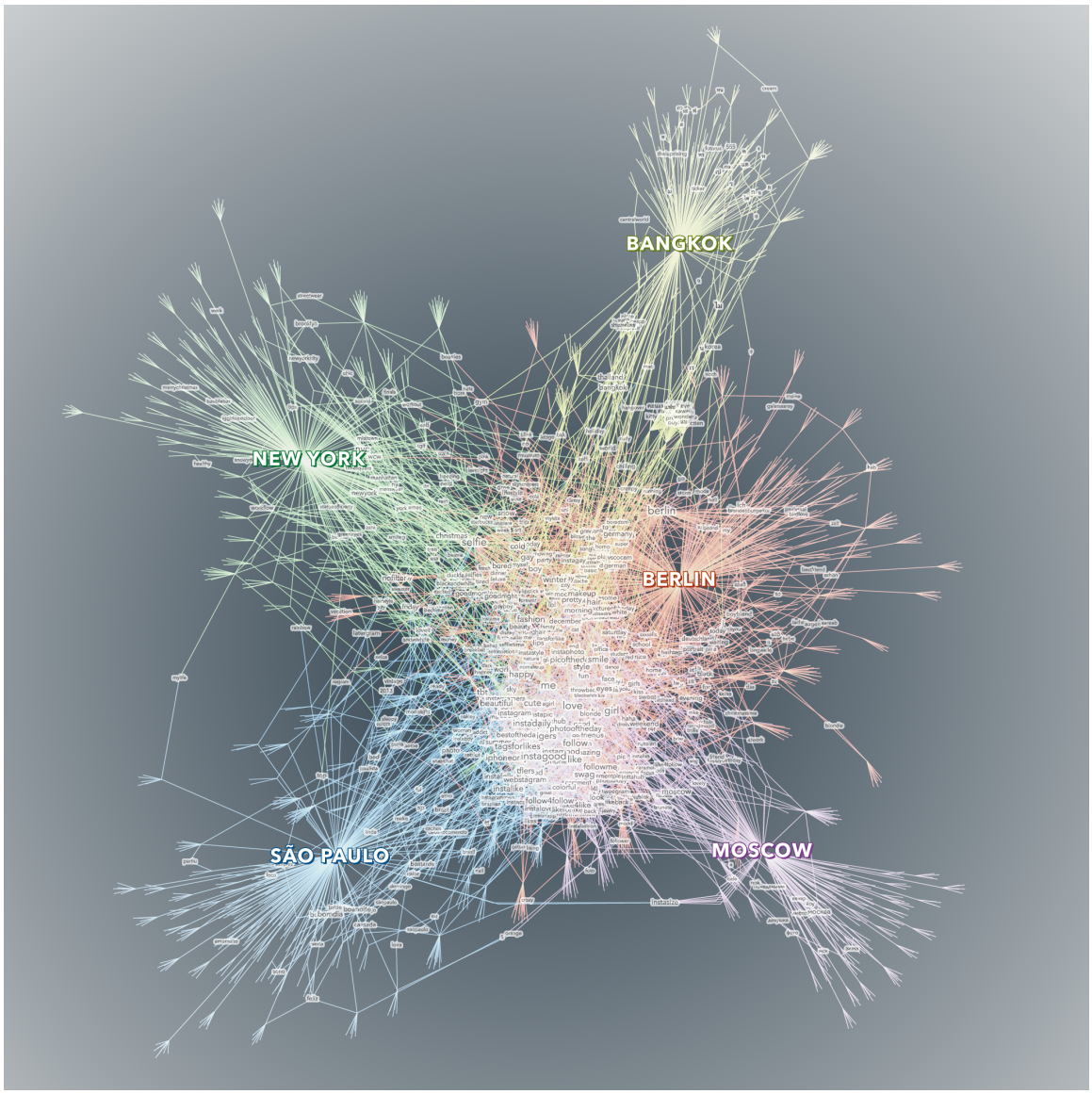


**Figure 35.** Moritz Stefaner (2014) Shared Tag Space, a comparative visualization of keywords people use in five cities to describe their selfies. The visualization displays a network of tags, cities and photos taken between 4-12 December, 2013. The photos are used as bridges between tags and cities. Bigger tags are used more often. The tags in the center constitute a shared vocabulary across the cities, while the ones on the outside are more specific to one (or sometimes two) cities.

Now notice this. In order for an image to retain its "functionality" with other images in a network space, and actively "participate" in the production of that space, it has to maintain a fairly stable set of structural relations with all other images in that space. This means that images have to be (1) publically shared by the users of social media platform, and be (2) automatically tagged (with geo-location coordinates or time) or manually described (with content keywords). If one of these terms is restricted (such as turning your photos "private" or disabling their location identification), then images no longer participate in the production of social media space and do not appear in any of the structural organizations mentioned above.

This point can be seen on the level of navigating personal webpages which are blocked for non-followers, as well as in the organization of large sets of social media image repositories. For example, for most applications (i.e. Instagram, Facebook) when users do not publicly share their personal account, their photos are not accessible to all other users who are not among their official followers and they also don't appear on collective pages presentations within the application or by third party applications (i.e. Iconosquare, 2014).[33] In a similar way, when crawling large social media images repositories through API calls only publically shared images which are geo-tagged will appear in the stream (either photos that are tagged with a specific location from a pre-determined list, or photos that are posted with longitude and altitude location indications).[34] In order to get images which are not (necessarily) geo-tagged but are publically shared, it is possible to crawl images by specific tags (keyword) that are manually added by users to describe their images or by particular usernames.

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[33] Accurate percentages of geo tagged images vs. not geo-tagged images; as well as for publically shared images vs. private ones are not yet available from any the currently large social media platforms.

[34] See note 2.

Under these terms, images which do not fulfill the structural network conditions (shared and tagged) lie "outside" of the network and become "others" to it.[35] These images are forms of alterity, as they set limits to the conditions of image possibilities and cannot be "datasized". While in some cases efforts have been made to reconfigure these alterities as part of the networks (i.e. images which are not tagged are analyzed to detect their approximate location [Park, 2014]) they remain "outer-space" and generate "forbidden" spatialities compared to all other spatialities that do exist within the network. As such, these unattainable spatialities also *politicize* all other networked image spatalities by underlining the material ways in which these spatialities are formed (by geo-location, tagging, sharing etc.) and actively refusing them.

Images that do comply with the requirements for a structural network space are, then, being used to reconfigure other types of space. Existing applications, and research into the automatic organization of social media images, exploit the tight interplay between images as *structure* (i.e. all images with the same tag, all images from particular users etc.) and images as content in order to organize and visualize large sets of photos as layers within geographical regions. In these cases, geospatial, location-based information is used to create a map-based interface of photos collections.[36] The result is sets of images within a particular network space (of specific users, times, tags etc.) layered over a standardized flat Euclidian space (i.e. Google maps). According to this logic, images are indications of particular actions taken in a place and thus are the representation of the never-ending process of making and remaking of this place (see for example: geofeedia, 2014; coeverywhere, 2013; nowapp, 2013).

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[35] Notice that I refer here to large, retrievable image collections and not to individual users and their followers who does constructed their own "private" social media space.

[36] See: http://en.wikipedia.org/wiki/Location-based_service

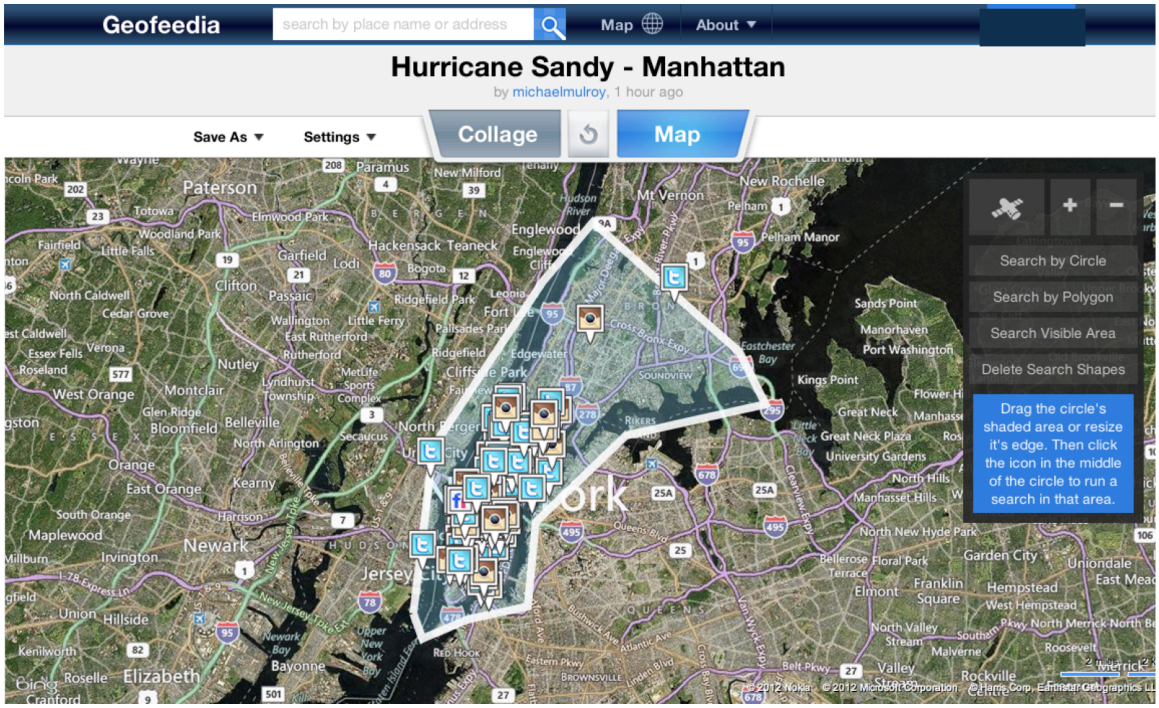



**Figure 36.** Geofeedia (2013). A screenshot from the application.

In other cases, image structure (geospatial and tag information) is combined with image content in order to assemble groups of similar photos within larger heterogeneous visual collections. For example, Moëllic et al. (2008) use a shared nearest neighbors technique (SNN), a density-based unsupervised categorization approach, in order to locate edges between photos based on textual data (tags) and on the similarity of low-level visual features. In a similar way, Papadopoulos et al. (2010) apply community detection algorithms that group together image nodes that are more densely connected to each other than to the rest of the network. Based on the result, they identify landmarks and events in the data according to temporal, social, and tag features.

Posing some more challenging research goals yet using similar "image clustering" approaches, other studies looked at the "visual style" of varying geographies. In this genre, research has focused on the identification of typical architectural elements in particular areas,

their geo-spatial distribution (i.e. the boundaries between visually coherent areas in a city) and their evolvement and changing shape over time (Doersch, 2012; Vanegas, 2010; Sivic, 2014; Zhou et al., 2014). In all of these cases, the results are maps that emphasize visual similarities within particular regions and reveal differences across other regions.

In other visually sophisticated applications, image clusters are turned into a continuous representational whole. This technique is called "image stitching" and includes feature extractions and the detection and calculation of correlation between matching points and interest points. A geometric alignment technique is then used to adjust different images with overlapped parts (such as corners, blobs and the intersection) and create a continuous single image from many images with limited angle of view (Szeliski, 2010: 429). For example, Li et al. (2008) detect representative or "iconic" views of popular landmarks and recreate them as 3D models. Similarly, Agarwal et al. (2011) preform image matching and 3D reconstruction from large sets of social media photos using image sets from Dubrovnik, Rome, and Venice. The outcome is a form of visual arrangement that leaves the one dimensional line created by the treatment of image as structure (as a measure of relational distance from other images), and the projection of a two dimensional plane of the single image content, and enters into the domain of a three dimensional space. We witness the gradual transformation of a photograph into a sculpture.

This exact interplay between different modes of visual arrangements is explored in the project *On Broadway* (Figure 37). The interactive installation visualizes and juxtaposes multiple data sources (user-generated images, tweets, Foursquare locations, tags, Google street view) produced and collected along the 14 mile long Broadway Street in New York City. All data sources are interrelated in order to explore specific locations along the street from different data perspectives. The right bar of the installation shows content tags (posted together with geotaggd

images and tweets) that are associated to particular locations along the street as shown in the left bar. These representation are also connected to all other bars that exhibit the volume of data produced along differed locations of the street (second bar on the right), and the three middle bars that juxtaposes image content (from Instagram photos, Google street views) along signified locations. The resulting representations mediate our experience of a collection of images as a network space (a set of stable relations of an image with other images in a network, in this case tags, location and volume) and our movement *between* these images *through* a confined Euclidian space.

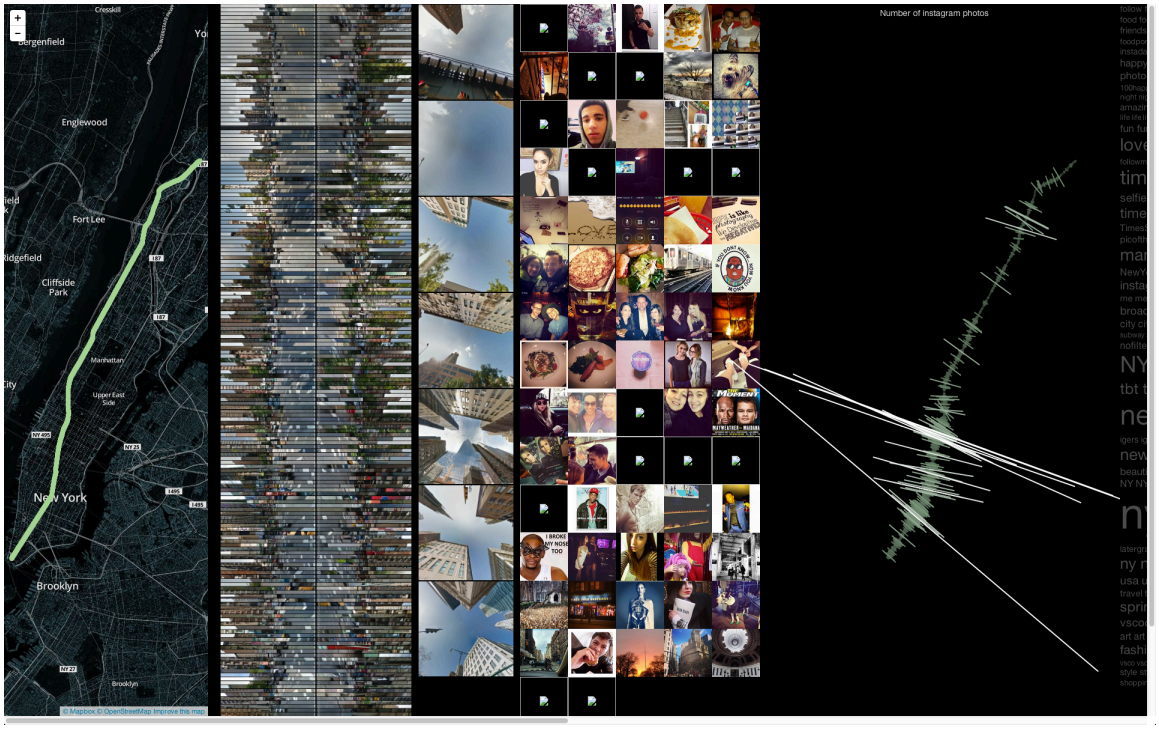



**Figure 37.** On Broadway (2014)

It is this type of understanding that is best understood in terms of what Latour has identified as interplay between immutability and mobility (1986). Immutability indicates a consistent and stable network space, while the mobility, a Euclidean quality, is enabled by the

network immutability (Law, 2002:96). Put in our context, a stable, rigid "immutable" image network space (image structure that includes users, tags or other image metadata) enables its positioning along multiple other images within a Euclidian space, thus creating a sense of mobility and movement from one perspective to another through this reconstructed space. Illustrating the "immutable mobile" principle, these reconfigured spaces enact the multiplicity of spaces within a physical place, and trace the social media elements which generate, and are in turn generated by, a physical place. In short: image network immutability opens it up to our engagement with its physical mobility.

