






Multitudinous identities: a qualitative and network analysis of the 15M collective identity

Arnau Monterde^{a,b*} , Antonio Calleja-López^{a,c} , Miguel Aguilera^{b,c} ,
Xabier E. Barandiaran^{b,d}  and John Postill^f 

^aInternet Interdisciplinary Institute, Open University of Catalonia, Barcelona, Spain; ^bDatanalysis15M Research Network, Barcelona, Spain; ^cDepartment of Computer Science and Systems Engineering, University of Zaragoza, Zaragoza, Spain; ^dIAS-Research Center for Mind, Life, & Society, Department of Philosophy, University School of Social Work, UPV/EHU – University of the Basque Country, Bilbao, Spain; ^eDepartment of Sociology, Philosophy and Anthropology, University of Exeter, Exeter, UK; ^fSchool of Media and Communication, RMIT University, Melbourne, Australia

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The emergence of network-movements since 2011 has opened the debate around the way in which social media and networked practices make possible innovative forms of collective identity. We briefly review the literature on social movements and ‘collective identity’, and show the tension between different positions stressing either organization or culture, the personal or the collective, aggregative or networking logics. We argue that the 15M (*indignados*) network-movement in Spain demands conceptual and methodological innovations. Its rapid emergence, endurance, diversity, multifaceted development and adaptive capacity, posit numerous theoretical and methodological challenges. We show how the use of structural and dynamic analysis of interaction networks (in combination with qualitative data) is a valuable tool to track the shape and change of what we term the ‘systemic dimension’ of collective identities in network-movements. In particular, we introduce a novel method for synchrony detection in Facebook activity to identify the distributed, yet integrated, coordinated activity behind collective identities. Applying this analytical strategy to the 15M movement, we show how it displays a specific form of systemic collective identity we call ‘multitudinous identity’, characterized by social transversality and internal heterogeneity, as well as a transient and distributed leadership driven by action initiatives. Our approach attends to the role of distributed interaction and transient leadership at a mesoscale level of organizational dynamics, which may contribute to contemporary discussions of collective identity in network-movements.

Keywords: collective identity; network-movements; 15M; systemic dimension; network analysis; synchronization analysis; multitudinous identity

Introduction

Some scholars regard 2011 as the year of the emergence of network-movements (e.g. Castells, 2012). Particular forms of collective action operating at different scales reached the public arena with an intensive use of digital networks, amplifying their events around the world, engaging thousands of people within shifting political scenarios, singular forms of political

*Corresponding author. Email: amonterde@uoc.edu

subjectivity and collective action and generating emergent forms of identity. These movements are exploring new answers to one of the central questions in social and political life, that of being and acting together. As a result, the debate around collective identity, already posed in the literature on social movements (Melucci, 1988, 1995, 1996), gains a renewed interest. Taking our cue from old and new discussions on the topic, as well as from empirical materials and our own experience and observation as participants, in this article, we develop an inquiry into some of the systemic characteristics of collective identity in Spain's 15M (*indignados*) movement.

We start with a brief introduction to the question of collective identity and social media in the new protest movements, as found in the existing literature, zeroing in on recent debates around collective vs. connective identity, aggregative participation and leadership. We then essay a first approach to the notion of 'multitudinous identity' as a contribution to this literature, from a systems and network theoretic viewpoint. Then, we outline 15M's evolution, focusing on the initiatives that have contributed to shape the movement's identity over time through actions and events. We then develop a delimitation and characterization of 15M's collective identity from a static and dynamic, network and system analysis. This analysis shows the relevance of transience, distributedness and transversality in 15M's collective identity. We end by proposing a working definition of 'multitudinous identity' in light of our analysis, and in relation to a discussion of current debates on social movement organization and collective identity.

Collective identity and social movements

Melucci's (1988, 1995, 1996) writings are now the obligatory entry point to the literature on collective identity. His proposal of this notion tried to bring attention to aspects of collective action and social movements neglected by previous approaches: frequently informal, emotional and cultural aspects – and, ultimately, identity – were thereby brought to the fore at every level of analysis (Flesher Fominaya, 2010; Opp, 2009; Polletta & Jaspers, 2001; Snow, 2001). Research on frame theory (Benford & Snow, 2000) connected with many of these leitmotifs, and provided new tools for understanding how collective actors construct their shared views, motivations and feelings.

Complementarily, Melucci explored 'the dynamic process through which [social movements'] actors negotiate, understand and construct their action through shared, repeated interaction' (Flesher Fominaya, 2010, p. 394). He gave a system- and network-friendly definition of collective identity by considering it 'a network of active relationships between the actors, who interact, communicate, influence each other, negotiate and make decisions. Forms of organization and models of leadership, communicative channels and technologies of communication are constitutive parts of this network of relationships' (Melucci, 1995, pp. 44–45).

More recently, Bennett and Segerberg (2012) take an approach that attends to the roles of social media in new forms of collective action and that differs from Melucci and the tradition he inaugurated. These scholars posit the recent emergence of a 'logic of connective action' based on sharing personalized contents through social media. They distinguish this logic from an earlier logic of collective action linked to 'high levels of organizational resources and the formation of collective identities'.

Along similar lines, Juris (2012) argues that social media contributed to an 'emerging logic of aggregation' during the first stages of the Occupy movement; that is, the social media supported the swift congregation of individual protesters in physical spaces, especially camps in squares. However, after camp evictions, a 'logic of networking' familiar from earlier movements (Juris, 2008) predominated. Meanwhile, Lim (2013) used Bennett and Segerberg's dual model to argue that the Tunisian revolution was spearheaded by a 'hybrid network' of political actors that meshed collective and connective forms of action and identity.

A more dramatic departure from the Melucci legacy is McDonald's (2002) critique of the concept of collective identity. For the author, this notion depends on the idea of solidarity, when in fact 'fluidarity' is the defining condition of collective action in contemporary 'network societies'. McDonald calls for a shift in the focus of social movements studies from collective identity to 'the public experience of self' (2002, p. 109).

However, Gerbaudo (2014) is critical of this prominence given to fluidarity and connective action for its methodological individualism and downplaying of culture, meaning and intentionality. Gerbaudo urges scholars to continue to study the cultural and collective dimensions of protest, as pioneered by Melucci.

Multiple problems have been noticed in the concept and the literature on collective identity. According to some, the notion has been 'overextended', 'forced to do too much analytically' (Polletta & Jasper, 2001, pp. 284–285), of which a somehow 'slippery concept' (Flesher Fominaya, 2010, p. 394) resulted. Others (Opp, 2009) have considered Melucci's work on collective identity as merely 'orienting', filled with hypotheses and statements of heuristic value whose causal and 'empirical informativeness' is questionable.

That said, the continuous production of a strong strand of research on movement literature seems to suggest that abandoning the concept of collective identity would be a mistake, as it has generated rich insights into the 'cultural and emotional dynamics of mobilization' (Flesher Fominaya, 2010, p. 401). What may be required is a recognition, clear definition and systematization of its various aspects, in order to avoid both overextension and slipperiness. Snow (2001) has rightly noticed that collective identities can be multidimensional – including cognitive, emotional and moral dimensions (Melucci, 1989; Polletta & Jaspers, 2001) – and multi-layered – including a 'wider social movement community or solidarity group' of social support, 'the social movement layer' of the movement itself, and the 'organizational layer' composed by concrete actors and groups within it (Gamson, 1991; Stoecker, 1995).

In the face of a potential split in the social movement literature between approaches focused on organizational and informational structures, on the one hand, and approaches using the notion of collective identity and attending to the cultural, symbolic or emotional dimensions of social movements, on the other (as suggested by Treré, 2015), we believe that adding a systemic dimension to the notion of collective identity may be of value: first, to prevent an apparently widening gap, and second, to enrich the analysis of collective identity in social movements. This would obviously entail a heterodox reading of Melucci's. A systemic (Luhmann, 1995) approach to collective identity would try to analyse how activity in circuits such as social media networks shape the operational unity and cohesion of a movement, both synchronically and diachronically. This approach is especially pertinent when, as often suggested by the literature (Candón Mena, 2013, Padilla, 2013, Toret et al., 2015), the 'network view' itself has become a key part of the self-understanding and organizational practice of movements such as 15M.

