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This is the accepted manuscript after the review process, but prior to final layout and copyediting. **Please cite as:**

Gloor, P. A., Fronzetti Colladon, A., Miller, C. Z., & Pellegrini, R. (2016). Measuring the Level of Global Awareness on Social Media. In M. Zylka, H. Führes, A. Fronzetti Colladon, & P. A. Gloor (Eds.), *Designing Networks for Innovation and Improvisation* (pp. 125-139). Cham, Switzerland: Springer International Publishing. Print ISBN: 978-3-319-42696-9.  
[http://dx.doi.org/10.1007/978-3-319-42697-6\\_13](http://dx.doi.org/10.1007/978-3-319-42697-6_13)

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# Measuring the Level of Global Awareness on Social Media

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**Abstract** We introduce a novel approach to measure the degree of global awareness by analysing social media. Tracking six honest signals of collaboration on Twitter (strong leadership, rotating leadership, balanced contribution, responsiveness, honest sentiment, shared language), we illustrate how social media builds collective awareness through Twitter activity while prominent events are unfolding. We compare three events in 2015: Francogeddon – the sudden unpegging of the Swiss Franc to the Euro, the launch of the Apple watch, and the Greek vote on Grexit, finding that Francogeddon shows the highest short-term impact on global awareness.

## 1 Introduction

What are the things that capture our attention? When walking down the street in our neighborhood we might notice a "for sale" sign that was not there before or a newly planted flower bed. We tend not to notice things that have not changed, but if we see a broken window that was in one piece yesterday, it captures our attention. We wonder how it happened. Who might have done this and why? Most likely we will tell someone and ask if they saw it, too.

While this scenario unfolds at the neighborhood level a similar phenomenon occurs at the global level. We use Twitter, Facebook, email and other online media to communicate what we 'see' is happening in the world. We interact through multiple networks sharing information, opinions and insights, in the process creating a collective awareness around the event (Sparrow et al. 2011). We participate in a process of collective sense making within a global community of people who share an interest in the things that we are interested in and whose lives are affected by the things that impact our lives.

Does an organization – and thus ultimately humanity – show some sort of consciousness or self-awareness? One might think so, at least in moments such as on the day when princess Diana died, or more recently, on that day in April 2013 when one of the authors was stuck at home in Cambridge while the Boston Marathon bomber was roaming at large in the neighbourhood. In those intense moments we feel maybe not “collectively intelligent” but certainly “collectively aware” or “collectively conscious”. If we meet a stranger in those moments, we know what they are thinking, namely “it’s so sad Diana died,” or “where might the marathon bomber be hiding and hitting next”. Moments like these motivate an informal definition of “organizational consciousness”. It is analogous to the human body, where the brain is conscious of the toe, and will respond differently depending on whether a person hits her toe at the door, or somebody else steps on her toe. Extending this metaphor, a “collectively conscious” organization will respond differently if somebody hits a member purposefully, or if a member hurts her/himself. Similarly to the neurons in the brain that are communicating through their synapses to create consciousness, humans communicate by interacting with each other verbally, through text, or other signals, either face-to-face or over long distance by phone or Internet.

To prove existence of consciousness on the individual level, Descartes famously stated “cogito ergo sum” - I think, therefore I exist. Extending this definition to an organization, “if the organization thinks and acts as one cohesive organism, it exists” and thus shows collective consciousness, defining organizational consciousness as common understanding of an organization’s global context that allows the members of the organization to implicitly coordinate their activities and behaviours through communication.

As an example of a global level event, in the case of the Boston Marathon bomber, everybody in the Boston area was trying to stay abreast of the most recent developments on Twitter, Facebook and the News, and looking out for traces of the terrorists. On the organizational level, a well-oiled team of software developers working together closely face-to-face, using chat, or using e-mail trying to debug a jointly developed application also shows a high level of organizational consciousness, as they are able to coordinate their work with minimal use of words.

## **2 Coolhunting with the Six Honest Signals of Communication**

Our aim is trying to make this implicit understanding more measurable, similarly to brain researchers, who measure individual levels of consciousness by attaching probes to individual neurons, tracking the electrical flow of current flowing through synapses between the neurons. In our work, we measure interaction among people through “coolhunting” in online media such as e-mail, Twitter,

Facebook, and blog posts, applying a framework of “six honest signals of collaboration” to assess the level of global consciousness (Clark 2001).

## ***2.1 Coolhunting Overview***

We use the coolhunting approach (Gloor 2010). It distinguishes between three different sources of information: the crowd, the experts, and the swarm. The difference is explained well through the metaphor of coolhunting for a restaurant as a tourist in a foreign city. Following all other tourists will bring us to the places where all the tourists go, these restaurants will be crowded, full of other tourists, expensive, and not particularly good. This is what following the crowd gives us, as the crowd likes to follow well-trodden paths.

If we ask the concierge in our hotel for a recommendation, we will end up in a better restaurant, with better food, but it most likely will still be full of tourists, and much more expensive. This is what following the advice of the expert brings us. The problem with experts is that they take kick-backs from the organizations whom they recommend, as they are paid to give advice, just like the rating agencies Moody’s and Standard & Poor’s, which get paid from the same companies and government whom they are supposed to assess, leading to serious conflict of interest.

We will find the best places to eat if we visit the places popular with the local residents. The hard part is trying to identify the locals on the street and in a crowded restaurant, as they are hard to distinguish from the tourists. We might get some hints by looking at their clothing, and listening to their language. We call this the swarm, leading in our restaurant example to the best meal at the lowest price.