We can also think about the interplay between image network immutability within a Euclidian mobility in a historical way. The immutability of a single image perspectival viewpoint that guided the attention of the classical spectator was created by a pictorial structure that was constructed around a particular point in space (known as the vanishing point in Renaissance painting for example). This immutable point within a pictorial space that was once used to organize all other elements in that space, is now replaced by the immutability of an image structure (i.e. location coordinates or content tags) that exists outside of the image and is being used to organize all *other* images that are connected to it in a Euclidian space. In other words, the immutability of an internal image organizational structure has become external to it, and thus enables our *spatial mobility* within other images that share a similar structure.

The result is a vision that situates the viewer in a complex spatial relationship to the representation, where instead of providing a statically ordered perspectival arrangement as described above, the center continually shifts. These organizational forms construct a view of space which is made out of variable points of view and perspectives from different points in time. The classical perspective manner of looking at things from outer single point in space is

slowly broken into *our movement within all possible (network and Euclidian) spaces within a single place*.

It is in this sense, to continue a similar aesthetic line of thought, that we can think of these representations as having affinities with complex, dynamic multi-perspectival motion in space, like that developed in Baroque art and architecture. According to this polycentric logic, no respect is being paid to the "limit of the image frame" and thus the shifting view points and perspectives allow the flow of the spectator between the inside and the outside of the image (Ndalianis, 2004). The resulted representation therefore tends to "invade space in every direction, to perforate it, to become as one with all its possibilities" (Focillon, 1942: 58).

What is important to remember, however, is that the organization of images according to these parameters still carries the characteristics of *mimetic continuity* with real world spatial references. It places the image as a representation of particular place and then combines it with all other representations of this place in order to capture the multiplicity of spaces that operate within it. On the one hand images are representation of the physical, topological space, but on the other hand they also invent or redefine the spatial possibilities of this space. The organization of large sets of images in a place is a visualization of the work of producing this space. It is a form of spatiality that is reified in a continuous series of individual pictorial enactments, an enactment of a networked space within a physical space. The reconstruction of physical objects through the multiplicity of its representational spaces establishes the representation of a physical object as an intersection of multiple, synchronous network and Euclidian spaces that operate within it. They extend space in every direction yet constitute a cohesive representational whole with all its possibilities.

Let us recap what have been established thus far about the mingled operation of the structural and layered image spatialities within current organizational modes for large sets of social media images. As we have seen, the rigidity of structural networks turns images into layers within Euclidian regions. The combination of these two spatialities treats the visual as *place-bound*, connecting images to particular locations. However, when organized together, these images function as *place-binding*: they unfold to us not *as* places, but through or along places. In other words, the organization of aggregated sets of images are representation of *paths* taken within these places, or better, as I explained, a representation of (potentially) all *possible paths within these places*. A place becomes the intertwining of trails, and the larger the number of "lines" that are intertwined, the greater the density of the representation of this place. When placed over a standardized Euclidian map, cartographic conventions that once signified a mosaic of predetermined areas is now supplemented by the sum of trails or paths that operate within them.

While images as networks and layers/regions are worked together within current visual organizational modes on social media platforms and, as I have shown, emphasize the physical space as the prime navigational tool of large image organization, there are other spatial possibilities. The essential mechanism that underlies the organization of images as networks within regions emphasizes the geographical identification of an image, its continuation with a specific physical space. But what happens if we shift our "core" interest and situate networks of visual meaning productions under a different organizational mechanism? What happens if we refuse to endorse images' physical and mimetic spatiality as the sole mechanism of visual organization? What if we stop thinking about image continuities within a *physical* space and

locate these continuities somewhere else? What type of "data geographies" might these new organizations create?

## 4.3 CONCEPTS, CLASSES AND FLUIDS

The challenge is then to loosen up previous relational (Euclidian and network) knots, and open images to broader (potential) forms of spatialities. We might find such alternatives if we treat images as "concepts." In this third kind of organizational modality, images are analyzed by means of what is termed in computer vision "object recognition" and in the identification of their constituent objects. The task here can be divided into object detection (if we know what type of object we are looking for), or instance recognition (if we have a particular object we want to recognize). A more challenging approach is called class recognition, which includes recognizing diverse instances that relate to the same class (such as "car", "face," or "bicycle" etc. [Szeliski, 2010:657]). As opposed to the accurate reconstruction of 2d or 3D models using images with different views of the same scene, in this paradigm, also known as "generic object recognition" (Ponce et al., 2006) the goal is to reassemble groups of images not according to a fixed, reconstructed, mimetic geographical structure, but rather to organize the documented world by grouping it into similarities of "objects," "classes," "themes," or "scenes."

As demonstrated above, while the accurate reconstruction of physical mimetic scenes is highly developed, visual category recognition is still in its infancy. However, although most existing image search engines depend mostly on image structure (using keywords found in captions, nearby text, or filenames [Craswell and Szummer 2007]), recognition algorithms that

use visual features and visual similarity are gaining prominence and starting to have some impact on visual information organization and retrieval.

The most advanced and prevalent example of organizing images into classes using visual features is face detection and recognition. In addition to simple and now most common face detection in digital cameras and in most consumer photo organization tools (i.e. iPhoto, Picasa, Google+ etc), in other services (i.e. Facebook) faces are not just detected but also automatically tagged and matched by locating similar enough descriptions from different images (Taigman et al., 2014). Other visual search mechanisms such as Google's 'search by image' tool offer a visual similarity application where instead of typing words, it is possible to use a picture and find related images to it from around the Web.[37] The image results are for images that are similar to yours, or Web results for pages that include matching images. Similarly, Flickr and Pinterest incorporated visual search mechanisms that automatically recognize visual content in images and enable users to search their database by image themes and concepts, or to recognize particular items (i.e. the shape of clothing) and show similar items the viewer might be interested in (Constine, 2014; Panzarino, 2014). Other applications (Camfind, 2014; Google Goggles, 2013) uses visual search technology to identify real-world objects and connect them to available similar objects over the internet, or automatically understand where images were taken (i.e. indoor/outdoor), determine the mood of photos, or make style judgments according to particular visual and style identification (Jetpac, 2014).

This visual organizational logic has recently been given artistic expressions. The work *San Diego Study #3* by Cy Kuckenbaker (2013) reorganizes a four-minute footage taken in state highway 163 in San Diego by the colors of 462 cars that passed by during that time and were

[37] See: http://www.google.com/insidesearch/features/images/searchbyimage.html (Accessed 27 July 2014).

captured by the camera. To do this, Kuckenbaker manually cut out each car from individual frames and then replaced them on top of a shot of an empty lane by the prevalence their color: white, silver/gray, black, blue, red/orange/yellow, green. The result actively collapses the actual time as captured by the camera footage by eliminating the duration between the appearance of cars of the same color within it. According to this logic, a place is not represented by a mimetic temporal continuity or its original "travel-time" within real-world spatialities, but rather by the organization of similar "informational species" (Pinte, 2009) of classes, groups, themes, or concepts that (atemporally) exist within it (Figure 38).

**Figure 38.** Cy Kuckenbaker (2013) San Diego Study #3: San Diego Traffic Time Collapsed and Reorganized by Car Color.

A similar organizational principle is offered by the project *The Time of the Game* (2014) by Teju Cole, Jer Thorp, and Mario Klingemann which aggregates over 2,000 different photos of people's screens showing the 2014 World Cup. The photos were submitted by users via the social network Twitter together with the hashtag #thetimeofthegame, and also with time (what

minute of the game was captured) and location indications (where the image was captured). The photos were then identically aligned with respect to the position of the screen showing the games, and designed to create abstractions of the individual images, but still maintain a degree of fidelity with respect to image details and context. Then, the photos were placed one after the other according to their time of creation in order to generate an abstracted, chronological animation of all photos from each city with a green screen as the continual center of the shot.

The work creates a "synchronized view" of the games that turns a public time (the time of the game which is captured and shared by all other viewers of the game) into the equivalent of a public space (encapsulated by the informational collage of all photos from that game at the same time [Meyer, 2014]). This is achieved via a visual continuity that does not merely reflects images' fixed structure (tag, time, location) but also by the identification of a particular content feature within these images and the construction of this feature as the organizing principle of the representation. In this way, the video indeed mirrors Kuckenbaker's work but in a way that *retains a continuous mimetic time but actively collapses space within that time* (Figure 39).

**Figure 39.** The Time of the Game (2014) by Teju Cole, Jer Thorp and Mario Klingemann.

While these two works reflect on a particular organizational principle in which mimetic time and place are suppressed in favor of a visual continuity of particular visual features, they do so superficially without attending to the actual material configurations enabled by computer vision algorithms. Such more complex view is offered by the visualization project selfiecity (2014). Using the case study of a dataset of social media self-documentary images the project experiments with the possibility of alternative visual ordering mechanisms based on multiple algorithmically extracted features from each image (Figure 40).

Using face analysis software (Rekognition, 2014), self-documentary social media images within a pre-selected set were first translated into collections of algorithmically detected categories (pose; race; age; glasses; eyes closed/open; mouth closed/open; gender).[38] In order to organize the dataset of photos in a way that highlights the multiplicity of continuities between different images and collections in various dimensions of the data an interactive tool enables the filtering of the data according to multiple categories. On its upper section, the tool displays charts for all data dimensions that can be filtered (by gender, city, age etc.) by clicking or brushing in a selected color (i.e. cyan) subsets of the overall distribution for each category. Once a filter is set (or a set of filters, as multiple filters can be combined), the lower part of the interface shows all the photos that conform to the filters requirements.

The result is thus the placement of images not solely according to mimetic experiences anchored in specific physical location, but as one of many other organizational possibilities. While the physical place still exists (as you can choose the city in which images were taken),

[38] The photos were first identified as "selfies" by manual tagging using Mechanical Turk. See: http://selfiecity.net/#dataset

images do not function as a continuous representation of physical spatial possibilities but rather as performances of more fluid continuities enabled by means of intrinsic visual "data-binding" methodologies as apposed to former time-space-binding approaches.

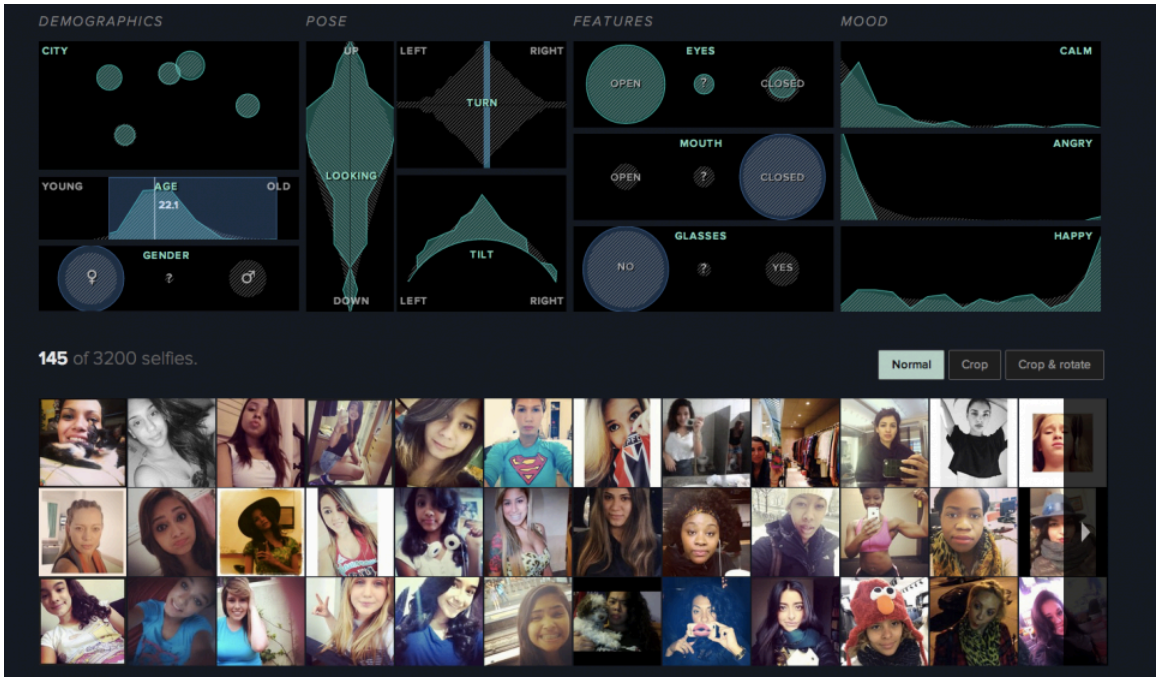



**Figure 40.** A screenshot of "Selfieexploratory", an interactive tool to explore visual continuities in self-documentation photos. See: www.Selfiecity.net

This mutability—the reconfiguration of the image in multiple content proximities with other images—also extends what it is for the image to "work" or "function" within larger networks of visual meanings. However, as it turns out, these continuities and expanded image functionalities are highly variable. The results generated by vision algorithms differ on their level of accuracy for each category, and "read" or identifies instances within the image on a scale of certainty. In the case of Selfiecity, for example, the "FaceDetect" algorithm returns detected faces in each photo, with the location (x,y) of the eyes, nose and mouth, and measurements of their width and height, close and open. Moreover, the algorithm generates estimations as for the mood of the face detected, its race, and gender. For most categories, the algorithm's output is a

floating number between 0.0 and 1.0 scale that indicates the certainty of the category/instance detected. For gender for example, 0.0 would be the highest percentage of certainty of a female and 1.0 for a male.[39] As such the results are never cutoff points that separate two opposite conditions such as 'yes' and 'no,' and thus it is impossible to precisely determine content categories. An image can be identified both as contain "face" and "non-face", "male" or "female", or both "happy" and "sad" on various scales (Figure 41).