Although we recognize its limitations (see the methodological and discussion sections), this systemic approach may help to address some of the ongoing debates on the relation between aggregation and networking (Gerbaudo, 2013; Juris, 2012), connective and collective logics of action (Bennett & Segerberg, 2012), and the way they relate to the notion of collective identity. Moreover, it may shed light over other questions related to collective identity such as the maintenance of complex networks' unity and cohesion or the evolution and transformation of a collective identity over time. In addition, a systemic and network theoretic approach to collective identity brings the notion closer to the operationalization that some authors demand (Opp, 2009). Attention to the systemic dimension of collective 'identity' seems especially relevant in the case of recent, organizationally fluid networked movements.

Hardt and Negri's (2004) notion and analysis of the 'multitude' may serve as a broad reference in order to think collective identity in the face of the acceleration of social differentiation and

fragmentation already noticed by Melucci (1988, 1996), and the intensification and complexification of the technological mediation of collective action (Bennett & Segerberg, 2012; Castells, 2012; Earl & Kimport, 2011, etc.). A key aspect of Hardt and Negri's 'multitude' is its irreducible internal complexity (2004, pp. 99–100):

The components of the masses, the mob, and the crowd are not singularities – and this is obvious from the fact that their differences so easily collapse into the indifference of the whole.(...) The multitude, designates an active social subject (...) an internally different, multiple social subject.

We contend that the idea of the 'multitudinous' helps to understand some features of 15M's internally complex macroscopic identity, or meta-identity, at the 'movement layer'.

The notion of a 'multitudinous identity', whose final working definition we propose in the discussion, tries to bring to the fore the emergence of 15M's complex, macroscopic, collective identity from the technologically mediated coordination, action and interaction of collectives and singularities within the movement. Thereby, this notion puts the focus, on the one hand, on network and systemic aspects of collective identity, and on the other, on its internally complex and emergent character.

Interestingly, neuroscience faces a similar issue when trying to characterize the emergence of a unified consciousness (and, by extension, of psychological identity) out of a massively distributed neuronal activity: how to provide a systemic account of the emergence of unity and identity out of a multiplicity of networked processes. In this sense, recent advances on large-scale systems neuroscience can provide powerful analogies and methodological tools to explore parallel questions in the field of network-movements such as 15M (Barandiaran & Aguilera, 2015). In contrast to the classical idea of hierarchical structures converging into a centre of neuropsychological identity and control, many contemporary approaches (Edelman & Tononi, 2001; Friston, 2000; Lachaux et al., 2000; Varela, 1995) propose that consciousness emerges through transient moments of large-scale synchronization of functionally different and segregated sub-networks. These moments create what in neuroscience is called a 'dynamic core' (Edelman & Tononi, 2001), that is, a cluster of synchronized neural activity that transiently serves as a pole of reference for the activity of other parts of the network. For the purpose of this paper, the goal of exploring this analogy is to focus only on the generic properties and way in which its complex unity emerges from the dynamics of a centre-less network (primarily, on social media).¹

The 15M movement and its evolution

We take the Spanish 15M movement as a case study to depict some fundamental characteristics of the forms of collective identity arising around the wave of network-movements since 2011 (Castells, 2012). 15M displays a rich history of evolution and maturation, being still active in the present. This allows us to explore not only how network-movements' identities arise but also how they evolve and adapt over time. The first collective initiative that can be safely categorized as '15M' is the grassroots platform *Democracia Real Ya!* (Real Democracy Now, henceforth DRY), which called for marches around Spain on 15 May 2011, to demand 'real democracy'. Much of the organization took place in a web forum and Facebook groups, in which some of us were involved. The DRY label was soon appropriated by citizens around Spain who were encouraged to create their local nodes, without requiring any central authorization or supervision (Toret et al., 2015).

On 15 May 2011, simultaneous demonstrations took place in 60 cities up and down the country. Despite the silence of the mainstream media, about 130,000 people attended (Serrano, 2012). DRY groups soon reached over 120 Spanish cities and 50 cities abroad during the first

days after the 15M demonstration. Simultaneously, a similar process unfolded between 16 May and 22 May, when a small sit-in in Madrid's main square, Puerta del Sol (*Acampada Sol*), evolved into a camp that served as the first node of a network of camps that soon reached over 130 cities across Spain and another 60 around the world. Once again, the camps spread around the whole Spanish territory, multiplying the 'camp' form through socio-technologically structured processes of replication. In Toret et al. (2015), this replication process is characterized by the proliferation of labels that serve in the construction of new, networked nodes; those labels are easily replicable and highly adaptive to different local contexts (e.g. Sol-camp, Sevilla-camp, Barcelona-camp, etc.). Thus, a myriad of branches of different mesoscale initiatives (contained within the 15M macro-identity) replicated quickly, creating the backbone of the camp network. A vast network of connected camps and squares emerged within which information, calls and actions circulated and reverberated engaging up to between 6 and 8 million people in the protests (RTVE, 2011).

When compared with forerunners such as the alter-globalization movement (Juris, 2008), 15M exhibits an increase in the range and variety of participants' networked practices, for example, viral campaigns on Facebook, activity coordination on Twitter, protest live-streaming, and so on (Pérez & Gil, 2014). Unsurprisingly, internet traffic in Spain increased by 17% from April to May 2011, and there was a 20% increase in smartphones' data traffic (Monterde & Postill, 2014).

During the following years, the movement evolved through a continuous renewal of its repertoire of practices, combining moments of latency with periodical outbreaks of massive mobilizations, displacing the centre of gravity from DRY and the camps to new initiatives. These new initiatives included global joint mobilizations with other movements such as the Occupy movement, or the anti-austerity protests in Greece and Portugal (such as the 15 October 2011, global demonstration), legal actions of civil disobedience, for example, the one (supported on a crowdfunding campaign online) against the director's board of a bailed out Spanish bank accused of fraud and corruption (*15MpaRato*), or massive actions of civil disobedience such as the surrounding of the Spanish Congress by 60,000 people (*Rodea el Congreso*) on September 2012. Some of these initiatives acquired special importance within the ecosystem of the 15M movement, and became permanent spaces for action (e.g. the teachers and public health workers mobilizations under the label *mareas* (tides), or the fight against housing evictions). These practices entailed intensive use of social media and digital tools, open labels that can be easily appropriated, and transversal calls to actions not centred on identity or ideological premises (Candón Mena, 2013; Monterde & Postill, 2014; Toret et al., 2015).

In 2013, a key initiative was the *Plataforma de Afectados por la Hipoteca* (Platform of People Affected by Mortgages, from now on PAH), a movement to support families at risk of eviction or already evicted from their houses, after being unable to pay their mortgages. Since the beginning of 15M, hundreds of people joined the platform (founded on 2008) multiplying its nodes and participating in peaceful actions to stop evictions. But it was in February 2013 when they experienced their fastest growth spurt. A national campaign around a Popular Legislative Initiative formalizing their demands raised visibility for the PAH. This growth was aided by ample coverage on TV and other mainstream media, social media activities and the resulting high media profile of its spokesperson, Ada Colau. Yet, despite gathering over 1.5 million signatures, carrying out several large demonstrations, and attaining 90% of public support (El País, 2013), the Legislative Initiative was rejected.

To recapitulate, 15M was born in 2011 and continued to evolve through to 2014, in continuous transformation and development of new forms of collective action and identity, which currently appears to be veering towards institutional politics. The first 15M-derived political party to emerge was *Partido X* (in 2013), followed by *Podemos*, which obtained 1.2M votes in the May 2014 European elections. According to some polls, by early 2015, *Podemos* had become

Spain's first political party in vote intention (Metroscopia, 2015). Both of them make intensive use of social media for the construction and spreading of their narratives and organization.

Thus, three years after the mid-2011 explosion, new events and initiatives emerged that maintained part of the initial technopolitical practices of the movement while transforming and adapting them to new goals, needs and situations. Our suggestion of the existence of a 15M collective identity on the macro-scale relies on the maintenance of some common features: (a) the way the initiatives operate and interact, via technopolitical practices (Toret et al., 2015), and (b) the existence of key nodes and sub-networks (such as DRY) that remain operative over time even as initiatives and events change the configuration of the network as a whole.

Methods

To define and characterize the 15M's macroscopic identity requires a multidisciplinary combination of theoretical and experimental methods. Reductionist network approaches, solely based on topological analysis and the characterization of the activity of individual nodes or singular actors, are insufficient to describe processes of political large-scale self-organization in recent network-movements. More holistic approaches, such as the analysis of the robustness of the network at different scales, or the analysis of activity synchronization patterns, afford a description of phenomena that are not accessible at the level of individual nodes. Although they still present limitations, advances in complex dynamical systems and network analysis provide a methodological toolbox that, together with the availability of large amounts of digital quantitative and qualitative data, could extend the repertoire of analysis in social movement studies, including the one on collective identity.