| age | glasses | pose_pitch | pose_roll | pose_yaw | smile | eye_closed | eye_right_x | eye_right_y | eye_left_x | eye_left_y | mouth l_y | mouth l_x | nose_x | nose_y |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4.03 | 0.93 | 4.33 | -57.72 | 15.07 | 1 | 0.94 | 130 | 90.7 | 112.5 | 115.4 | 132.3 | 133.5 | 133.9 | 111.2 |
| 6.24 | 1 | -9.27 | -1.19 | -8.59 | 0.08 | 0 | 78.9 | 50.2 | 45.8 | 50.9 | 91.4 | 52.8 | 61.9 | 73.7 |
| 13.11 | 0 | -9.1 | -4.18 | 19.6 | 0.12 | 0 | 96 | 38.4 | 67.8 | 39.8 | 70.5 | 71.8 | 85.3 | 57.1 |
| 14.07 | 0 | -4.6 | 28.19 | 21.21 | 0.78 | 0 | 112.9 | 64.1 | 83.8 | 48.4 | 80.4 | 72.7 | 93.4 | 75.4 |
| 15.05 | 0 | -14.9 | -4.4 | 10.51 | 0.99 | 0 | 100.7 | 82.6 | 77.7 | 84.1 | 109.8 | 84.8 | 94.7 | 102.5 |
| 15.61 | 0 | -6.95 | -17.06 | 31.43 | 0.13 | 1 | 88.7 | 64.4 | 63.7 | 69.9 | 94.2 | 69.8 | 83.9 | 80.2 |
| 15.8 | 0 | -6.63 | 11.9 | -24.64 | 0.99 | 0 | 89.5 | 69 | 49.7 | 62.7 | 96.4 | 46.8 | 59.2 | 86 |
| 16.23 | 0.19 | -15.74 | 6.2 | -24.76 | 0.99 | 0 | 79.7 | 49.7 | 58.9 | 47.8 | 68.5 | 60.1 | 66.1 | 62.2 |
| 16.38 | 0.02 | -13.01 | 1.75 | 6.32 | 0.25 | 0.02 | 78.8 | 70.7 | 50.3 | 69.5 | 102.6 | 53.9 | 64 | 91.7 |
| 16.43 | 0 | -16.8 | -2.64 | -42.49 | 0.44 | 0 | 74.2 | 57.4 | 54.7 | 58.6 | 77.6 | 61.5 | 61.6 | 72.2 |
| 16.44 | 0 | -2.78 | 12.4 | 28.95 | 0.78 | 0 | 112.2 | 74.8 | 80.6 | 66.9 | 106.3 | 75.1 | 96.3 | 92.4 |
| 16.59 | 0 | -8.77 | 1.57 | 39.21 | 0.72 | 0 | 103.7 | 77 | 76.6 | 75.4 | 108 | 74.3 | 94.4 | 96.6 |
| 16.66 | 0 | -18.36 | 6.53 | -37.38 | 0.99 | 0 | 94 | 54.1 | 58.1 | 50.8 | 89.1 | 63.5 | 67.8 | 79.2 |
| 16.83 | 0 | -10.36 | 1.73 | 1.49 | 0.99 | 0 | 80.3 | 27 | 67.7 | 26.6 | 37.5 | 70.1 | 74.8 | 33.9 |
| 16.84 | 0 | -7.04 | 0.47 | -23.29 | 0.31 | 0 | 78.4 | 43.6 | 59.1 | 43.6 | 64.5 | 61.1 | 63.7 | 55.2 |
| 16.95 | 0 | -12.66 | 15.92 | 36.48 | 0.83 | 0 | 101.3 | 57.8 | 65 | 46.2 | 87.9 | 53.4 | 83.7 | 83.2 |
| 17 | 0.1 | -17.69 | -21.31 | -34.38 | 0.74 | 0 | 97.8 | 49.6 | 65.4 | 62.6 | 91.6 | 88.4 | 87.7 | 81.3 |
| 17.03 | 0 | -8.8 | 9.93 | -4.49 | 0.98 | 0 | 102.2 | 53.8 | 59.3 | 46.9 | 90.6 | 60.4 | 77.1 | 77.8 |
| 17.04 | 0.08 | -10.38 | 0.69 | -10.56 | 0.88 | 0 | 96.1 | 76.8 | 78.3 | 76.6 | 94.7 | 79.7 | 85.6 | 87.7 |
| 17.13 | 0 | -11.23 | 3.88 | 28.73 | 0.97 | 0 | 86.4 | 41.1 | 66.7 | 39.3 | 60.5 | 66.4 | 79 | 54 |
| 17.17 | 0.23 | -17.85 | -13.39 | -14.21 | 1 | 0 | 91.7 | 57.4 | 60.5 | 64.4 | 93.7 | 69.2 | 77.5 | 83.4 |
| 17.17 | 0 | -10.2 | -4.69 | 24.84 | 0.88 | 0 | 87.1 | 43.9 | 51 | 45.7 | 81.9 | 57.3 | 75.2 | 68 |
| 17.18 | 0 | -9.7 | 8.44 | -32.75 | 0.99 | 0 | 88.5 | 54.1 | 55.6 | 50 | 84.7 | 56.1 | 63.2 | 73.5 |
| 17.38 | 0 | -13.94 | 9.66 | 12.15 | 0.9 | 0 | 82.8 | 41 | 58.5 | 37.3 | 59.1 | 56.7 | 69.2 | 54.2 |
| 17.58 | 0 | -15.44 | 12.67 | -1.06 | 0.13 | 0 | 89.9 | 35.7 | 59.2 | 29.7 | 60 | 61.7 | 70.8 | 52.6 |
| 17.65 | 0.07 | -14.67 | 15.71 | 8.9 | 0.99 | 0 | 95.8 | 30.6 | 77.9 | 25.2 | 44 | 73 | 83.6 | 41 |
| 17.81 | 0 | -7.9 | -6.62 | -0.88 | 0.86 | 0 | 95.6 | 47.7 | 80.8 | 49.3 | 65.4 | 83.5 | 88.1 | 57.4 |
| 17.98 | 0 | -6.96 | 14.53 | 35.98 | 0.94 | 0 | 85.3 | 95 | 59.8 | 88 | 116.2 | 52.7 | 71.3 | 111.3 |
| 18.1 | 0.36 | -14.99 | -28.15 | -0.6 | 1 | 0 | 70.4 | 46.3 | 35.8 | 64.2 | 98.6 | 52.5 | 63.5 | 80.6 |
| 18.12 | 0 | -15.61 | 38.24 | 28.88 | 0.19 | 0 | 99.3 | 74.3 | 75.9 | 54.8 | 81.7 | 55.9 | 77.8 | 84.5 |
| 18.15 | 0.97 | -2.78 | -4.62 | -21.64 | 0.98 | 0 | 125.8 | 59.1 | 104.9 | 60.9 | 82.5 | 105.9 | 112 | 73.4 |
| 18.16 | 0 | 2.65 | -0.16 | -31.68 | 0 | 0 | 92.7 | 33.3 | 76 | 33.5 | 55.3 | 75.9 | 78.7 | 44.6 |
| 18.18 | 0.46 | -3.03 | -6.21 | -6.73 | 0.95 | 0.94 | 101.2 | 46.7 | 58.6 | 50.9 | 93.2 | 62.2 | 81.1 | 73.9 |
| 18.26 | 0.02 | 1.66 | 5.39 | 57.01 | 0.02 | 0 | 89.8 | 43.8 | 63.1 | 40.2 | 75.3 | 64.9 | 86.1 | 59.7 |
| 18.27 | 0 | -15.4 | 31.29 | -23.71 | 0.99 | 0 | 109.5 | 85.8 | 77.4 | 67.3 | 102 | 67 | 78.3 | 98 |

**Figure 41.** An example of a data output generated by Rekognition algorithms. The indicated categories values are as follows: gender: 0.0 for a female and 1.0 for a male; emotion; race: the return value shows the confidence; age: the person's approximate age; glass: 0.0: without glasses - 1.0: with glasses; mouth_open_wide: 0.0: closed - 1.0: open; eye_closed: 0.0: closed - 1.0: open; beauty: 0.0: normal - 1.0: beautiful.

This last point is also explored by Shinseungback Kimyonghun. In 'Cloud Face' (2012) a set of images of clouds from Flickr were identified by face-detection algorithm as humane faces. Similarly, in Cats or human (2013), human faces were recognized by the algorithm as cats and

[39] http://rekognition.com/developer/face

cat faces are recognized as a human faces (Figure 42). Since the "working" of an image depends on its degree of relatedness to the original image (if we look for matching and similarity) or its degree of fidelity to predetermined categories such as face, gender, race, etc. its placement within a collection is a matter of configurational distance, as apposed to the fairly stable relational image structural and Euclidian distance.

**Figure 42**. Cloud Face (2012) Shinseungback Kimyonghun. Installation view.

But does this mean that the image fails to function properly? That this type of space does not retain a sense of stability and consistency? As these examples show, images functionality within larger visual orderings fluctuates. Since the image does not change only its contexts, it is useful to think about it in terms of what Law has called a 'fluid' object, one that flows between different organizational configurations but retains its shape as it shifts form one context to another (Law and Mol, 2001:6); A state in which "similarity and difference aren't like identity and non-identity. They come, as it were, in varying shades, shapes, and colors. They go together." (Mol and Law, 1994:659)

To elaborate on this last point, what is most important to remember from all these examples is that while algorithmic visual proximities do move and change they always preserve some sense of similarity. But this similarity does not create a mimetic continuity. The appropriate metaphor, then, as also suggested by Law, might be something along the line of Wittgenstein's notion of family resemblance. In this third fluid space, "there is a sameness, a shape constancy, which does not depend on any particular defining feature or relationship, but rather on the existence of many instances which overlap with one another partially" (Law and Mol, 2001:6).

It is, then, an alternative form of organization in which images are not sorted by structural and Euclidian spaces in order to reconstruct fixed *mimetic spaces* (organizing by location or reconstructing location) but are organized in *navigational spaces* by thematic and visual continuity.[40] In these new conditions, no particular structure (metadata) is necessary for image classification and thus larger groups of photos turn into "functionalities." In these new conditions, an organizational imbalance between what was going on outside of the image (metadata) that dominated all previous large-scale visual organizations is now slowly supplemented with the identification and organization of what is going on inside an image. In other words, predetermined and prerequisite network and physical knowledge, categories or structures are neglected in favor of intrinsic image attributes. In short: image first, metadata second.

Let's focus on this last distinction between the mimetic and navigational spaces. My discussion thus far can be framed to deal with the difference between the two in the organization

[40] This follows November et al. (2009) distinction between mimetic and navigational use of maps.

of social media images and the consequences of each for the type of spaces they create. As we have seen, the first and second spaces devise a mimetic continuity which is made by stitching together all possible images over all possible maps (as in some cases you can even replace one layout with another; say a satellite view with a standard map view), and force a constant movement between them (from the abstract Euclidian space to real-world actions taken within that space). In this view, "space is but the virtual image of all the virtual images of all the mapping techniques that have been interpreted in a mimetic way" (November et al., 2010:591).

At the same time, emerging vision algorithms are being used to revise and *reinterpret mimetic space as navigational space.* In these new conditions, there is no longer a projection of a continuous Euclidian space, and the primacy of predetermined territories is supplemented by something else. In this new territory, image spaces are constructed from the calculations and distribution of visual features embedded within the image, and thus the result is something different from previous mimetic mappings. We can think of the two modalities along the lines of what Tim Ingold calls 'wayfaring' and 'transporting'. While wayfaring signifies the organization of information "as paths along which life is lived" (Ingold, 2009:38), transporting information means the organization images across a *surface* (following Unwin, 1981) defined in our case by intrinsic content attributes. Images do not act as paths within real space but rather as sets of points, values and concepts that can travel from one context to another without the need to follow predetermined "lived" trails.

Put differently, while networks and regions are forms of image mimetic organization *in* space—creating a sense of coherence between standardize former spaces (maps) and the representation of documented spatialies within these spaces—fluid spatialities are forms of navigational organization (by creating new typologies, proximities, continuities) *across* space.

These types of visual informational conformity to various organizational mechanisms carry distinctive experiential consequences for what we might call the spatial informational awareness of various wholes: the relations of the part to all other parts in an informational group. In our case, we can articulate these distinct qualities as *vertical and horizontal awarenesses*. The first organizational mechanism *unifies space vertically* as it merges all possible former, historic representation of that particular place and bind them into a unified whole. It is a confined spatial awareness that extends a *single* sense of place and fills it with all possible data about this place (what McLuhan would call a "high definition state" [1964:23]). The second mechanism *unifies space horizontally* as the goal here is not to merge representations of the same place but rather to bind all possible similarities of particularities across different spaces. It is an open-ended and fluid spatial awareness that extends the sense of spatial continuity among a multiplicity of fragments within different places, and gives a small amount of information about each of these individual places (and as such, it is a mechanism of "low definition" spatial state).[41]

To the integrated vertical data geography of images as "locations" and "structures" we now have a horizontally integrated image classification of things (symbols, content, visual features) found in them. The former is held together by chains of mimetic, physical point to point connection, the latter by algorithmic taxonomic aggregation and divisions of the database. This type of fluid continuity allows the incorporation of images that are "others" to the network (i.e. not geo or content tagged) within new forms of large-scale image organizations. It opens the image-object into multiple other organizational possibilities that are not confined by standardized

[41] This type of "informational awareness of the whole" is also reflected in the early work by John Simon 'Every Icon' (1997). The work presents a raster view of an image and its relation to all other possible images that are similar to it. It is a visual organizational logic that depends on a configurational matrix in which each image (or every icon) can be placed in relation to all other possible images in such a way that contains all their typological possibilities. See: http://numeral.com/appletsoftware/eicon.html (Accessed 26 July, 2014).

network or geographical measures. In other words, it turns larger groups of photos into a multiplicity of functionalities.

As opposed to a fairly limited informational configuration produced by a stable set of relations to all other images in a set that are placed as indications of fixed physicality, this new image functionality enables us to fulfill an image configurational potential. In this logic, image fluidity does not mean that the image itself changes but that its functionality changes. The circumstances in which images are experienced, organized, or analyzed change. Continuing a line of thought we discussed earlier, as apposed to images as immutable mobiles (the stability of image structure that enables our experience of mobility in a physical space through these images) in this modality an image becomes a *mutable mobile*.

This mutability within a configurational images space can then be summed up as follows. First, within an organizational fluid modality, an image is broken and turned into a variable object. Images do not exist as fixed entities but rather acts as a gradient, as crossing points between other images with similar visual attributes. As a result, an image can perform multiple continuities and generate "fluid geographies" with other images in a set. It can dissolve itself from one arrangement to another without discontinuity with all other images in a collection.

Lastly and most importantly, a fluid spatiality offers a third spatial metaphor for imagining global visual productions. It suggests that image displacement depends on mutability instead of, or as well as, immutability. While images in the first and second space inhabit a physical mimetic space, groups of images created within fluid spaces reside *in* the world but are not necessarily *of* it. They exist in the world but do not comprise a mimetic representation of the world as their groupings are symbolic or imagined.

All of this is not to say that the third fluid image space exists independently from all other image spaces that are out there. In most cases, visual organizational mechanisms integrate many types of spatial components and emphasize one type of space or the other in different configurations. My goal throughout this chapter was to taxonomize and theorize the distinctive qualities of each image space, and underscore the ways in which the spatial ontology of contemporary visual organizations is also about the varying *representations of "scale-spaces"*[42]—our awareness of the organizational modes of large-scale visual sets and their interpretations, implications and applications of globalized visual spatialeties.