In contrast to the adoption of the network metaphor that is common in the literature, which comes accompanied by a set of very rough and general properties (horizontality, flexibility, spontaneity, etc.), the complex reality of network-movements such as 15M demands, beyond the loose metaphor, a detailed network and system analysis and characterization. When looked up closely, the identification of a network remains far from straightforward, and empirically identifying the structural properties characteristic of network-movements is far from trivial. Finally, the study of the functioning and evolution of a network demands sophisticated measures to capture the complex forms of dynamic organization displayed by network-movements. None of these specific complexities are graspable from a generic and superficial 'network approach', and yet they uncover relevant network properties, complementing or expanding upon what personal frameworks or aggregationist perspectives are capable of explaining.

In this sense, we propose a methodological and data triangulation that combines structural and dynamic network analysis with quantitative data from an online survey and qualitative data from participant observation. Our objective is not to explain the system under study by reducing its complexity to some general, statistical or experimental indices that characterizes most 'big data' approaches (Crawford & Schultz, 2014), but rather to analyse irreducible systemic aspects of the networks that compose 15M's macroscopic identity, in order to shed light on its underlying properties and on the kind of processes that may be responsible for its emergence. The first part of the network analysis delimits the boundaries of the collective identity using different standard network metrics (strongly connected components and modularity) and a characterization of its structure using k-core decomposition (a technique for detecting the existence of cohesive subsets of the network, see Dorogovtsev, Goltsev, & Mendes, 2006; Seidman, 1983) to determine whether it exhibits a centralized or distributed structure. This structural analysis comprises a large data set of Facebook activity, including 4957 fanpages related to the 15M movement and other 'external' agents such as trade unions (that are used as boundary contrast). Fanpages were extracted from two initial samples of 100 representative fanpages (one related to 15M

and other to Spanish trade unions). A Facebook Query Language script extracted the list of fanpages ‘liked’ by the initial sample (Facebook allows fanpages to create lists of other pages that present affinity to them). Repeating the process again from the set of extracted pages, a larger network of related pages is obtained. A second analysis takes 14 of the main fanpages from the previous data set and extracts the activity of their users to conduct a synchronization analysis using Phase Locking Statistics (Lachaux et al., 2000), to observe what kind of dynamical structure underlies the hub of fanpages that concentrates most of the activity of the network.

The qualitative part included participant observation in 15M by three of the authors, undertaken in different periods between 2011 and 2015, which served (along with the survey results) to make a first selection of the initiatives to analyse, and, more importantly, to interpret the results of the network and synchronization studies. The quantitative part of the analysis includes an online survey, conducted through an electronic questionnaire (Networks, Movements & Technopolitics, 2014). The survey was launched in May 2014 via Social Networks² and email, using snowball techniques and obtaining 1320 responses in 10 days. The survey asked 51 questions about respondents’ participation in 15M, previous experiences with social movements, information and communications technologies use during the protests, the role of emotions, the evolution of the movement and its impacts. In this paper, we focus on those respondents who participated in the movement (1014 respondents, corresponding to 76.8% of the sample), a significant sample to illustrate the opinions and experience of 15M participants. The survey results helped us in the sample selection for network analysis, as well as in the exploration of types of participation in 15M. This methodological and data triangulation has allowed us to bring together variegated sources and results, connecting and combining them, all of which provides a richer approach to 15M’s complex collective identity.

Delimitation and characterization of the 15M collective identity

In what follows, we depict the identity of the 15M movement as a specific form of collective identity that we call ‘multitudinous identity’. As we show below, this is a form of systemic identity that emerges from the networked interactions of heterogeneous actors (bloggers, activist reporters, alternative and independent media, etc.) including collective ones. These collective actors, which we name ‘collective initiatives’, range from social platforms (such as PAH) to initiatives (such as 15MpaRato); they may well be considered to have their own identities (Tascón & Quintana, 2012; Toret et al., 2015), but we do not analyse that here. Our interest lies in 15M’s systemic, macro or meta-identity, its emergence and evolution over time. As a first step in our analysis, we chose two sets of Facebook fanpages from two key initiatives, DRY and PAH, in order to map the 15M systemic identity via structural network analysis. DRY was the initiative calling the demonstration on 15 May, and PAH has been one of the most important initiatives connected to 15M (see the section on ‘15M Evolution’ above). According to our survey, 87.1% of 15M participants link PAH to the movement, which is the highest percentage of association.

As commented above, we focus on the systemic dimension of collective identity formation and evolution. This aspect of ‘operational identity’ does not exclude, but should not be confused with, mutual identification or solidarity at a personal or collective level, or as a social or psychological state of symbolic subsumption ‘I/we am/feel part of X’, being X the collective identity. In this sense, we leave aside the cognitive and cultural aspects of how a collective identity is formed. We focus instead on some of the communicative interaction processes that make a diffuse social entity such as 15M emerge and maintain itself over time in an autonomous manner, that is, independent from an external agent (e.g. the State or the media) that identifies or circumvents that collective entity.

Structural delimitation of the 15M identity in Facebook fanpage networks

In the case of a directed graph (a network whose links have a defined direction), the first property to consider in order to identify a systemic unity is a *strongly connected* component structure. A strongly connected component consists of a set of nodes of a directed graph in which, for any pair of nodes of the set, there is a path linking them. That is, information can circulate within a strongly connected component, potentially departing from and reaching any node of the component. If a node can send or receive information to or from a set of nodes, but not the opposite, it is not part of the strongly connected component, and therefore cannot be part of its systemic identity.³

Yet, depending on what kind of data we are looking at (the time-span, the level of detail of an interaction network, or the thresholds used to define the network graph), almost any social system can be pictured as a strongly connected network. For this reason, it may be useful to think about strongly connected components that are maintained in a robust manner under a variety of graph definitions of the same network. Strong connectedness can also be complemented with other criteria in order to depict a specific identity within a wider social environment. Modularity, which is often used to depict communities in social networks (Blondel, Guillaume, Lambiotte, & Lefebvre, 2008), is one of them. In graph theory, a module is said to be an ensemble of nodes whose internal connectivity (the number of group-links per node) is stronger than the connectivity of the ensemble with nodes or ensembles that lie outside of the module. The problem with modularity is that there is an indeterminate number of modules or communities (we use this term here as a technical network-analytic notion, which can be read as synonymous with 'sub-network') that can be extracted for a given network. Therefore, a threshold needs to be established to define how much connectivity is 'enough' to single out a community from the whole network. One way to avoid this arbitrariness is to progressively reduce the threshold, starting from a value that captures the (in this case, strongly connected) network as a whole, and then progressively lower it to depict a successive sets of nested communities (frequently, a qualitative knowledge of the actors in the network may be necessary to fix the connectivity parameter that better splits the communities, as was our case for 15M).

How can we apply this delimitation criterion to 15M as a collective identity considering the wide variety of collective initiatives, mass support and variations of leadership composition during the three-year period of study (2011–2014)? Although the 15M identity operates through a multilayered structure (from offline interactions to mass and social media) (Toret et al., 2015), we have chosen to study the structure of Facebook networks supporting the movement as a proxy for its overall network structure, since, according to our survey, up to 78.8% of 15M participants used Facebook for activities related to the movement.

Figure 1 shows the 15M Facebook network, outlining it – and thereby, its systemic identity – against the external elements of its environment (e.g. trade union fanpages). To arrive at this figure, we first computed the largest strongly connected component. We then applied modularity measures to distinguish 15M from what may be (part of) its 'environment'. The resulting network is composed of a huge number of Facebook nodes (only the most significant fanpages are depicted), and contrasts with two neighbouring communities, those of the main Spanish unions: CCOO (Comisiones Obreras) and UGT (Unión General de Trabajadores). The threshold parameter we used, following the modularity algorithm parametrization provided by the network analysis tool 'Gephi', is based on optimization for stability (Lambiotte, Delvenne, & Barahona, 2008), and it captures the stability of flows within the community. A value of the parameter at 3.8 gives us an interesting division of the networks: the Spanish 15M in green, international 15M support fanpages and Occupy fanpages in yellow and the two unions in red.