## 4.4 CONCLUSION

This chapter has reviewed, analyzed and theorized the ways in which the social media image inhabits several kinds of space within larger visual arrangements. Using the example of existing, emerging and experimental organizations of large sets of social media images, the chapter has outlined three different visual spatial typologies. First, there are images as 'structure' that measure the distance between images in a network space, and set the properties under which an image participates in the construction of other image spaces ("the formation of a conditional space"). Second, there are images as 'layer/region' in which image structure is placed over a

[42] The term "scale-space" has a rather different and specific meaning in regard to image processing. See: http://en.wikipedia.org/wiki/Scale_space

Euclidian map in order to reconfigure a sense of mobilization within a physical space and visualize its spatial possibilities ("the occupation of a mimetic space"). Third, I consider the treatment of images as 'concept'. In this mode, image organization is not dependent on physical boundaries but rather on "fluid spatiality", a performance of multiple content continuities ("the abandonment of a closed, immobile space and the creation of a navigational space").

As I explained throughout, the deeper question that underlies all these data-driven topologies is how to organize the increasing volumes of documentational data of our visual world, or more precisely, how to collect, segment or organize semantically differentiable scenes within this data? As we have seen, each type of data community, facilitated by the organization of large sets of images, affects the functionality of these images and thus the meaning and experience of images within each community.

Within these organizational configurations, the mingled operation of the first two organizational modalities of networks and regions, images are assumed to always come from one place or another (derived form their identification with particular locations, users, tags etc.). These images conform to mimetic cartographic conventions, occupy predetermined categories and borders, and create a "meshwork of intertwined trails" (Ingold, 2009:42) in which an image is always somewhere. While these types of place organizations dominate current large-scale visual representations, new realizations of space are coming into form. I identified this as the creation of fluid continuity in which images exist within multiple other alternative image spaces and thus (might) come from *everywhere*, and "travel" anywhere. In these new spaces, network space and mimetic space now exists alongside or within fluid, imagined spaces.

The result, however, we have to remember, is not a view from *nowhere,* a neutralized view of objective "infinite space" generated by neglecting physical space in favor of the

organization of other spaces via intrinsic content attributes. While this image similarity space is potentially infinite, its division to discreet semantic categories by the algorithm turns out to be extremely limited, twisted, and finite. This type of algorithmic criticism deserves a detailed examination that is beyond the scope of this thesis.

In any case, whether images are occupants of somewhere, come from everywhere or are inhabitants of nowhere, it is the argument of this chapter that each informational organizational mechanism, each new method of accumulating visual documentations of time and space, has particular consequences for image function, experience and meaning. These material configurations, I have shown, also have particular significations for the way "a culture sees the world, and makes it visible" (Latour, 1990:30). These mechanisms are thus new meeting points of words, images and numbers, new spaces that (might) redefine what it is to see, what there is to be seen, and what remains to be seen.

*

The next chapter expands my discussion on the spatial nature of large sets of photos, and attempts to historicize the notion of hyper-locality—the association of an information item with specific time and place-on social media. I ask: How has the treatment of visual materials historically come to define the relation between a physical place and its visual representations? How are these historical conceptualizations reincarnating in contemporary social media visual organizations? And finally, how do these modes of visual arrangements redefine the relations between physical places and their social media representations?

# 5.0 FROM SITE-SPECIFICITY TO HYPER-LOCALITY

## 5.1 INTRODUCTION


**Figure 43.** 31 Instagram photos taken by Banksy documenting his month long artistic residency in the streets of New York City during October 2013. The photos are sorted by their upload date from 1-31 October 2013 (left to right, top to bottom).

During the month of October 2013 the anonymous British street artist Banksy conducted a month long "residency" in the streets of New York City titled "Better in than out." Nearly every day of that month, Banksy installed a new work in a different location around the city (29 works were installed in physical locations and 3 works were only posted online; typically it was an image stenciled on a wall [Figure 43]). The information about the particular location of each work spread virally online. The artist himself posted a photograph of the work created each day on the

photo sharing application Instagram, and asked his followers to post other photos of the work with the hashtag #banksyny. In many cases, the only way to detect the location of the physical works was to search for their earlier representations online, posted via the #banksyny hashtag. In return, residents and visitors to the city flocked around the city's five boroughs in an effort to catch a glimpse of Banksy's works before they disappeared, defaced or painted over (Smith 2013).

The result of Banksy's artistic experiment was a month long succession of dispersed real-life events and online "data events" (photos and other social media data taken and shared about the events during that month) that mirrored and enabled each other, a reciprocal state of exchange that played an integral role within Banksy's well-rehearsed and thought out artistic investigation: *examining the relation between a site and its logic of reproducibility in social media platforms*. In his month long series of daily works, Banksy observed the ways in which the place he physically marked was documented, communicated and archived via social media.

By doing so, Banksy connected the history of artistic site-specificity (street art) to the history of reproduction by technical and artistic means (photography), and to the growing collapse of the difference between objects, information and places (encapsulated by social media information items). It is this historical trajectory that is the focus of this chapter. I argue that hyper-locality—the term that has come to denote the association of social media data (such as check-ins, tweets, photographs or videos) with specific time indications and place coordinates—can be understood within these historical aesthetical and informational conditions. It is a term that reflects upon the transformation of objects into places, the turning of places into information, and finally, the redefinition of a place and objects within it.

To better describe these conceptual and representational transformations of a place I follow the shift from historic artistic site-specificity to contemporary informational hyper-locality. First, I suggest that current organizations of geographical and temporal tagged images shared using social media platforms are a realization of neo-avantgarde ideas from the late 1960s. While Modernist art objects were detached from the context of the place and time in which they were presented, later neo-avantgarde groups proclaimed the importance of an artwork's site-specificity, where the object could only exist within and be defined by the context of its particular time and place (Buchloh, 1990; Ehrlich et al, 2003; Kwon, 2002).

Secondly, I illustrate, visualize, and analyze various aspects of the hyper-local. Exploring a dataset of 34,522 geo-located and time-stamped user-generated photos taken in three modern art museums, and 28,419 photos taken during Banksy's month long residency annotated with the hashtags #banksy and #banksyny, I examine how these photos represent specific spaces and times.

Finally, I address the ways in which we experience hyper-locality over social media platforms and ask: How is the physical place represented via the lens of social media data? How can we describe the *unique* aspects of this locality? Based on our historical discussion and the case study, I propose key characteristics of hyper-local visual social media data.

## 5.2 BACKGROUND

"Hyper-locality" has recently gained popularity as a term that describes a wide range of meanings. Most often, it is mentioned in the context of the news media's increasing ability to provide information in highly targeted geographic niches (Jarvis, 2009; Miel and Faris, 2008). In

this context, it refers to information that originates from organized online communities or individuals such as bloggers (Metzgar et al., 2011), or from user-generated social media that is automatically augmented with location information and timestamp (Hu et al., 2013; Ewart, 2013).

Existing research touches upon various aspects of hyper-locality, and offers conceptual and analytical tools for the study of its socio-cultural aspects. Wilken and Goggin, for example, offer a comprehensive account for the ways in which place and mobile technologies intersect and interact (Wilken and Goggin, 2012). Gordon and de Souza e Silva (2011) provide a useful discussion of the socio-cultural effects of "networked locality" (Gordon and de Souza e Silva 2011). In an earlier work, Dourish points to ways new technologies produce alternative spatialities and appropriate existing places in new ways (Dourish, 2006).

However, none of these studies agree upon the definition of hyper-locality, or propose concrete characteristics of hyper-local social media. Identifying a similar shortcoming, Metzgar et al. (2011) attempt to define the hyper-local, but their definition refers to geographically specific communities and organization of news reporting over the web, thus neglecting the ways in which different aspects of hyper-locality manifest themselves on social media.

Computer scientists offer an ever-increasing number of studies of hyper-local social media data (Cranshaw et al., 2012; Xie et al., 2013). However, while a few studies examine the particularities of a place via social media data do exist (Winter et al., 2009), the majority of this research is devoted to the study of the relation between *groups of places*, typically applying clustering or other methods in order to analyze social similarity between different geographical locations (ElGindy and Abdelmoty, 2012; Zhang et al., 2013). The results are homogeneous clusters of fixed entities that erase the particularity of a singular place, neglecting its dynamic,

temporal aspects in favor of its aggregation and categorization with other similar "types" of places (i.e. areas frequented by locals versus tourists; or defining the boundaries of a city based on clusters of places people attend frequently). Put differently, existing computational research typically looks for geographical *homogeneity* and neglects the *heterogeneity* of physical places as these are seen through the lens of hyper-local social media data. In doing so, it does not try to find ways to trace and analyze the particularity of unique singular places as they are represented in social media.

Guided by these shortcomings—the lack of consensual definition of hyper-locality on social media, together with the tendency in computational research to ignore the distinctive expressions of this locality in particular places—I offer a historical and theoretical discussion of the unique performances and exhibitions of a place (Hogan, 2010) in social media visual data. Specifically, I consider the following questions: How do the treatment and organization of visual materials have historically come to define the relation between a physical place and its visual representations? How are these historical conceptualizations reincarnating in contemporary hyper-local visual organizational forms? And finally, how do these forms of visual information redefine the relation between physical places and their social media hyper-local representations?

## 5.3 NOMADIC VS. NATIVE

In April 2011 a seemingly insignificant and minor structural change made by Bing image search engine radically disrupted the delicate relationship between content producers and their informational platform. Since then, searching for a particular image has resulted in continuous thumbnails of related images, that if clicked through, lead the viewer directly to the image itself,

disconnected from its original source page (Schwartz, 2001). Two years later, Google image search followed the same path and redesigned its interface to present hi-res images directly on Google's website instead on the original website (Wikipedia, 2014a). Both interface changes were followed by controversies of individual content providers against the giant companies over copyrights infringement and the loss of web traffic. These were a limited set of disputes that was quickly silenced and did not record any noteworthy effect to what immediately became a new informational norm.

But these anecdotal structural informational modifications also suggest something else. What we have here are opposing visual organizational logics—put fourth by prominent search engines in contrast to the desires of individual content providers that seek to preserve the original context of their visual data—that point to two prominent contesting modes of contemporary visual information organization. On the one hand, a "nomadic" visual logic, epitomized by prominent search engines, in which images may be placed singularly or collectively but are always stripped away from their original contextual source (i.e. webpage, user, location etc.). On the other hand, a "native" organizational mode that sets the image within its original environment or in direct relation to it. This structural logic is exemplified by social media platforms that arrange images *in* and *as* particular place and time. In this case, images are annotated with geographical and temporal metadata, and are sorted by upload time (typically this is the default representation) or by location (either on a personal photo map or collectively showing all images tagged to a place).[43]

[43] Notice that while these arrangements are currently the prominent ways to organize visual information, other possibilities do exist. For example, images can be sorted based on the interest of other people you follow (i.e. the Explore tag in Inastgram) or by algorithmic arrangement of content according to user's previous actions.

What are some of the possible histories of these two types of nomadic and native organizational forms of visual materials? What do these historical traces of similar visual informational understandings can tell us about the current structures and experiences of hyper-local images? I believe that the tension between the nomadic and native informational modes used to present images is not new. For example, if we look at the history of Modern art, we can find similar modes. The first resembles earlier conceptualization of visual materials from the beginning of the 20th century; the second corresponds to site-specific artistic practices, which emerged in late 1960s.

In fact, the nomadic notion of images has always been integral part of the emergence of what we have come to know as the contemporary form of an image. From the development of new physical conditions for the creation and transportation of images (i.e. the portability of easel painting in the early Renaissance; the use of canvas support; or the development of the bounding frame) to the formation of particular visual content attributes (compositional dependencies of form and narrative; or the implementation of linear perspective)—all served as a ways to liberate the *internal* representational space of an image from particular social and spatial contexts *outside* of the image (Roberts, 2014:2).

It is also this type of detachment of the physical from the (now) autonomous representational image format that culminated with the aesthetic autonomy that defined modern art practices and its theory. Modernist artists saw a visual art object as a thing in itself, which was not affected by the time and place in which it was presented. The spatial organization of the visual object was not supposed to impact the meaning and understanding of this object, and thus the white neutral museums walls were the ultimate venue for their presentation. The work was

designed for the “white cube”—an exhibition interface that could be located anywhere (O'Doherty, 1999). Figure 44

**Figure 44.** Elmgreen & Dragset (2014) The “Named Series.” Each frame consists of the color layer of a wall from a number of prominent art institutions’ white cube exhibition spaces (i.e. Centre Pompidou, Guggenheim, Tate Liverpool and others). The removed layers are mounted on canvas and framed in a black waxed oak frame. Photo by Anders Sune Berg (Installation view as part of the exhibition Biography, Astrup Fearnley Museum, Oslo)

Turning against this notion of treating the visual object with no relation to the distinctive qualities of a particular space in which it is being located, starting in the late 1960s neo-avantgarde groups (specifically, artists creating happenings, performances, and site-specific works) offered completely oppositional understanding of the visual object, and emphasized how the meaning of the artistic object is derived from the particularities of its organization in time and space. These avant-garde groups aimed to relocate the meaning of the visual from what was

going on inside it, to everything that is going on outside of this object. They sought to turn our attention from within the art object to the "contingencies of its context"; to shift Modernist understanding of the visual as independent from time and space towards a more sensorial, phenomenological understanding of lived bodily experiences around that visual object (Kwon, 1997:92). In short: to re-attach the visual to a particular time and site.

In this new paradigm, a site-specific work was conceived as a unique combination of phenomenological experiences that depended upon physical particularities (dimensions such as depth, length, height, temperature, etc.) and our experience of these conditions in defined times. In later stages, other site-specific practices expanded into the inclusion of social, institutional and discursive constructions of a place and responded to them (p. 92). In any case, whether a place was defined physicality, institutionally or discursively, the purpose was to secure the specific relationship between the visual and its (material or immaterial) site.

A famous early example of these new relations between the particularities of a place and the visual art object is Robert Smithson's *Spiral Jetty* (Figure 45). To create this 1970 sculpture located on the northeastern shore of the Great Salt Lake, the artist used local mud, salt crystals, rocks, and water. The result was a 1,500 foot long and 15-foot wide counter clockwise coil jutting from the shore of the lake (Smithson et al, 2005). As opposed to Modernist art objects (such as abstract paintings by Mondrian or Malevich) that were portable, nomadic, and could move from one museum space to another—and as such were "timeless," "placeless," and detached from any relations to their original time and place of creation—*Spiral Jetty* emphasizes the dimension of time, and the particular material condition of its place (the visibility of the sculpture depends on the water level of the Great Salt Lake). It is "an emblem of [the]

transience" (Owens 1980: 71) of a particular place, and a manifestation of a particular time-place relationship.