If we zoom in on the composition of the of the green community (15M) in Figure 1, we find there a multiplicity of heterogeneous collective initiatives beyond DRY and PAH, such as

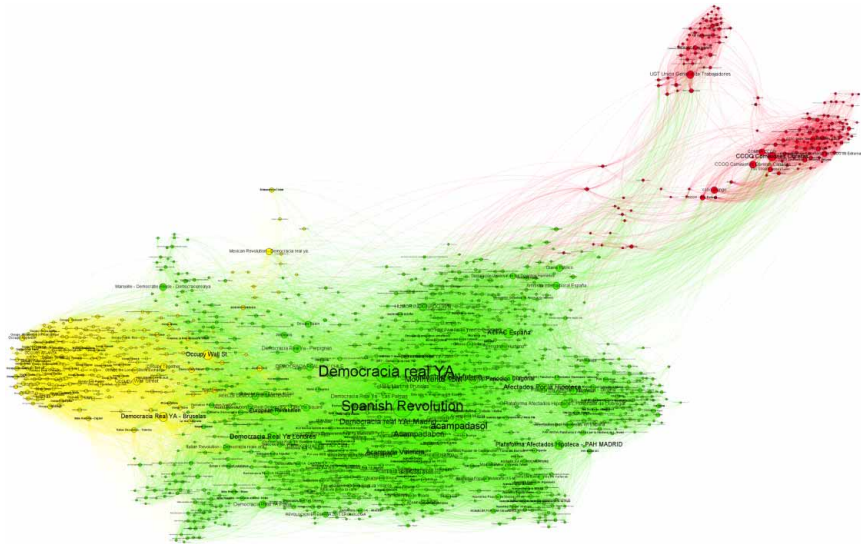


Figure 1. Strongly connected component of the merging of network of likes of CCOO, UGT, PAH and DRY facebook fanpages with depth 2. Only nodes with k-core of 15 or more are pictured (see text body for a detailed explanation). Computation of modularity (the extent to which a cluster of nodes shows more internal connections than connections with external nodes) makes possible to distinguish three communities. Spanish 15M movement in Green, international Occupy and 15M solidarity nodes in Yellow and the main Spanish unions CCOO and UGT nodes in Red. [Copyright 2014 Xabier E. Barandiaran, Arnau Monterde & Antonio Calleja-López Creative Commons Attribution-ShareAlike 3.0 Unported License.]

Acampadas (camps), neighbourhood assemblies, or others from the 2012 to 2013 period in 15M, such as *15MpaRato*, *Mareas* (tides) or *25s/Rodea el Congreso* (Surround Congress). These results match with those of our survey question about what (post-after May 2011) initiatives are related with the movement – being *15MpaRato* and *Mareas* (according to 76.3% of 15M participants) and *25s/Rodea el Congreso* (according to 74.6%) the most relevant ones. The network analysis adds fine-grained, qualitative and quantitative, details about the nature and structure of those relationships.

Structural properties of the 15M identity in Facebook fanpage networks

We can specify some properties of a given systemic identity by studying the set of structural and dynamic properties of its underlying interaction network. At the structural level, we can focus on the internal, statistical configuration of the 15M network (or module) as shown in Figure 1, and compare it with that of the unions. The first thing to note is that the 15M Facebook network is much larger than that of the unions. Consequently, the number of connections is also larger for the 15M network, with an average of 16.1 connections per node (vs. 5.7 for CCOO and 4.2 for UGT). Yet, this average could be the result of different conditions, one or a few nodes might have a huge number of connections, or the average could be the result of a homogeneously distributed network. The properties of the systemic collective identity in each case would be very different.

To further characterize it, we can also measure the network's *embeddedness*. The embeddedness of a link of the network is the number of nodes that are neighbours of the nodes of that link.

We computed the average embeddedness for each community and found that the embeddedness of 15M (21.5) is much higher than that of the unions (8.4), meaning that interactions between nodes of the 15M network are much tighter and more recurrent than those of the unions, and even more than the embeddedness of a random network of the same size and density (0.113). Embeddedness is a structural counterpart of social cohesion (Moody & White, 2003), so a high level of embeddedness indicates a high level of network cohesion. Cohesion is necessary for the endurance of a systemic collective identity, and that of the 15M network is much higher than the unions.

Another way to depict the distributed or centralized structure underlying each network is to reduce them to their k -core decomposition (Dorogovtsev et al., 2006; Seidman, 1983). Decomposition of a network to its k -cores allows a description of its robust underlying structure. In Figure 2, we depict the networks of the 15M network and the labour unions, and their k -core decomposition. For each one, we used the larger value of k before the network completely disappears, in order to obtain the minimal k -core structure. More specifically, we used the value of $k = 15$ for the

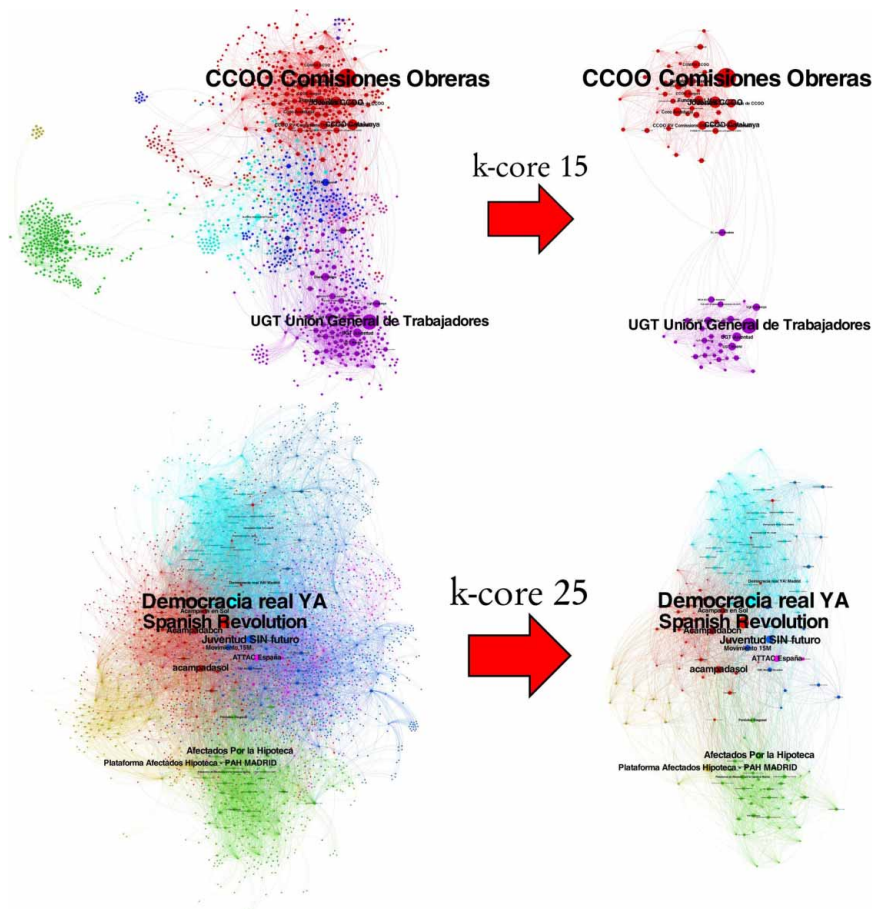


Figure 2. Networks and their k -core decomposition for the main Spanish labour unions (CCOO and UGT) and the 15M community (defined from the nodes of two main initiatives: DRY and PAH). [Copyright 2014 Miguel Aguilera, Arnau Monterde, Antonio Calleja-López & Xabier Barandiaran Creative Commons Attribution-ShareAlike 3.0 Unported License.]

labour unions network and $k = 26$ for the 15M network. We can observe how the union network is reduced to two main nodes around the central fanpages of each union (CCOO and UGT). Interestingly, the decomposition of the 15M networks shows a different picture. The initial structure is somewhat maintained, although the k -core network only comprises around 1.8% of the original nodes, and a good number of long-range connections are maintained.

These results suggest that while the systemic collective identity created by the unions is built around a more centralized and poorly interconnected structure, the 15M network creates an identity that cannot be confined to one or a few network subgraphs, for it emerges as a complex whole from a network of distributed interactions. Counterintuitively, in this case, more decentralized networks would be able to create more robust and cohesive structures, that instead of centralization use distributed resilience (as it has been found in e.g. internet networks) (Doyle et al., 2005).