**Figure 45.** Robert Smithson (1970) Spiral Jetty. Sculpture. Rozel Point, Great Salt Lake, Utah.

Miwon Kwon efficiently describes these new relations in terms of "nouns" and "verbs." The modern, "nomadic" notion, saw the visual object as a *noun/object* to be experienced in complete detachment from its place and time of presentation. In contrast, the "native" realization of the visual by the neo avant-garde of the 1970s turned it into a *verb/process* that is all about its relations to its surroundings in particular times (1997:91). These opposing views also stem from a different understanding of the physical site itself. On the one hand a site is viewed as an actual, singular, unique *physical* location that exists "out there" as a fixed entity. On the other hand, a site is not defined as, or is privileged by its physicality, but rather by all other (material and immaterial) things that *flow* within it.

It is in this sense that we can think of the contemporary geo-temporal digital image (the image which has spatial coordinates and a time stamp) as a new realization and amplification of this neo avant-garde concept. It actualizes their historical aspirations to locate the meaning of the visual in specific time and site, and materializes their desire to understand a visual object as a segue for "place attachment" (Low and Altman 1992) that captures lived, timely, fleeting and unrepeatable sensorial experiences within that site.

Through the lens of the multitude of visual and textual hyper-local activities, a physical site is no longer viewed as a fixed spatial entity (noun/object) but rather as a set of immaterial or informational "verbs" or "processes" that move through it. This site is remarkably similar in nature to what James Meyer has labeled as a "functional site" in relation to later site-specific artistic endeavors. This new type of site does not necessarily occupy a physical place, but is instead "a process, an operation occurring between sites...an informational site, a locus of overlap of text, photographs and video recordings, physical places and things... a temporary thing; a movement; a chain of meanings devoid of a particular focus." (Meyer, 1996:21)

Neo avant-garde ideas are thus infused with contemporary informational techniques in order to guarantee the specific relationship between the visual and its "site." Like in all former site-specific practices, these new relations reject the detachment between the physical and the representational, and insist on the representational *as* the physical. By ingraining the visual within specific time and place and presenting it as a particular, unrepeatable, experience of that place (accentuated by its near real-time presentation) the hyper-local signals and verifies the *permanence* of a place (its "existence") but at the same time manifests its *impermanence* (how it changes). Together with all other images from that particular place a greater sense of transience is materialized and visualized.

Modern art museums are one of the best examples for the ways in which a venue turns into a set of durational, momentary functions; a site where nomadic objects become native, and the intricate historical relations between the two conceptual modes are culturally recharged and accentuated. Within their confined walls that once signified the detachment of the physical location from the representational object, new documentational mechanisms have enable a new way to *reinvent nomadicity as site-specificity*. In this way, photos, videos and texts are shared around the museum experience and are informationaly associated with the museum (via location coordinates; or content tags). They mutate the artistic object into the sum of its interactions with all other viewers of the same object, and also with all other visitors to the location of the object. This location associated information item also reflects upon the institution where the object is located (via location identification), the discourse around a particular object (via content tags), or the phenomenological nature of the experience of the object (via the photographic distance from the object, angles of view, number of people viewing the same object, their origins [locals/tourists] etc.) (Figure 46, 47)

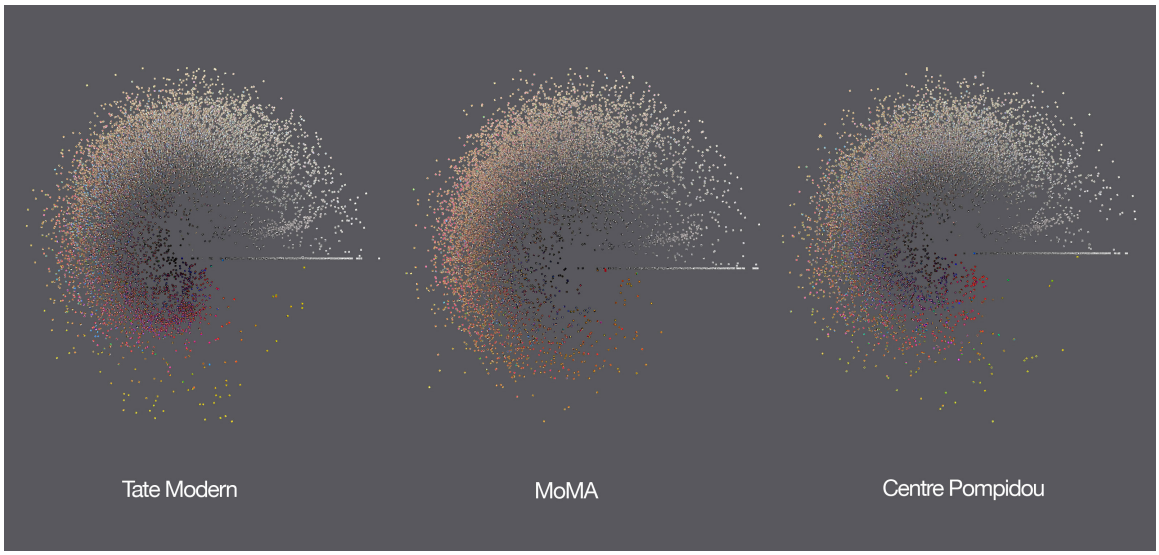



**Figure 46.** A comparison of Instagram photos taken at Tate Modern; MoMA, and Centre Pompidou. Each radial

visualization contains 10,000 photos actively tagged to the location of the museum by its users. The photos are sorted by saturation mean and brightness mean.

**Table 2.** Computed average visual features values

| Museum/Value | Hue mean | Saturation mean | Brightness mean |
|---|---|---|---|
| Tate Modern | 0.3543 | 0.3261 | 128. 133 |
| MoMA | 0.3008 | 0.3267 | 131.33 |
| Centre Pompidou | 0.3793 | 0.3216 | 124.02 |

It is in this sense that we can think of the hyper-local as an *amplification* of former site-specific relations. As previously explained, site-specificity diverges itself from all former nomadistic approaches by establishing indexical relations between an object and a place. While earlier nomadic conceptions positioned the signifier (the object) and the signified (the viewer) in an autonomous "here and now" esthetic affect of the former over the latter, site-specific notions situate the place, the institution or the discursive practices around a place as the signified (Kwon, 1998:98). These exact relations are replicated with hyper-local images that now reestablish former nomadic and native indexical relations but point to *all* these signified levels *at the same time.* The image is multiplied and positioned in relation to the visual content of an object (via image content), the institution where this object is located (via location identification and tags); the viewer of the object and the performative qualities of the representation, and finally in relation to all other images that facilitate similar indexical interactions and enable the production, dissemination, and verification of a representational social media place.

**Figure 47.** The nomadic is turn into native. Top: a montage visualization of 4,522 photos of the work *Starry Night* by Vincent van Gogh, located at the Museum of Modern Art (MoMA), New York City. The photos were extracted from a larger heterogamous set of Instagram photos tagged with the hashtag #MoMA and taken between 5 September 2010–19 October 2013. The photos are sorted by angle of view (right: 924 photos, left: 981 photos; center: 2617 photos). Bottom: a close up.

## 5.4 FOLLOWING BANKSY

While this trajectory does shed light on some historical parallels between dominant conceptualizations of the relation of the visual to its place, or the organization of the visual within a place, it is not complete. We are still concerned with the *distinctive qualities* of these hyper-local indexical relations: How does hyper-local visual data *diverge* itself from former site-specific practices? What particular type of indexicality it generates? What are the terms under which these functional hyper-local sites exist and represented?

In order to examine the conditions under which locality is reproduced and experienced via social media data I now turn to analyze a set of photos taken, shared and tagged to Banksy's month of residency in NYC. First I describe the dataset and computational techniques. Next, I visualize temporal, spatial and visual patterns within our dataset. Finally, based on the results, I propose some key characterizations of hyper-local social media data.

Using Instagram's API (application programming interface), I crawled photos and their metadata (user ID, latitude and longitude, comments, number of likes, date and timestamp, type of filter applied, and user–assigned tags) to find all publicly available photos with tags #banksy and #banksyny. I then created our data set by filtering these photos in the following way. I chose photos with the tag #banksyny shared from October 1st, 2013 until November 20, 2013. For photos with the tag #banksy, I included only the ones from October 2013 geo-tagged to NYC area. Since there was some overlap between these two sets, only one copy of each image was included. After this filtering the final data set has a total 28,419 photos (18,533 photos tagged #banksyny, and 9,886 photos tagged #banksy).

The dataset includes multiple photos of the same artwork taken by different people. We used a two-step method involving computer vision techniques to find all photos documenting the

same artwork by Banksy. We first identified clusters of photos that represent the same work, and then used these clusters to train a classifier to find more images of the same work.[44] Out of our full dataset of 28,419 photos, we decided to only use photos showing seven artworks. We selected all photos showing each of the works (4,559 photos in total), and numbered these clusters as illustrated in figure 48 and 49.


**Figure 48**. Instagram photos of 7 of Banksy's artworks used in our case study (selected from the larger set of photos for each artwork). Top: original photo posted by Banksy. Bottom: a montage of 4 photos taken by other users.

[44] There are numerous features that can be used to represent images for recognition and retrieval purposes (Szeliski, 2010). We used 150 x 150 pixels versions of Instagram images available via Instagram API. The images are in RGB format. We have used the raw pixel values as a vector for training (thus, for each image xi we have xi 2 Rn where n=150→150→3=67,500). To speed up training of the clustering and classification algorithms, we use Principle Component Analysis (PCA) and select the top 80 principle components to reduce the dimensionality of the data.

Using these 80 values, we clustered the images using the K-means clustering algorithm. In the K-means algorithm we must select the number of clusters we wish to find a priori, and here we selected this to be K = 500 and iterated the algorithm 50 times with random initializations. We found the "top" clusters by ranking clusters from the lowest average distance of images to their respective cluster center, to the highest. As even clusters that consist mostly of a single work will have false positives we manually removed such images.

As the resulting clusters contained photos of only a single work, we now had a labeled data set. Using this labeled data set, we trained a Random Forest classifier with 500 trees and used it as the test set for the images that were not part of the "top" clusters. We used the predictions of the Random Forest classifier to find additional photos of the same work that were not detected in the first step (Hastie, Tibshirani, and Friedman 2008).

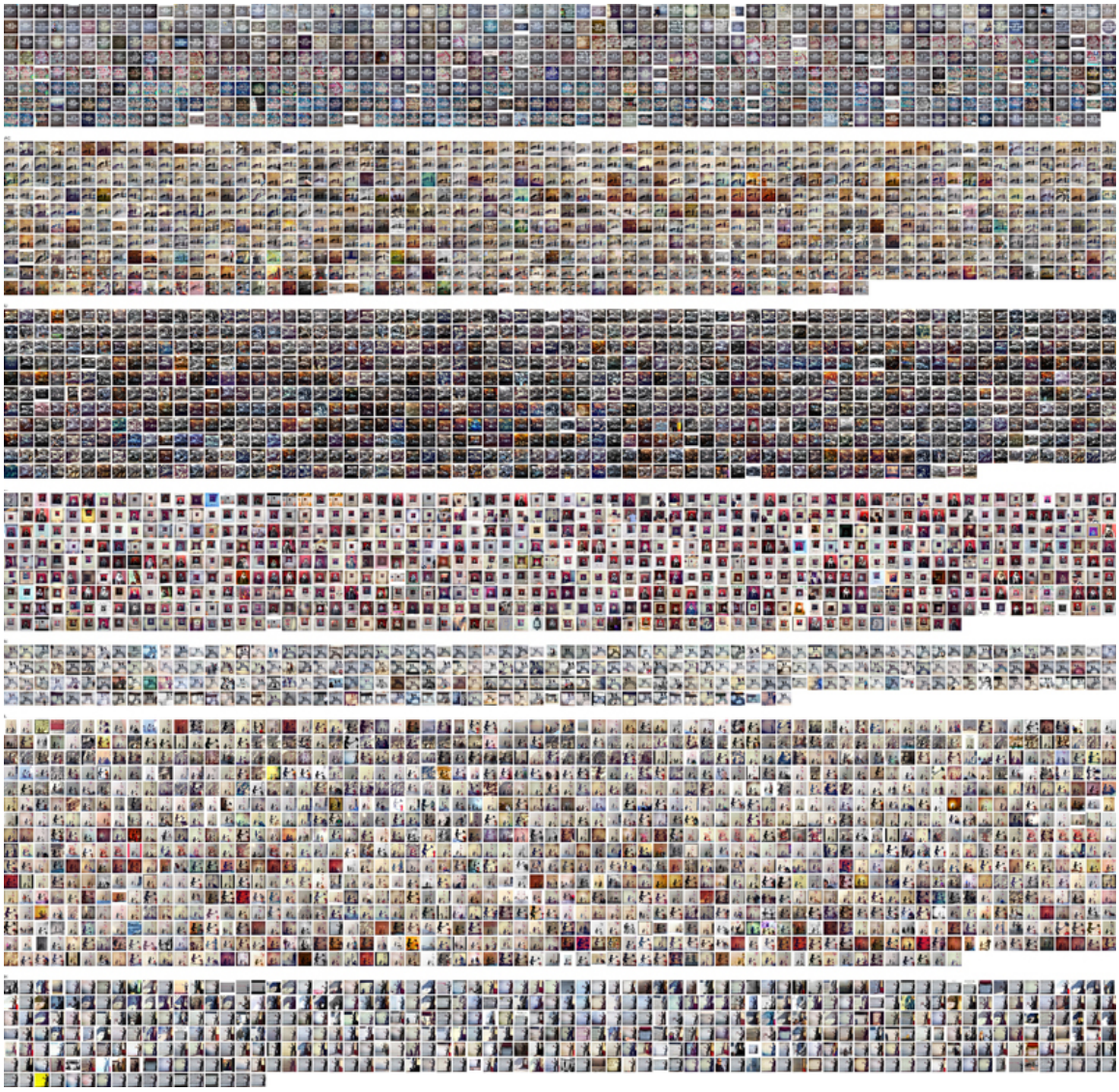


**Figure 49.** Montage visualization of all photos from each cluster sorted by time from no.1-7 (top to bottom). Each cluster includes the following number of photos: Cluster 1: 575 photos. Cluster 2: 704 photos. Cluster 3: 783 photos. Cluster 4: 638 photos. Cluster 5: 267 photos. Cluster 6: 1,142 photos. Cluster 7: 449 photos.

### 5.4.1 Temporal Patterns

Each photo in our dataset is stamped with its specific upload time to the application. This allows us to look at temporal patterns in the data. First, we plotted the entire dataset of images to show the volume of shared photos in each day, from October 1st to November 20 (see Figure 50). The least number of shared photos is on October 6, when no new work was announced. The highest number of shared photos in our dataset was on October 20, for the work in cluster 6.