Dynamic properties of the 15M identity and its evolution

In this section, we propose the hypothesis that transient large-scale synchronization may operate as a process underlying complex, macroscopic identities, linking component 15M communities into successive dynamic cores that should be identifiable as activity patterns of the macroscopic network. In the literature review, we proposed an analogy between the emergence of consciousness (a key condition for the constitution of psychological identities) from the large-scale coordination of (inter)activity of massive neural networks and the emergence of multitudinous identities from the (inter)activity networks of mass self-communication. Concretely, self-organized mass synchronization supporting the emergence and maintenance of a complex yet coherent identity may be a phenomenon that is pervasive in both domains. As we mentioned, the operation of synchronizing mechanisms in the brain in order to sustain coherent but adaptive and flexible consciousness (and, on that basis, psychological identities) has been addressed by the notion of a ‘dynamic core’. A dynamic core consists of a process of transient synchronized activity between different sub-networks of the system. The parts of the network that are involved in the dynamic core continuously change, thanks to their flexible connection and disconnection (synchronization and desynchronization), while the system maintains (or only more slowly changes) its own organization.

Here, we test this hypothesis in the activity patterns of some of the main 15M-related Facebook fanpages. We downloaded users’ activity in the form of comments along the lifetime of 14 of the main 15M Facebook fanpages. These fanpages were selected mixing qualitative criteria, such as their importance as 15M initiatives, quantitative criteria, such as their number of likes, and criteria related to our structural and dynamical network analysis. We selected those large pages with more than 5000 likes that appear well connected in the network of fanpages of the previous section. Using the Facebook Graph API, we scraped all the comments written in every post since the creation of each fanpage and up to May 2014 (Table 1).

The comments from each fanpage are arranged in a time-series depicting the evolution of the users’ activity, with a resolution of 6 hours. Then, the activity of each fanpage was analysed using Phase Locking Statistics (Lachaux et al., 2000), using wavelet filtering. In this paper, we have analysed synchrony around oscillations with a period of seven days, which was detected as the frequency band presenting the most intense moments of synchrony. The threshold for detecting significant synchrony was established as the phase-locking value between two signals being higher than 90% of the phase-locking value between surrogate random data. That is, we consider that two fanpages are synchronized when they are much more correlated than they might be merely due to chance. This analysis allows us to shed some light on the network of interactions between the users of the different fanpages. Since we have a quantitative description of the level of activity of such users, our analysis enables us to measure how one fanpage is synchronized with

Table 1. Summary of Facebook fanpages used for the analysis.

Facebook fanpage	15M initiative	# of likes (09/ 2014)	# of comments
nolesvotes	No Les Votes	31,507	15,759
juventudsinfuturo	Juventud Sin Futuro	118,199	66,860
DemocraciaRealYa/ AsociacionDRY	DRY	556,023	799,169
SpanishRevolution	SpanishRevolution	268,608	159,055
acampadasol	Acampada Sol	44,605	41,444
acampadabcn	Acampada Barcelona	76,509	67,381
acampadavalencia	Acampada Valencia	25,339	23,838
acampadazgz	Acampada Zaragoza	9,330	9641
acampada.sevilla	Acampada Sevilla	7,547	2496
malaga15m	Acampada Málaga	6,013	6211
15MpaRato	15MpaRato	7,883	1678
OcupaElCongreso	Ocupa el Congreso	16,716	6067
afectadosporlahipoteca	Plataforma de Afectados por la Hipoteca (PAH)	75,316	16,398

the others at different times. We can also measure the relation between two synchronized fanpages (which one is leading the other). In this way, we can elaborate a detailed dynamic description of the relations and interactions between the different communities of users acting under the fanpage of each initiative.

In [Figure 3](#), we show how a particular node of the 15M network (the PAH network) is synchronized with other nodes at different times over a three-year period. At the top, we can observe how many links of synchronization are found between the PAH node and the other 13 nodes. A synchronization 'link' simply means that the two nodes are synchronized at a given time, with a phase-locking value significantly higher than surrogate data. As we can observe, the levels of synchronization continuously fluctuate in time: from stages of no synchronization (0 or almost 0 links) to moments of strong synchronization (up to 7 out of 13 possible links). Moreover, we can analyse the directionality of those links. That is, if two nodes are oscillating but node 1 is oscillating before node 2, we can depict this as a directional link from node 2 to node 1 (meaning that node 2 follows node 1). Thus, we can observe in [Figure 3](#) (bottom) the number of links from the PAH node to other nodes (green), and the number of links from other nodes to the PAH node (blue). We observe how there is a fluctuation ranging from moments in which most of the links are green (meaning that the PAH node is following the activity of other nodes) to moments in which most of the links are blue (meaning that the PAH is leading the activity of other nodes). Interestingly, the most renowned campaign of the PAH, its Popular Legislative Initiative, that took place between January and February 2013, coincides with a moment of high levels of synchronization, where synchronization links go from other nodes to the PAH, meaning that the PAH is leading the activity.

We have depicted how a relevant sub-community of the network (which is composed by the activity of its thousands of users) continuously changes its role in relation to the rest of the network. This leads us to underline the role of temporality in the emergence of a complex, macroscopic identity such as 15M's. In traditional political structures, where collective identities are sustained by centralized and hierarchical structures, the timing of the system is strongly enforced by the organization's centre of power (e.g. a strike announced by union leaders) or the needs of the structure itself (e.g. a political party that mobilizes its base every electoral cycle). Interestingly, the temporality of network-movements such as 15M seems to be continuously constructed between a

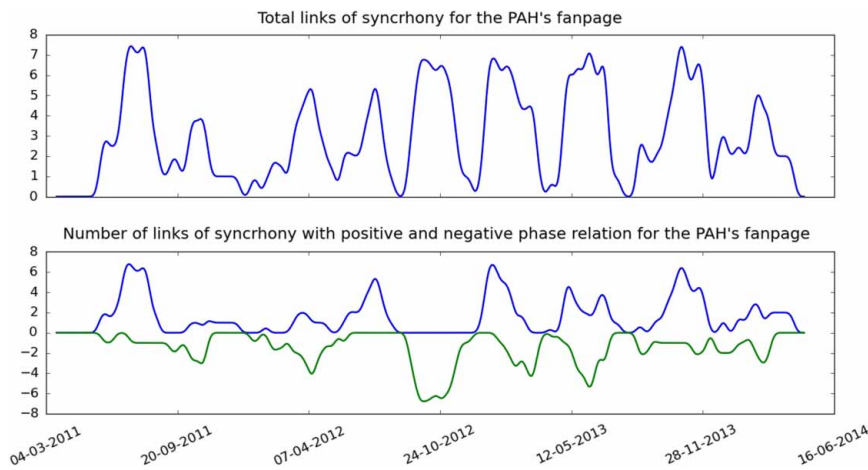


Figure 3. Plot of synchrony links between the PAH's fanpages and the others. On top, we can observe the fluctuation of the total number of links. At the bottom, we display the number of links presenting a positive phase relation (blue) and negative phase relation (green), showing the alternation between the moments in which the activity of the PAH's fanpage is 'following' other fanpages (majority of green) and moments in which the PAH's fanpage is 'leading' the activity of other nodes (majority of blue). For example, we can observe a majority of blue links around February 2013, a moment in which the PAH was leading a Popular Legislative Initiative campaign that was strongly supported by the rest of the 15M movement. [Copyright 2014 Miguel Aguilera Creative Commons Attribution-ShareAlike 3.0 Unported License.]

diversity of distributed actors, with no central pacemaker structure, but rather a web of synchronizing and desynchronizing relations that create a collective and complex multitudinous rhythm. Moreover, we observe how the growth of the network and the emergence of new sub-networks alters this rhythm and changes existing relations.

We can use the above synchronization index to characterize the dynamic structure of the 15M network by computing the phase-locking values between the 14 fanpages selected at different significant moments (Figure 4). We observe how the network starts with three synchronized nodes (15/05/2011) leading to the constitution of a highly synchronized network (15/07/2011). However, the network synchronization fades away after some months (15/09/2011) – a period of network latency. This moment of desynchronization soon gives way to new moments of strong synchronization coinciding with relevant events such as *Primavera Valenciana* (22/02/2012), the surrounding of the Spanish Congress (25/09/2012) or the ILP campaign of the PAH (24/01/2013).

Furthermore, particular nodes have a special relevance in the network at different points in time. Taking the example of PAH's ILP campaign (24/01/2013), we can see that the PAH community (whose fanpage is 'afectadosporlahipoteca') has a rather central position in the synchronization network at this particular moment. In Figure 3, we can also observe that at this point, there is a high number of 'blue' links, meaning that the community is leading the synchronization process. This suggests that the organization of 15M identity may rely on moments of transient integration in which some parts of the network act as poles of reference leading a process of synchronization that extends to the rest of the network. This is consistent with the perspective of 15M participants. Our survey confirmed a perception of 85.5% who believed that the movement undergoes successive transformations focusing on different events, actions or projects over time.