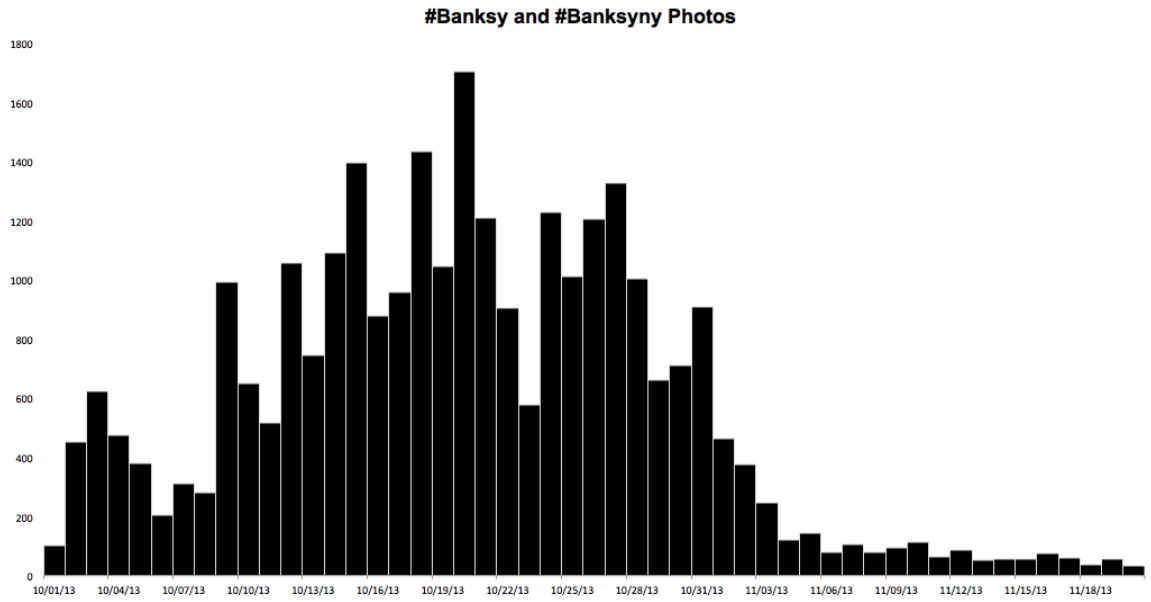



**Figure 50.** Number of photos annotated with the hashtags #banksy and #banksyny (a total of 28,419 photos) for each day from October 1st to November 20th 2013.

We also plotted the data over time for each cluster (Figure 51). While all clusters show a similar pattern (first a few photos, then a rapid rise, followed by a gradual decline), a few unique patterns emerge.

In two cases images were posted before Banksy's own photo of the same work. In cluster 2, nine users posted a photo of the artwork one day before the it was announced and posted on Banksy's account and website. In cluster 4, fourteen users posted a photo of the work starting

from ten days before Banksy posted a photo of the work on his official Instagram account. As we can tell from these results, some of the works were installed a few days before their official announcement, and were then detected by social media users.

Cluster 3 also has an unusual temporal pattern. While photos in all other clusters continue to appear after the peak throughout the whole period we analyzed (up to November 20), photos in this cluster abruptly stop on October 31st 2013. And finally, in cluster 7, contrary to all other clusters, many photos of the new artworks were posted at nearly the same time.

In summary, every hyper-local event in our case study—the creation of a new artwork by Banksy and photos by users of these artworks shared on Instagram—has a different temporal profile in the beginning. In other words, while the "tails" are rather similar, the "heads" are different.

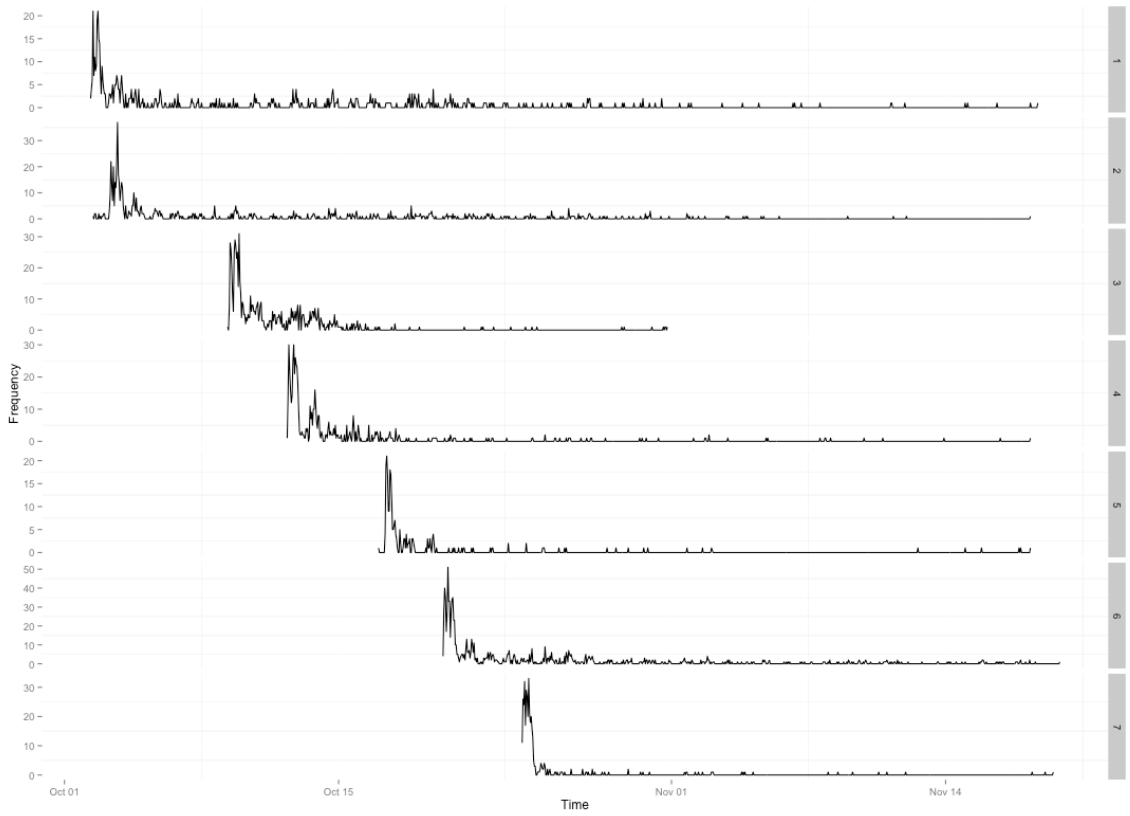



**Figure 51.** A temporal plot of each cluster organized by time (X) and volume (Y).

### 5.4.2 Spatial Patterns

Our data contains 65.9% geo-tagged images. To study the global spread of a local event via social media, we visualized the data in two ways. First, we plotted all geo-tagged images with the tag #banksyny and #banksy over a world map in order to locate the geographical "boundaries" and see how far the photos of particular artworks have travelled (see Figure 52). While 16,164 photos are from NYC area, 2,571 photos of the event are spread over Europe, Australia and the West Coast of the US.

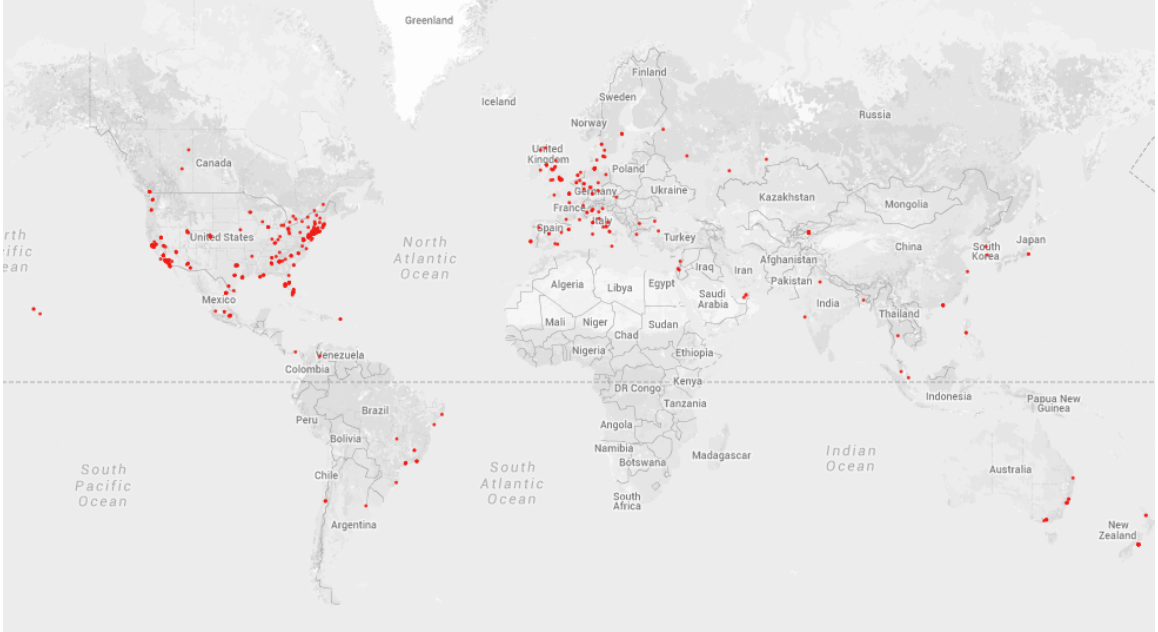



**Figure 52.** A global spread of all geo-tagged images with the tags #banksyny or #banksy. 16,164 images are in NYC, and 2,571 images are outside of NYC area.

Then, we plotted our 7 clusters over a world map using different colors for each cluster, to see the spread of photos of each work (see Figure 53). As the visualization shows, some clusters are more concentrated than others, and remain in their confined original places where artworks were created (i.e. cluster 5) while other clusters are spread all over and outside New York City.

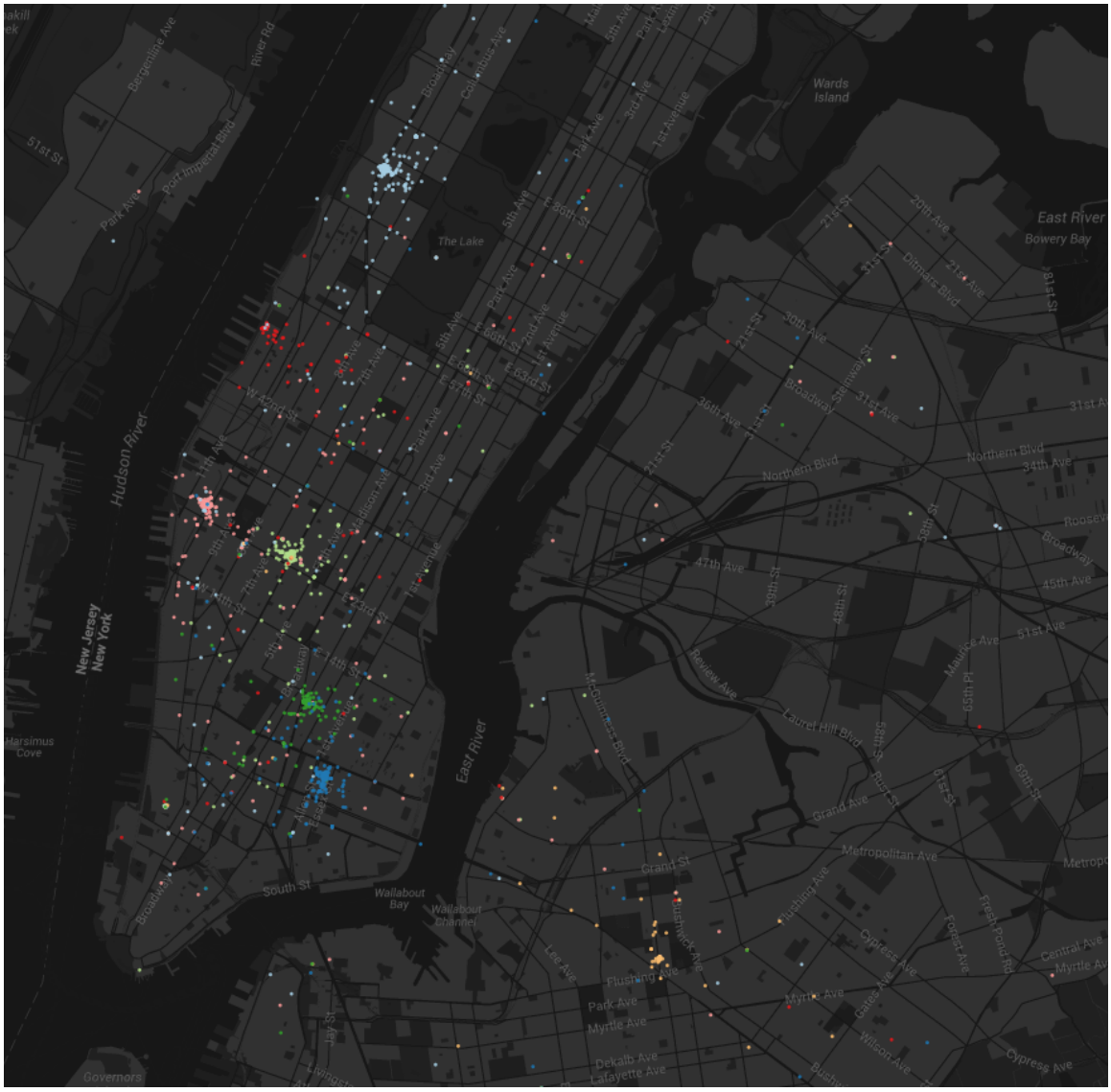
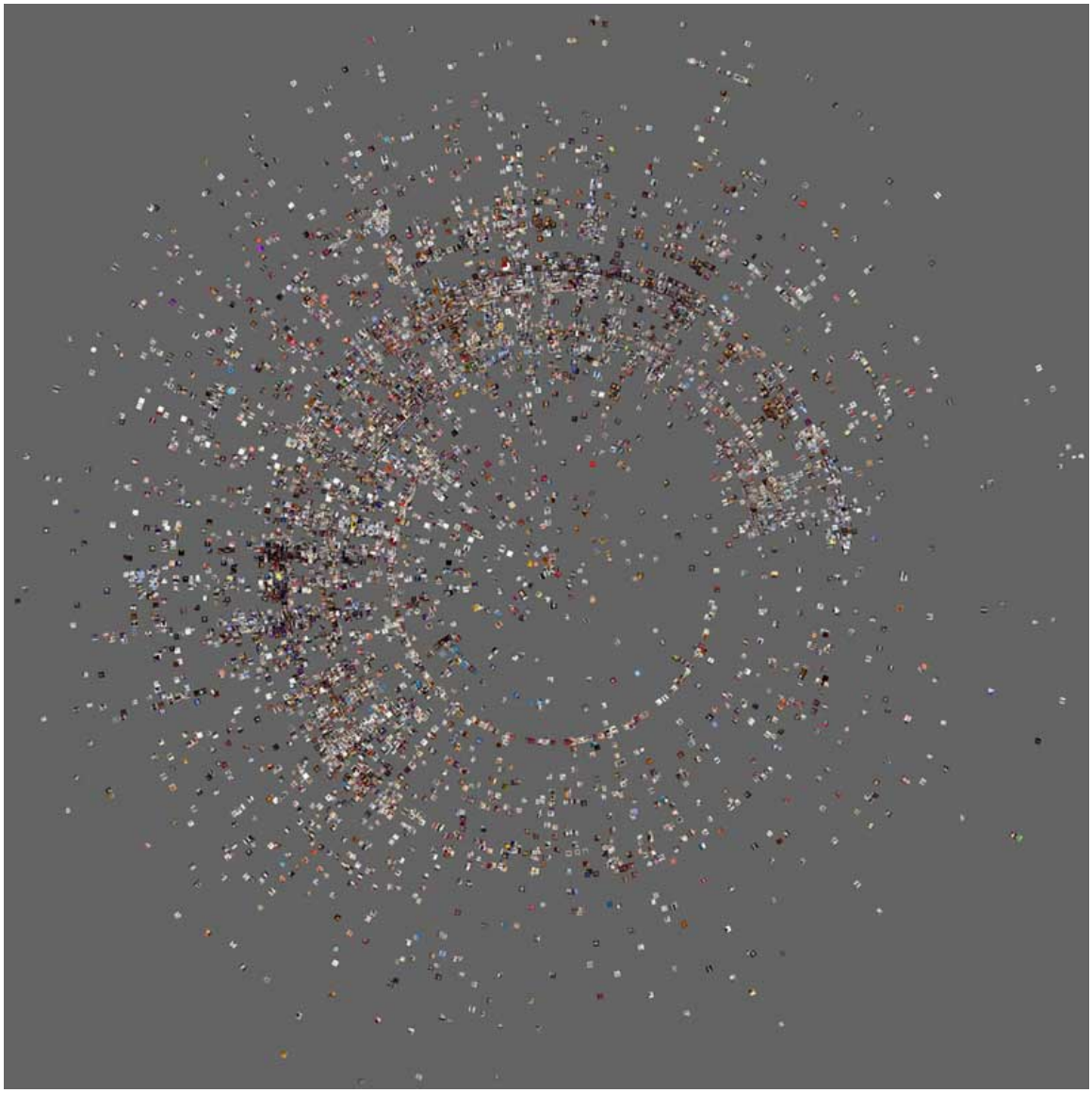