This analysis invites a number of interesting conclusions. Synchronization through social media cannot be seen just as a homogeneous reaction to, or amplification, of external events.

deployment of digital media in collective action (Earl & Kimport, 2011). This is linked to an increase in the number of forms and gradations of ‘taking part’ and ‘being involved’ in movements such as 15M. An intriguing aspect of 15M participation resides in its rich action repertoire: 92.4% of *indignados* took part in a demonstration, 77.6% in camps, 76.4% in assemblies, 73.7% signed an online petition, 71.7% joined through social networks and 68.5% linked via online social networks from camps and demonstrations. In addition, we have a different level of involvement through another set of actions, such as posting in blogs (23.6%), organizing an action (33.1%) or participating in a PAH eviction-stoppage (23.7%). These results show the variety of actions related to the movement, and how this variety expands the richness of participation and the involvement process, with online and offline action having similar percentages of participation.

Countless actors have contributed to shaping the various and variegated initiatives that came to shape 15M’s multitudinous identity. Groups and initiatives’ slogans, demands and practices have interacted, mixed, and remixed over time (Monterde, 2013). Something similar happened with the initiatives’ participants: 15M’s identity transversal character is tied to multiple participation, as well as the connectedness and passability between collective initiatives, that is, the ease of moving from one to another: an example of this is the increase of participants in PAH’s eviction stoppages after the 15M camps period or how some 15M assemblies were converted into PAH local nodes.

Discussion

A first tension we identified in the literature review was that between approaches prioritizing organizational dimensions (Bennett & Segerberg, 2012) and those calling for culture-centred analysis (Treré, 2015). As we argued in the theoretical section, we believe that adding a systemic dimension (and approach) to the multidimensional notion of collective identity may contribute to connect these two tendencies. In our inquiry, we have found value in Melucci’s suggestion that identity takes its form ‘as a process because it is constructed and negotiated through a repeated activation of the relationships that link individuals (or groups)’ (Melucci, 1995, p. 44). Our analysis has not shown the discursive content of such negotiations, but rather has taken a complementary approach by analysing the organizational dynamics and structures giving rise to 15M’s macroscopic collective identity. In this sense, above or below the dimensions of framing and the negotiated content of a collective identity, our analysis tries to contribute to specify and clarify how ‘forms of organization and models of leadership, communicative channels, and technologies of communication are constitutive parts of this network of relationships [that forms collective identities]’ (Melucci, 1995, p. 45).

A second tension we previously identified was that between analytical approaches stressing the relevance of the personal dynamics and others stressing the collective ones (Bennett & Segerberg, 2012; Gerbaudo, 2013, 2014; McDonald, 2002). In this regard, it is important to underline that 15M arose with few attachments to pre-existing identities (Candón Mena, 2013; Toret et al., 2015), relying on intensive deployment of social media for the continuous construction of its emerging, shared systemic identity (a traditional constructivist condition in terms of Melucci, 1988, 1996). Following our analysis, we wish to propose a working definition of multitudinous identity as the result of processes by which a dynamic network of recursive interactions among heterogeneous, autonomous actors emerges and differentiates itself, as a macroscopic unit, with respect to its environment, showing high degrees of distributed cohesion, transversal participation and transient adaptive poles of reference (a form of non-representational and temporally distributed leadership driven by action initiatives). We have shown how this macroscopic identity is structurally distributed and cannot be reduced to the action of one or even many centres of

power, but is the combined result of a set of relations and interactions across the whole network, with a central role of collective or mesoscale initiatives. Moreover, for this identity to persist, the underlying networks of interaction have to undergo a process of change and evolution (as the activity of its participants changes) while maintaining certain organizational properties.

Rather than by direct, upwards identification with a symbol, person or cause, multitudinous identities emerge from large-scale processes of self-organized, continuous, interaction, where relationships of various kinds at the ‘organizational layer’ (Snow, 2001) (including relations some-to-many, and many-to-many, distributed and transient), are the norm rather than the exception. In other words, the intensive use of social media and related sociotechnical practices have brought about a specific form of collective identity from the macroscopic to macro-level perspective, at the ‘movement layer’: multitudinous identities.

Lance Bennett & Alexandra Segerberg’s framework of connective action stresses the role of personal contributions to the dynamics of network-movements. According to them, ‘connective action networks are typically far more individualized and technologically organized sets of processes that result in action without the requirement of collective identity framing or the levels of organizational resources required to respond effectively to opportunities’ (Bennett & Segerberg, 2012, p. 750).

Although we agree with Bennett and Segerberg that the most innovative aspect of action in network-movements does not depend on ideological identification, our analysis of 15M evolution suggests that collective initiatives (such as PAH, DRY, etc.) remain central to the activity of the movement at the organizational layer. This does not deny the importance of the personal dimension and singular actors (stressed by Bennett and Segerberg’s connective action or McDonald’s fluidarity), but emphasizes the value of mesoscale activity, actors and interactions. Collective initiatives, with collective goals and messages (even if frequently transient and prioritizing participation over delegation, features of fluidarity), seem at least as relevant as dynamics centred on singular actors and personal expression to account for the complex architecture and dynamics of the 15M network.

Going further, and although not fully developed in our analysis, the notion of multitudinous identity points towards the centrality of interactions within and between mutually irreducible scales (micro, meso and macro) for the constitution of 15M’s systemic collective identity. Gerbaudo (2013) questions Bennet’s logic of connective action and McDonald’s notion of fluidarity for taking a somehow individualistic approach to movement dynamics, while he favours a collective dimension. Although sympathetic to these two points, we still differentiate our approach from what we may call ‘aggregationist’ views, such as Gerbaudo’s. The discussion around logics and processes of aggregation and those based on networking is the third main one found in the literature review, from the viewpoint of our systemic approach to collective identity. Gerbaudo (2013) suggests that an emerging culture of digitally mediated activism brings about the primacy of processes of aggregation, ‘a process of *reductio ad unum* – a reduction of the complexity of the social’, as he characterizes it, quoting Ernesto Laclau. Furthermore, he points that aggregation implies ‘an emphasis on unity, collectivity and uniformity’ distant from what he sees as the familiar, individualistic discourse on networks. Juris (2012) has also spoken of ‘a “logic of aggregation”, which entails the assembling of masses of individuals from diverse backgrounds within physical space (...) displacing logics of networking characteristic of a previous wave of global justice activism’ (p. 260). This new logic ‘generates particular patterns of social and political interaction that involve the viral flow of information and subsequent aggregations of large numbers of individuals in concrete physical spaces’ (p. 266).

However, as we have shown, the main structural properties shaping the 15M identity were not aggregative, but rather multitudinous, expressed through the multiplicity, changing nature and diversity of the interactions between singular actors, groups and collective initiatives. The

emphasis on the ‘logic of aggregation’ overlooks the structure and dynamics of the network of interactions between heterogeneous actors (especially collective initiatives), their complexity, diversity and variability. The 15M connected multitude (Toret et al., 2015) is not a ‘mass’, ‘crowd’, or ‘mob’ of individuals, even if, thanks to the type of structural and dynamic properties we analysed above, it may eventually perform in ways that resemble the features of smart mobs (Rheingold, 2003), as noted by Juris. Therefore, we believe a multitudinous identity may account for the phenomenon of aggregation described by Juris. The most innovative 15M ‘patterns’ take the form of a complex organization of interactions that are internally multiple, exhibiting multi-scale actors and recursivity – and still generate an emerging 15M systemic, if diffuse and fluid, identity. Therefore, they are irreducible to individuals’ aggregated activity, viral flows, or simple ‘sub-sequences’ of action from the online into the offline.

Also relying on aggregation in the analysis of collective identity, discourse analysis approaches to 15M (e.g. Errejón, 2011) leave aside the study of the networks that enunciate such discourse. Within the populist construction of political identity, currently serving as theoretical background to channel the 15M identity under the form of a political party (Errejón, 2014), a unified, meaningful, discursive framework symbolically aggregates – and thereby subsumes – the heterogeneity of a fragmented society around a leading signifier – as postulated by Laclau and Mouffe (2001). The discursive logic of equivalence and articulation (Laclau, 2005) can easily turn into forms of aggregation around leading signifiers and their spokespeople (frequently identified with them), wiping out the complexity of the mesoscopic structures and dynamics, their richness and autonomy. We have shown that a constructivist logic of collective identity can be built along the lines of direct participation in a multitudinous identity. And, although rarely in an academic idiom, 15M *indignados* are aware of it. Both in its origins and throughout its development, 15M has defended the internet, social media and certain practices in them as conditions for democracy (Candón Mena, 2013; Padilla, 2013; Toret et al., 2015). This is key to understand some of the disputes within the latter stages of 15M’s evolution into the political arena. But that is a matter for future research.

Conclusion

While discussing the complex structure and dynamics of the 15M multitudinous identity, we identified in the literature (a) the ontological tension between microscale personal networking and macroscopic notions of aggregation, (b) a methodological or epistemological tension between individualism and holism and (c) a gap between organizational and cultural approaches. With regard to (a) and (b), our analytical contribution lies right at the level of a statistically irreducible mesoscopic multitude, thanks to a system methodology where we highlight not the individual, not the totality, but the mesoscopic network of communicative interactions (between multiple singularities, groups and collective initiatives).

With regard to c), our analysis has tried to extend Melucci’s definition of collective identity. First, we have added a new, systemic dimension to it. Second, we have refined techniques for network and complex system analysis in order to explore this dimension in the case of 15M. Third, we have applied it to a context of intensive social media use where we can no longer reduce the system to one-to-one relations among individuals, groups or collective initiatives as unities. Fourth, we have further described 15M collective identity as emerging from systemic interactions within and between irreducible scales: from micro-personal exchanges to transiently coordinated activity of large groups of synchronized actors, up to the evolution of the organization of the macroscopic network as a whole. Fifth, we have proposed the notion of ‘multitudinous identity’ as a new type of and taking on collective identity. Moreover, our approach can account for the role of distributed interaction and transient leadership in the evolution and

maintenance of this large-scale network of (inter)active relationships, which challenges more traditional forms of centralized and hierarchical political organization.

A systemic understanding and operational treatment of the complex structure and dynamics displayed by networked movements is slowly emerging, potentially enriching the view of collective identities in the social media era. We hope to have contributed to this endeavour.

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Notes

1. A more detailed account of the analogy between neurodynamic and technopolitical networks can be found at Barandiaran and Aguilera (2015). For a quantitative analysis of self-organized criticality (which is also characteristic of complex brain activity) in 15M Twitter networks, see Aguilera, Morer, Barandiaran, and Bedia (2013).
2. With the support of some important Twitter accounts in 15M as @democraciareal or @Acampadasol and spreaded with the help of some 15M activists.
3. Note that there is a significant difference between A being part in an interactive identity and A being identified – or even identifying itself – with it.

Notes on Contributors

Arnau Monterde is a PhD candidate in Information Communication and Society at the Internet Interdisciplinary Institute (IN3), Open University of Catalonia UOC, where his supervisor is Manuel Castells. He is conducting the research coordination of ‘Network, Movements & Technopolitics’ research group in the same Institute. Currently his research focuses on the relationship between communication and emergent network-movements. He is also an experienced activist-researcher, most recently with Spain’s Indignados/15M movement. [email: amonterde@uoc.edu]

Antonio Calleja-López is a Ph.D. student in Sociology at the University of Exeter, analysing 15M and Occupy as network movements and assemblages of ontological conflicts and possibilities. He holds a master’s degree in Political Science at the Arizona State University, United States, as well as a Master’s of Advanced Studies in Philosophy at the University of Seville, Spain. He has been visiting researcher (with a Fulbright scholarship) at the Center for Science, Policy and Outcomes and the Center for Nanotechnology in Society, both radicated at the Arizona State University (Tempe, Arizona), and the Colorado School of Mines (Boulder, Colorado). He currently holds a position as research assistant at the Network, Movements

and Technopolitics group at the Internet Interdisciplinary Institute (IN3) of the Open University of Catalonia (UOC). [email: acallejalo@uoc.edu]

Miguel Aguilera is a Ph.D. student at the Department of Computer Science and Systems Engineering at the University of Zaragoza. He has been a visiting researcher at the Cognitive Science Program at Indiana University and the Ikegami Lab in the Department of General Systems Studies at the University of Tokyo. His research focuses on autonomy in biological and social systems from an interdisciplinary perspective, integrating insights from cognitive science, theoretical neuroscience, computational modeling, adaptive behaviour, and complex systems. [email: miguel.academic@maguilera.net]

Dr Xabier E. Barandiaran is a philosopher of biology, cognitive neuroscience, and technopolitics with a special focus on simulation modeling techniques as integrative tools for the study of cognitive systems. He obtained his MSc on Evolutionary and Adaptive System from Centre for Cognitive Science (COGS), University of Sussex, UK, and his Ph.D. on ‘Mental Life. A Naturalised Approach to the Autonomy of Cognitive Agents’ (supervised by Prof. Alvaro Moreno) from the University of the Basque Country (Spain). He has been a visiting researcher at the KLI (Konrad Lorenz Institute, Austria), at the Autonomous Systems Lab (School of Industrial Engineering, Polytechnical University of Madrid), at the Centre for Computational Neuroscience and Robotics and COGS (University of Sussex, UK) and at the Centre de Recherche en Epistemologie Appliquée, CNRS – Ecole Polytechnique (Paris, France). Dr Barandiaran currently holds a Lecturer tenure-track position at the University School of Social Work, Department of Philosophy, University of the Basque Country (UPV/EHU), and is a researcher at IAS-Research group (Department of Logic and Philosophy of Science, University of the Basque Country). He holds more than 20 publications in peer-reviewed journals, books, and conference proceedings and has collaborated with over 10 different researchers on the fields of theoretical biology, philosophy of complex systems, cognitive and neural sciences, philosophy of mind, social systems, and free/open knowledge societies. [email: xabier.academic@barandiaran.net]

John Postill holds a Ph.D. in anthropology from University College London (UCL, 2000). He is Vice-Chancellor’s Senior Research Fellow at Royal Melbourne Institute of Technology (RMIT) University, Melbourne, and Digital Anthropology Fellow at UCL. His publications include *Localizing the Internet* (2011), *Media and nation building* (2006), and the co-edited volume *Theorising media and practice* (2010, with Birgit Bräuchler). Currently he is conducting anthropological research on digital activism and political change in Indonesia, Spain, and globally. He is also writing a book on the new protest movements as well as the co-edited volume *Theorising media and change* (with Elisenda Ardèvol and Sirpa Tenhunen). [email: john.postill@rmit.edu.au]

ORCID

Arнау Monterde  <http://orcid.org/0000-0003-3455-7643>

Antonio Calleja-López  <http://orcid.org/0000-0003-2160-683X>

Miguel Aguilera  <http://orcid.org/0000-0002-3366-4706>

Xabier E. Barandiaran  <http://orcid.org/0000-0002-4763-6845>

John Postill  <http://orcid.org/0000-0002-4463-4780>

References

- Aguilera, M., Morer, I., Barandiaran, X., & Bedia, M. (2013). Quantifying political self-organization in social media. Fractal patterns in the Spanish 15M movement on Twitter. En P. Lio, O. Miglino, G. Nicosia, S. Nolfi, & M. Pavone (Eds.), *Advances in artificial life: ECAL 2013* (pp. 395–402). Cambridge, MA: MIT Press.
- Barandiaran, X., & Aguilera, M. (2015). Neurociencia y tecnopolítica: hacia un marco analógico para comprender la mente colectiva del 15M. In J. Toret (Ed.), *Tecnopolítica y 15M: La potencia de las multitudes conectadas* (pp. 163–212). Barcelona: Editorial UOC.
- Benford, R. D., & Snow, D. A. (2000). Framing processes and social movements: An overview and assessment. *Annual Review of Sociology*, 26(1), 611–639.
- Bennett, W. L., & Segerberg, A. (2012). The logic of connective action: Digital media and the personalization of contentious politics. *Information, Communication & Society*, 15(5), 739–768.
- Bennett, W. L., Segerberg, A., & Walker, S. (2014). Organization in the crowd: Peer production in large-scale networked protests. *Information, Communication & Society*, 17(2), 232–260.