**Figure 52:** A map of locations of all photos from our 7 clusters (Only NYC area is shown). Each cluster is colored in order to represent the spread of photos of the same artwork: Pink - cluster 1. Light Green - cluster 2. Blue - cluster 3. Green - cluster 4. Orange - cluster 5. Light Blue - cluster 6. Red - cluster 7.

In addition, we visualized 16,164 images geo-tagged to NYC area (from both #banksy and #banksyny sets) using a radial layout, sorted by location (perimeter) and upload time (angle) (Figure 54). Each “ring” represents a different location in the city and the location on the ring represents the upload time of an image. Each ring is assembled by photos of the same work

(since they are from the same location). Similar to Figure 51, this visualization shows how each ring has a different “life span”, and allows us to compare content of images, locate areas with concentration of images, and compare differences and similarities between different locations and time periods (The original visualization has resolution of 20,000 by 20,000 pixels, which allows us to see details of all photos [see close up in bottom of Figure 51]).



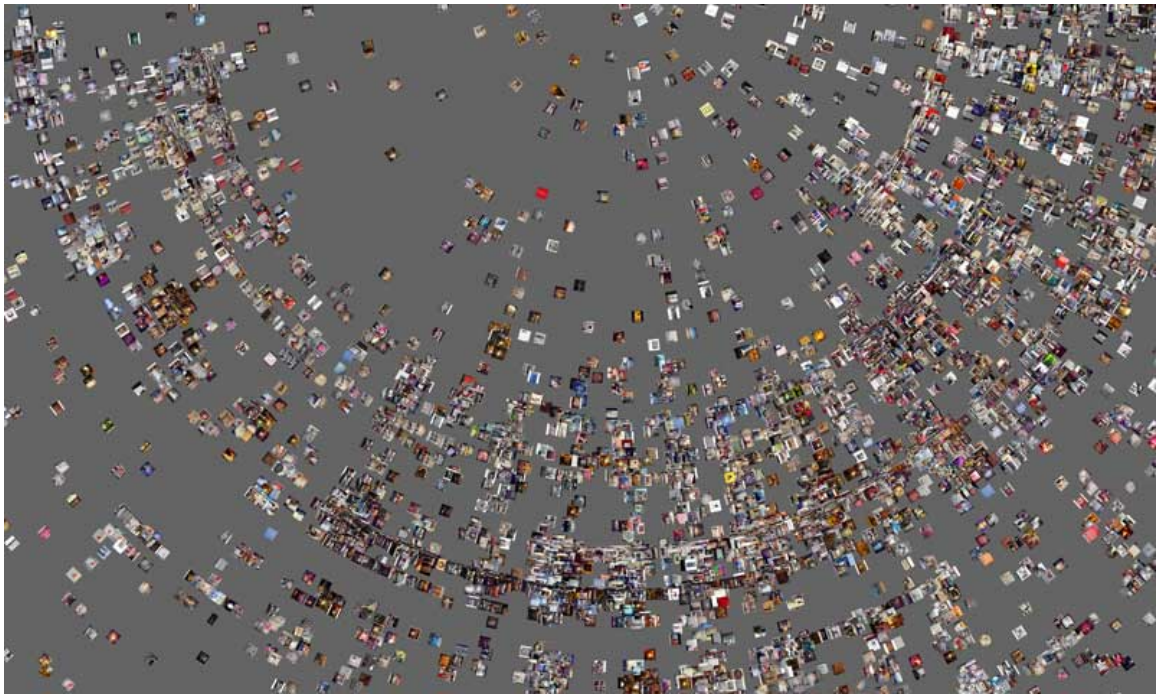


**Figure 51.** Top - Radial visualization of 16,164 Instagram photos geo-tagged to NYC area between October 1 and November 20,2013. The photos are organized by location (perimeter) and upload date and time (angle). Bottom - Close up.

### 5.4.3 Visual Patterns

Our informal examination of photos in each cluster revealed significant differences in their visual characteristics. There are multiple reasons for these differences, ranging from different conditions when photos were taken (time of the day, weather) to the use of Instagram filters. While some of these differences are not intentional, others are. By adding a filter, or photographing an artwork from a particular angle, or posing with an artwork, or interacting with it in some unexpected ways, people add their own meanings to the artist's works. While such additions and "rewrites" can also be found in earlier contexts (for example, fans creating their own versions of Star Trek episodes, or participating in an art happening), social media

photography as exemplified by Instagram offers new ways of interpreting or rewriting the message of a hyper-local event, and immediately sharing it with others.

To further study the visual differences in the photos in each cluster, we extracted multiple visual features from each image (contrast, hue, brightness, etc.) and plotted all images in each cluster using the values of these features. In Figure 52, we visualized photos in each cluster organized by brightness mean on X axis, and hue mean on Y axis. We indicated the locations of the photo taken by Banksy himself using red squares.

This allows us to see the positions of Banksy's own "official" photos of his artworks in relation to all other photos of the same artwork taken by other people. The visualizations show that visual variability (at least, as indicated by the two features we used) changes significantly from cluster to cluster (due to the different colors of each work, location, time of day, and other factors). They also show that Banksy's own photos do not lie in the center of the clusters. Instead, the photos of other people create their own center—an unofficial "canonical" image of the artwork different from that of the artist himself (if we want to quantify this observation, we can calculate the distances between the center of each cluster and the original photo taken by Banksy).

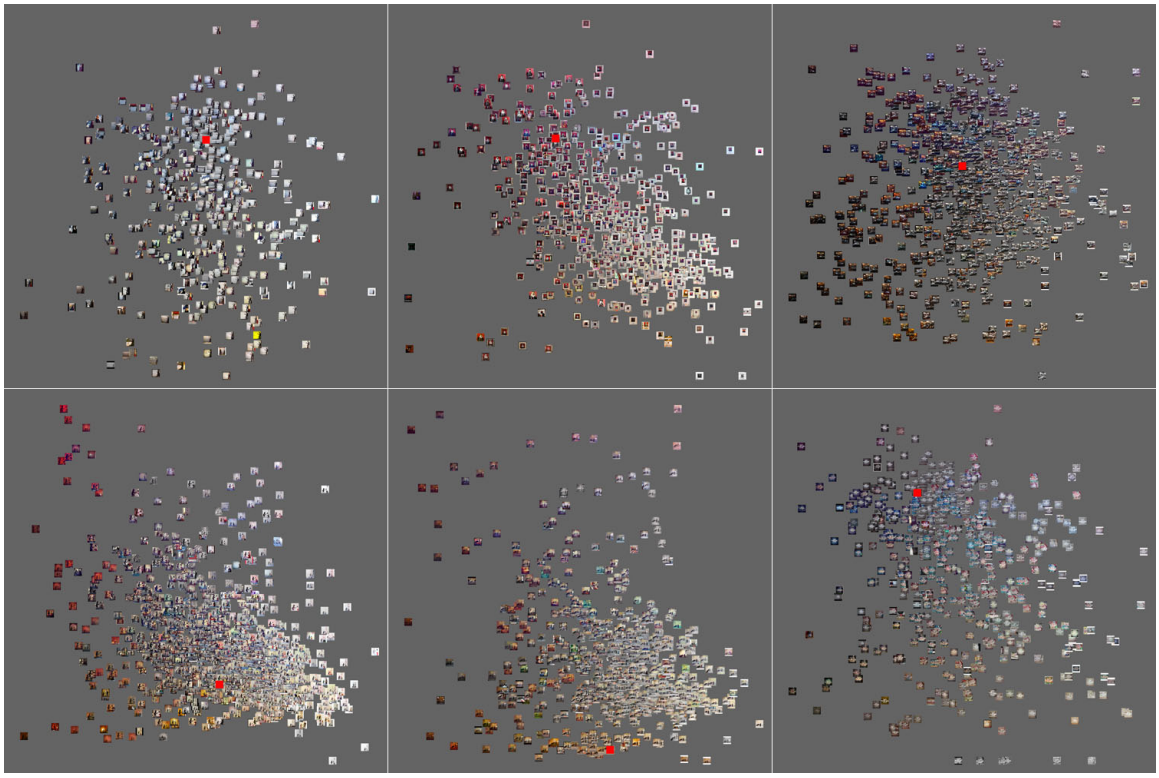


**Figure 32.** A matrix image plot visualization of 6 clusters. In each cluster, (X) - brightness mean, (Y) - hue mean. A red square represents the original photo of an artwork posted to Instagram by Banksy himself. Top row from the left: cluster 1, cluster 2, cluster 3. Bottom row from the left: cluster 4, cluster 6 and cluster 7.

We also analyzed the presence of people in each of our clusters. While in cluster 6 we found 17.3% of photos with people in them, in cluster 2 we only found 7.2% percentage of such photos. These results show how the design of the work in a particular place affects social media activity within this place. In this case, two relatively similar works generate significantly different reactions as manifested in their social media representations. (See figure 48 for images of these works.)

Finally, we sorted each of our clusters by time and hue. These visualizations reveal the changing appearance of the artworks over time, as each was repainted, sprayed and manipulated. Figure 53 shows these patterns of visual change over time in cluster 2 (left) and cluster 1

(middle), organized by hue mean (X) date and time (Y). Cluster 1 shows an interesting pattern. An early photo of the work taken when it initially appeared was re-circulated time and again, and appears at different later times, together with photos of the work in later stages after it was sprayed on and damaged (see close up on the right side of figure 53).

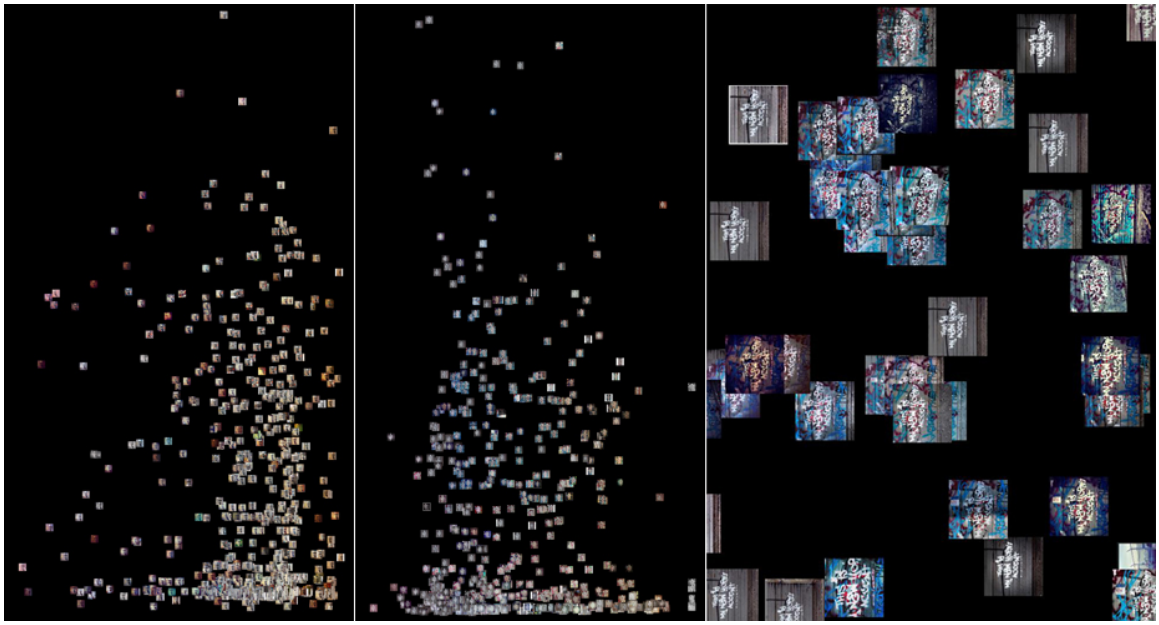


**Figure 53.** Visualization of cluster 2 (left) and cluster 1 (middle), sorted by hue mean (X) and date (Y). Right panel shows a close up of cluster 1. The visualization is rotated 90 degrees.

## 5.5 ON HYPER-LOCALITY

If social media hyper-local data is a particular manifestation of a "hyper-real" world (Eco, 1986)—where images and simulations of an event have greater significance than the actual site where this event took place—Banksy's art project in New York City can be seen as a poetic inquiry into the conditions of a representational "data superiority" over physical inferiority.

The distinguishing characteristic of the social hyper-local and the site-specific from all other previous models is the ways in which a site becomes *secondary* to all (artistic or social

media) actions taken within it. The physical site is not stated as a precondition but is generated by the convergence of all social media or artistic discursive productions within it. In Banksy's case, the location of the work was disclosed by social media information about the particular location (first by the artist himself and then by all other followers that "verified" that place and enabled all other social media productions that related to that place by utilizing the discursive and informational mechanism of the hashtag #banksyny). In other words, the site is structured by the work as "content" and it is then fabricated and performed by the all other social media discursive productions within it (tags, photos, tweets etc.).

By announcing the location of his works via a daily photo shared on Instagram, and asking all visitors taking photos of these artworks and posting them on social media platforms to tag them with a specific hashtag, the artist transformed the visit to the physical location into a banal experience, and actively turned all these tagged photos into a representation of this banality. This banality is double sided. One the one hand, it is banal in the sense that the visitors to each location followed the online representations of this location left by other people. On the other hand, Banksy himself already took an image of that work in that place and all other images are reproduction of the same "original" image.