- Blondel, V. D., Guillaume, J.-L., Lambiotte, R., & Lefebvre, E. (2008). Fast unfolding of communities in large networks. *Journal of Statistical Mechanics: Theory and Experiment*, (10), 100–108.
- Candón Mena, J. (2013). *Toma la Calle, Toma las Redes: El movimiento 15M en Internet*. Sevilla: Editorial Atrapasueños.
- Castells, M. (2012). *Networks of outrage and hope: Social movements in the internet Age*. Cambridge, MA: Polity Press.
- Christensen, K., & Moloney, N. R. (2005). *Complexity and criticality* (Vol. 1). London: Imperial College Press.
- Crawford, K., & Schultz, J. (2014). Big data and due process: Toward a framework to redress predictive privacy harms. *Boston College Law Review*, 55(1), 93. Retrieved from <http://lawdigitalcommons.bc.edu/cgi/viewcontent.cgi?article=3351&context=bclr>
- Dorogovtsev, S. N., Goltsev, A. V., & Mendes, J. F. F. (2006). k-Core organization of complex networks. *Physical Review Letters*, 96(4), 040601.
- Doyle, J. C., Alderson, D. L., Li, L., Low, S., Roughan, M., Shalunov, S., ... Willinger, W. (2005). The “robust yet fragile” nature of the Internet. *Proceedings of the National Academy of Sciences of the United States of America*, 102(41), 14497–14502.
- Earl, J., & Kimport, K. (2011). *Digitally enabled social change: Activism in the internet age*. Cambridge, MA: MIT Press.
- Edelman, G. M., & Tononi, G. (2001). *A universe of consciousness: How matter becomes imagination*. New York: Basic books.
- El País. (2013). *Los desahucios unen a los votantes*, 17 February. Retrieved July 20, 2014, from <http://politica.elpais.com/politica/>
- Errejón, I. (2011). El 15-M como discurso contrahegemónico. *Encrucijadas. Revista crítica de ciencias sociales*, 2, 120–145.
- Errejón, I. (2014). PODEMOS como práctica cultural emergente frente al imaginario neoliberal: hegemonía y disidencia”. Conversación con Íñigo Errejón Galván. *IC Revista Científica de Información y Comunicación*, 0(11), 17–46.
- Flesher Fominaya, C. (2010). Collective identity in social movements: Central concepts and debates. *Sociology Compass*, 4(6), 393–404.
- Friston, K. J. (2000). The labile brain. I. Neuronal transients and nonlinear coupling. *Philosophical Transactions of the Royal Society B: Biological Sciences*, 355(1394), 215–236.
- Gamson, W. A. (1991). Commitment and agency in social movements. *Sociological Forum*, 6(1), 27–50.
- Gerbaudo, P. (2013). *Online aggregation in the mass web*. Retrieved September 20, 2014, from <https://www.opendemocracy.net/paolo-gerbaudo>
- Gerbaudo, P. (2014). The persistence of collectivity in digital protest. *Information, Communication & Society*, 17(2), 264–268.
- Treré, E. (2015). In search of the “we” of social media activism: Introduction to the special issue on Social Media and Protest Identities. *Information, Communication & Society*. doi:10.1080/1369118X.2015.1043319
- Hardt, M., & Negri, A. (2004). *Multitude: War and democracy in the Age of empire* (Reprint edition). New York, NY: Penguin Books.
- Juris, J. S. (2008). *Networking futures: The movements against corporate globalization*. Durham: Duke University Press.
- Juris, J. S. (2012). Reflections on #occupy everywhere: Social media, public space, and emerging logics of aggregation. *American Ethnologist*, 39(2), 259–279.
- Lachaux, J.-P., Rodriguez, E., Le Van Quyen, M., Lutz, A., Martinerie, J., & Varela, F. J. (2000). Studying single-trials of phase synchronous activity in the brain. *International Journal of Bifurcation and Chaos*, 10(10), 2429–2439.
- Laclau, E. (2005). *On populist reason*. London: Verso.
- Laclau, E., & Mouffe, C. (2001). *Hegemony and socialist strategy: Towards a radical democratic politics*. London: Verso.
- Lambiotte, R., Delvenne, J.-C., & Barahona, M. (2008). Laplacian dynamics and multiscale modular structure in networks. *arXiv preprint arXiv:0812.1770*.
- Lim, M. (2013). Framing Bouazizi: ‘White lies’, hybrid network, and collective/connective action in the 2010–11 tunisian uprising. *Journalism*, 14(7), 921–941.
- Lin, X., & Kede, Q. (2011). *Embeddedness, social network theory and social capital theory: Antecedents and consequence*, pp. 1–5. En 2011 International conference on management and service science, MASS.

- Luhmann, N. (1995). *Social systems*. Stanford, CA: Stanford University Press.
- McDonald, K. (2002). From solidarity to fluidarity: Social movements beyond 'collective identity'—the case of globalization conflicts. *Social Movement Studies*, 1(2), 109–128.
- Melucci, A. (1988). Social movements and the democratization of everyday life. In J. Keane (Ed.), *Civil society and the state* (pp. 245–259). London: Verso.
- Melucci, A. (1989). *Nomads of the present: Social movements and individual needs in contemporary culture*. London: Hutchinson.
- Melucci, A. (1995). The process of collective identity. *Social Movements and Culture*, 4, 41–63.
- Melucci, A. (1996). *Challenging codes: Collective action in the information age*. Cambridge: Cambridge University Press.
- Metroscopia. (2015). *Barómetro electoral 2015. No es solo la economía*, 9 February. Retrieved February 10, 2015, from <http://www.metroscopia.org/>
- Monterde, A. (2013). Las mutaciones del movimiento red 15M. in *15Mp2p. Una mirada transdisciplinar del 15M* (pp. 294–301). Barcelona: IN3.
- Monterde, A., & Postill, J. (2014). Mobile ensembles: The uses of mobile phones for social protest by Spain's indignados. In G. Goggin & L. Hjorth (Eds.), *Routledge companion to mobile media* (pp. 429–438). London: Routledge.
- Moody, J., & White, D. R. (2003). Structural cohesion and embeddedness: A hierarchical concept of social groups. *American Sociological Review*, 68(1), 1–25.
- Networks, Movements and Technopolitics. (2014). #Encuesta15M2014 [Dataset]. Barcelona, Spain: IN3, Universitat Oberta de Catalunya. Retrieved September 15, 2014, from http://tecnopolitica.net/encuesta15m2014_datos
- Opp, Karl-Dieter. (2009). *Theories of political protest and social movements: A multidisciplinary introduction, critique, and synthesis*. London: Routledge.
- Padilla, M. (2013). *El kit de la lucha en Internet*. Madrid: Traficantes de Sueños.
- Pérez, B., & Gil, J. (2014). ¿Mercantilización o Revolución? Reflexiones en torno a la figura del streamer como nuevo sujeto prosumidor. In *15Mp2p: Una mirada transdisciplinar del 15M* (pp. 294–301). Barcelona: IN3. Retrieved from <http://dx.doi.org/10.7238/in3.2014.1>
- Polletta, F., & Jasper, J. M. (2001). Collective identity and social movements. *Annual Review of Sociology*, 27, 283–305.
- Postill, J. (2011). *Localizing the Internet: An anthropological account* (Vol. 5). New York: Berghahn Books.
- Postill, J. (2013). Democracy in an age of viral reality: A media epidemiography of Spain's indignados movement. *Ethnography*, 15, 50–68.
- Rheingold, H. (2003). *Smart Mobs: The Next Social Revolution*. Cambridge, MA: Basic Books.
- RTVE. (2011). *Más de seis millones de españoles han participado en el Movimiento 15M*, 6 August. Retrieved September 4, 2014, from <http://www.rtve.es/noticias/>
- Seidman, S. B. (1983). Network structure and minimum degree. *Social Networks*, 5(3), 269–287.
- Serrano, E. (2012). New technologies, social networks and media: Spanish revolution. *Romanian Journal of Journalism & Communication*, 7(3–4), 27–34.
- Snow, D. (2001). *Collective identity and expressive forms*. UC Irvine, Center for the Study of Democracy. Retrieved from <https://escholarship.org/uc/item/2zn1t7bj>
- Stoecker, R. (1995). Community, movement, organization: The problem of identity convergence in collective action. *Sociological Quarterly*, 36, 111–130.
- Tascón, M., & Quintana, Y. (2012). *Ciberactivismo: Las nuevas revoluciones de las multitudes conectadas*. Los Libros de la Catarata.
- Toret, J., Calleja, A., Marin, O., Aragón, P., Aguilera, M., Barandiaran, X., & Monterde, A. (2015). *Tecnopolítica y 15M: La potencia de las multitudes conectadas*. Barcelona: Editorial UOC.
- Varela, F. J. (1995). Resonant cell assemblies: A new approach to cognitive functions and neuronal synchrony. *Biological Research*, 28(1), 81–95.