I do not mean to use "banality" here in derogatory terms but rather as a recurring informational mechanism that requires our attention, and as an element that diverge Banksy's work from former site-specific artworks. While typical site-specific works routinely engaged the collaborative participation of viewers in order to help them reveal a site as something that contains more than its fixed physicality (i.e. repressed social history; the location of disenfranchised social group), Banksy's work is occupied with the *informational processes* that underlie the production and reproduction of contemporary sites.

Banksy illustrates the *dissemination* of social media representation of a place and *performs* these processes via the reciprocal relation of places, objects, and data. This historical circular movement (the turning of objects into place and the transformation of a place into information) to which Banksy draws our attention contains three crucial elements: 1. The reproduction of a place via social media information items (tweets, photos, videos) 2. The turning of these representation/objects into quantifiable data, and 3. The organization of this data and the consequences of these informational forms for the ways we experience the place they represent.

In this sense, Banksy experiments with the ways in which a site becomes the sum of its multiple fragments, an endless signifying chain of photographic social media sights. By turning a physical site-specific work into a "hyper-local social media work," Banksy's project emphasizes the historical parallels and differences between the nomadic Modernist understandings of the visual versus the native, site-specific notion suggested by the neo avant-garde as I described above. Banksy offers us "staged" performances that have unique time and space coordinates—but at the same time they are designed with the understanding of social media trails. While the actual "original" performance is still a spatial experience and thus is similar to 1970s site-specific performances (you have to be there), its social media representations are not experienced physically (you don't have to be there) and thus they have different characteristics.

The interest of site-specificity in revealing phenomenological, institutional and discursive strategies that operate within a place now turn out to be the reveling of social media strategies that generate a place and are in turn generated by this place. It is rather the *practices* of social media representations and their *effects* as they define the production, presentation, and dissemination of a representational hyper-local site. Under these new conditions, I ask again:

How does hyper-locality render a place *differently* from site-specificity*?* What are the unique characteristics of this new form of representation?

Generalizing from this discussion and the particular case study of the Instagram photos of Banksy artworks, I can identify these "strategies" as possessing three characteristics: they are fragmented, temporalized, and nomadic.

### 5.5.1 Fragmentation:

As opposed to the physical spatial sensorial experience of a place, social media hyper-locality is a representation of fragmented performances and exhibitions from multiple perspectives and times. If site-specific artistic works aimed to "localize" our experience with the visual and turn it into the sum of its interactions in time and place, the hyper-local is a contemporary manifestation of a similar desire: the (visual) hyper-local is now the sum of its multiple media representations of all *other* people interacting in that place and time. As such, these representations allow us to explore interactions in that space, track their multiple representations, and explore their relations to a physical location (i.e., how the structure of a physical place conditions social media productions within it), as well as other dimensions.

Moreover, this fragmentary nature also speaks to the organization of hyper-local information within a place. Each site is described in terms of its own social media history and this history is emerging as a *lexicon*. Individual representations of a site are randomly juxtaposed with all other representation of that site and are then categorized into classes of information within that place in a fragmentary mixture of ages, styles, origins, gender, popular viewpoint, and other attributes. Which is to say that the site is now structured according to the fragmentary "orders of things" found within it rather than by its mimetic spatially.

### 5.5.2 Temporalization:

If site-specific works aimed at the spatialization and territorialization of the visual experience (grounding it in time and space), hyper-local social media data is actually a manifestation of its temporalization and "de-territorialization." Social media hyper-local data converts a place into an endless set of exchangeable sights that do not generate a single sense of that place. Rather, this vision is now constructed from an endless series of representations that are for the most part a manifestation of different times in that place.

In other words, the experience of a place via hyper-local social media data is not spatial (we do not "navigate" a space through these representations). They are not meant to represent a map of a place, but rather a "schedule", or a route, a sequence of representations of times within a space. This allows us to compare different temporalities in a place (i.e., by various social groups), to compare temporalities of different places, and experience the dynamic structure of a place over time.

### 5.5.3 Nomadization:

A third difference between site-specific art and the social hyper-local is that while original site-specific works were grounded in a fixed physical location, the virtual hyper-local site is fluid. This nomadicity is evident not only in terms of the unstructured narrative of a place articulated by the multitude of paths of people within it, but also in the spread of images that transcends the original boundaries of that place into larger areas (such as the entire city and other locations around the world). In this sense, and in a paradoxical way, as our results demonstrate, while the geo-temporal tagged image is indeed a realization of avant-garde aspirations to contextualize the

visual in time and place, social media platforms also bring back the nomadic modernist understanding of that visual, as it is shared by users not only in their original location but also in other places around the world.

But this nomadicaity lies *in between mobilization and site-specificity*, as it can always be *measured* with precision (i.e. measuring the distance between photos in terms of their content; location etc.). Under these new terms, being nomadic is not about being "out of place" but rather to be always *able to calculate the distance* of the representation from a particular place and from all other representations that were taken in, on at or in relation to that place.

## 5.6 CONCLUSION

In this chapter I historicized, visualized, and theorized the distinctive ways in which localities are experienced and preformed through their social media hyper-local representations. I analyzed the organization of contemporary visual social media data in relation to two prominent paradigms in 20th century visual art, and drew historical parallels between artistic site-specificity and social media hyper-locality. I also looked at the relation between physical places and their social media representations using particular case studies—social media photos taken in certain Modern art museums around the world, and photos taken during the street artist Banksy's residency in New York during October 2013. Finally, based on our theoretical and historical analysis and the case study, I identified key characteristics of hyper-locality in social media.

The reinvention of site-specificity as hyper-locality comes in the midst of a cultural turn from former representational *standardized* spaces (particular maps of neighborhoods, cities or the entire earth) dictated from above (i.e. satellite views, municipal borders) towards more

*intimate* visual and textual representations that are generated within these places. However, as with all other previous documentation mechanisms that were used to dedifferentiate and unify discrete spatialites (by annotating groups of places as neighborhoods, cities etc.), these idiosyncratic views are now used in similar manner: to locate similarities within large sets of heterogeneous personal data collections, and thus emphasize once again the embedded logic of deterritorialization facilitated by network connectivity. In other words, by focusing on locational similarity (i.e. algorithmically locating groups of "similar" places) they intensify the conditions of spatial sameness, repetitiveness and uniformity.

In these emerging representational conditions, site-specificity reincarnation as hyper-locality is infused with a crucial insight: if social media can reflect the particularities of places as opposed to their similarities, we need to find ways to analyze, visualize and theorize these differences. Banksy's work can thus be summed up as asking what would it mean in contemporary conditions to maintain the socio-cultural and political specificity of a place? By understanding hyper-locality as fundamentally connected to the particularities of site identities, Banksy rematerializes and renders places as different from each other, as one unique place within others.

# 6.0 CONCLUSION

Interpreting the organization of contemporary large-scale visual information and its relation to larger cultural trends is challenging. Different elements are constantly being added, changed or removed, new services are frequently developed and released for public use, and new technologies capture the imaginations of many. Within this flux, what can we say about the presentation of social media images in particular and contemporary image production in general that is not confined to simply describing the characteristics of one platform or another? Can we identify overarching processes that cross platforms and are destined to change the way we interact with images?

This dissertation has set out to examine how time and place are mediated through the arrangement of large sets of social media photos. Throughout, I have followed three lines of inquiry that directed my overall discussion and analyses. First, I examined how contemporary forms of large-scale visual social media materials are organized and presented in specific platforms and applications. Second, I reflected upon the ramification of these visual arrangements for the ways we experience these images, historically as well as culturally. Third, I experimented with alternative organizational forms of visual materials and offered potential ways in which we *might* view large sets of social media photos.

What I believe to be the most crucial recent and ongoing developments in contemporary visual organizational mechanisms were the central focus. I started with an analysis of the presentation of images in a stream, contrary to the previously dominant organization using a

structured database. Next, I focused on the association of images with specific times and places, and analyzed the ways these informational conditions shape new representational experiences. Finally, I surveyed, analyzed and theorized current organizational modes of large sets of social media photos (inside and outside the data stream) as these are manifested in existing applications, emerging computational research, and artistic investigations. I taxonomized these practices and reflected upon them in order to better understand the distinctive qualities of each visual arrangement for the ways we understand the functions of these images, and the experiences they afforded. Throughout, my discussion was historically oriented, comparing current organizational forms with previous ones, and elaborating on the differences and similarities between the two.

I also pointed to the current limitations of each representational strand as they come to handle large sets of photos: from the misrepresentation of time in current applications and visualization practices, noting the neglect of place-specificities in favor of locating geographical homogeneities, to the arrangement of visual knowledge according to predetermined spatial categories and metadata as opposed to their inherent content. In each of theses cases, I noted alternative, experimental organizational forms that try to direct our attention to other existing possibilities in the construction of visual meaning.

My discussion throughout shifted from a close examination of the particularities of media interfaces, to a theoretical discussion of the consequences of these forms for the ways we understand images within them (reflecting on the "aesthetics" of informational forms, their histories and meanings). I then turned to a quantified analysis of the products of these organizational changes, and examined large-sets of photos from particular places and times. My effort was to balance my theoretical and analytical discussion in such a way that the one informs

and illustrates the other. It is my hope that despite the mingled operation of what are usually distinct and remote investigational orientations, they are brought here into a cohesive format.

In this conclusion, I will attempt to summarize some of my core overarching theoretical arguments, as these, in themselves, draw a particular historical story.

1. The implementation of the data stream as the core mechanism of contemporary informational systems reconditions the terms under which time and space are experienced. Contrary to a previous database structure that had no predefined notions of time, and consequently did not favor the temporal and linear organization of data objects, the temporal element is the core organizational and communicational factor of the data stream. It structures our experience of contemporary history in a new order of *"stream time."* In these new conditions, we are occupied with being before/after/at the same time with others that are always at a short and roughly equal temporal distance from us.
2. Prominent contemporary modes of visual organization are a realization of visual concpetualizations in twentieth century art. In particular, I read geo-temploral visual identifications as a realization of neo-avantgarde site-specific aspirations, and specified the differences and similareties between the former and the latter.
3. Emerging changes in visual informational arrangements recondition the terms under which images, text, and numbers come together. Words and numbers are not meant to explicate an image (as an indexical sign) but rather to group it with all other images that share data similarity. Images that once pointed towards themselves now point directly outside, looking for connections, relations and patterns with other items in a collection.
4. The result of this potential positioning of a single image with all other images in the same "social (media) space and time" positions the image within a *multiplicity of spatial and*

*temporal relations*. Images do not exist as a singular spatio-temporal form, but maintain multiple proximities with other images in a collection with different representational implications.

My two-fold research path—the theoretical and the analytical, the qualitative and the quantitative—also underscores the contributions of my work relative to other existing research in the field. The humanities and social sciences typically do not relay on large sets of visual data, and are rarely focused on the organization of visual information. In computational sciences, while numerous studies have worked with large-scale visual social media data, their interest is focused on locating general patterns and regularities in the data but rarely on the cultural and social implication of this data. In contrast, my work draws on methodologies from each of these research domains: digital humanities, media theory, information science, software studies, art history, cultural studies, social computing, and computer science. By examining the "material conditions" of information I relate to a long research tradition that looks at the ways in which informational forms are intertwined with knowledge production practices. To examine the range of organizational possibilities that are currently "out there," I looked at computational research, existing applications, and artistic investigations. Finally, I used visualization techniques as a means by which I could illustrate my theoretical discussion, facilitate new research directions, and transcend the limitations of current informational possibilities.

Although a crucial element of this work was to expand its relevance and appeal to wider academic domains, its tone and interests are rooted in distinct humanistic territories. It is here, I believe, that we can find its foundations, and I will point to some of its chief contributions in that

regard. None of these can claim value in and of itself. Together, however, they may amount to an advance on previous thinking.

1. The use of computational tools in the humanities has expanded in recent years and my work participates in this direction. However, most existing research is focused on *textual* rather than *visual* analysis. In addition, it relies on existing representational forms such as networks, points and lines, and does not experiment with the creation of new representational forms as part of its process. In contrast, this work develops experimental organizational forms in order to explore large visual user generated collections. As opposed to previous forms which reduced original artifacts into points or lines, most of the visualizations offered throughout this research visualize images without reducing them to something that they are not. As such, they allow us both to view patterns within the entire collections, but also to zoom in and explore the content of individual images.
2. This last point also applies to the collaborative nature of the quantified sections of my work. As opposed to traditional work in the humanities which is typically based on an individual investigation of a confined research domain, parts of this research has been realized together with artists, designers, and computer scientists. My reliance on, and use of visualization techniques values design and "graphical knowledge" are comparable to the historical and the theoretical elements of this project.
3. Most existing work in the humanities, even among that which does include computational analysis, deals with relatively small amounts of (usually textual) data. In contrast, my discussion involved the analyses of millions of images from many places and times. As such, it also moves form the micro-scopic to what is beginning to become a truly *macro*-scopic view of the data.

Some of these contributions however, also define the limitations of this study and its main challenges. As I said before, writing the "informational contemporary" is difficult. Visual forms on the Internet are in a constant flux, and new developments construct distinctive experiences at a rapid pace. To stay within defined research boundaries, my work focused on visual materials produced over "social awareness streams" (Naaman et al, 2010) which denotes a particular type of images within a distinct organizational logic.

In addition, it should also be emphasized that as a reflection of social reality, social media data only captures the lives of some members of society and not others. My data is based on limited samples shared on Instagram and is therefore biased towards the types of places and content that people using this application typically want to publicly share. Moreover, usage percentage among various applications changes constantly, and varies from one location to another. The demographic of Instagram users, is usually characterized as young professionals in the ages between 25 and 35, owners of smartphones and urban residents (Duggan and Brenner, 2013).

Lastly, and most importantly, there are factors regarding the nature of working with user-generated data and its claims to privacy. In a domain where the decorum and ethics of working with large data sets are still very much in flux (see for example: [Boyd and Crawford, 2012]), working with personal image collections is particularly sensitive. In general, I used two approaches to protect users' privacy in my analysis. First, none of the visualizations, graphs, or their labels shows usernames or their information. Second, images always appear as small thumbnails (maximum size is 50 x 50 pixels).

In the tenuous process of working with large visual data it is the final point by which one is able to organize the data in particular form, visualize its organizational choice, and then

compare the result to other organizational forms of the *same* data sorted in other ways, that is the most joyful and rewarding. It is also this action that infuses the final representation with historical and cultural consequences. While social media data is the epitome of bottom up representational mechanisms that negate modernist notions of unified and fixed metanarratives, the accumulation of data from many people and times creates new types of collective representations that depends on a particular logic of spatial, temporal, and visual sorting mechanisms. It is my hope that my work unfolds the most relevant of these representational "classification systems" (Bowker and Star, 2000) and that it has demonstrated the key ways in which they structure—metaphorically as well as literally—certain of our definitively contemporary spatio-temporal visual experiences.

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