When doing coolhunting on social media, we need to make the same differentiation between crowd, experts, and swarm, based on the source. Twitter usually gives us the wisdom (and madness) of the crowd, blogs and online newspapers give us the (paid) wisdom of the experts, while the swarm might be found among Wikipedia editors, in Facebook groups, and on subject-matter specific online forums. Obviously, the intrinsically motivated swarm will give us the best information quality. Tracking the right hashtags on Twitter might also lead us to the swarm for a certain topic.

## 2.1 *The Six Honest Signals of Collaboration*

To measure the impact of a topic on global consciousness, we use the “six honest signals of collaboration”. They were originally defined for measuring collaboration within organizations by analyzing e-mail archives (Gloor 2015); they can be similarly applied to online social media. They are based on key social network analysis metrics (Wasserman & Faust 1994), and include two metrics each for structure, dynamics, and content of the network.

The two structural metrics are central leadership and balanced contribution. *Central leadership* measures betweenness centrality of a network, indicating how much the network is dominated by one or a few leaders. *Balanced contribution* measures, through contribution index (Gloor et al 2003), how much members of a group are senders or receivers of information, and if the information is contributed by a small subset of the group, while the other group members are passive information consumers.

The two dynamics-based metrics are rotating leadership and responsiveness. *Rotating leadership* measures how much members of the network take turns in leadership by tracking oscillation in betweenness centrality. *Responsiveness* measures how quickly one actor responds to another one, for example in Twitter how quickly a tweet is retweeted, or one person responds back to a tweet from somebody else, and how many nudges (pings) it takes.

The two content-based metrics are *honest language*, and shared context. The more the language in tweets or online forums includes both very positive and very negative language, the more honest it is. *Shared context* measured how much a group is defining their own vocabulary, making up their own words and abbreviations.

These six “honest signals of collaboration” have been measured in online social media using the Condor tool ([www.galaxyvisors.com](http://www.galaxyvisors.com)), which automatically collects Twitter, Facebook, Blog, and Wikipedia data and calculates the metrics.

## 3 Results

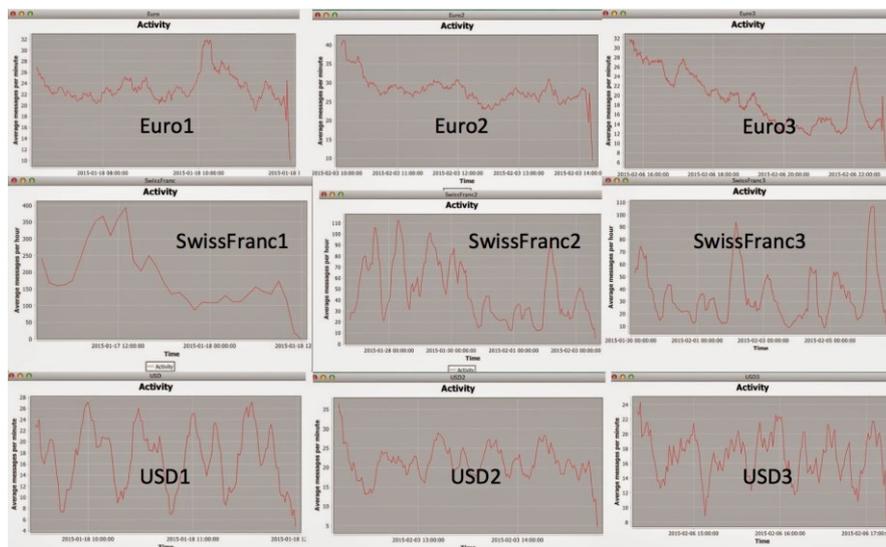
We will now describe three case studies of measuring collective awareness through Coolhunting on social media. “Francogeddon” was the event January 2015 when the Swiss National bank overnight removed the fixed binding between Euro and Swiss franc, leading to huge turbulences at the global exchange markets. We compare this event against one pre-planned and well-orchestrated event, the launch of the Apple watch in Italy. Our third case is the turbulent months when Greece was teetering on the brink of bankruptcy and was pondering “Grexit”, the exit from the Eurozone.

### 3.1 Francogeddon – Uncapping the Swiss Franc – a Signal of Global Consciousness?

We start illustrating global consciousness by the example of Francogeddon. On January 15, 2015 financial markets were in turmoil. In a surprise move – later termed Francogeddon - the Swiss National Bank removed the artificial exchange rate of Swiss Franc 1.20 to the Euro, which it had set and defended by buying massive amounts of Euro and Dollars since September 6, 2011. Within hours the exchange rate between Euro and Swiss Franc fluctuated from 1.20 Francs per Euro to 95 Swiss cents per Euro, leading to massive losses at stock markets around the world, forcing hedge funds into insolvency.

Such an unexpected event at the financial markets offers a unique natural experiment to measure global consciousness of financial markets. Using Condor, we collected the most recent 12,000 tweets containing the string “Swiss Franc”, as well as another 12,000 tweets each containing “Euro” and “USD” on January 18, when Francogeddon was still a major issue, and currencies were still fluctuating wildly. We repeated the data collection at two later points in time, on February 3 and February 6, 2015, when Francogeddon was over, and things had settled down. This nine-part dataset allows us to compare a moment of high public consciousness, when Francogeddon was at the top of everybody’s minds involved in currency trading with a baseline of two later points in time when the event was over and public consciousness should be low again.

**Fig. 1.** Twitter activity after January 18, 2015 for search strings “Swiss Franc”, “USD”, and “Euro”.



The nine charts in figure 1 illustrate the activity of the tweeters on these three days. While the tweet activity about Euro and USD is about the same on all three sampling days (20 to 30 tweets per minute), tweet activity for Swiss Franc is about 200 tweets pro hour on January 18, dropping to 50 tweets per hour on February 3 and 6.

**Fig. 2.** Twitter network structure on January 18 and February 6, 2015 for search strings “Swiss Franc”, “USD”, and “Euro”.

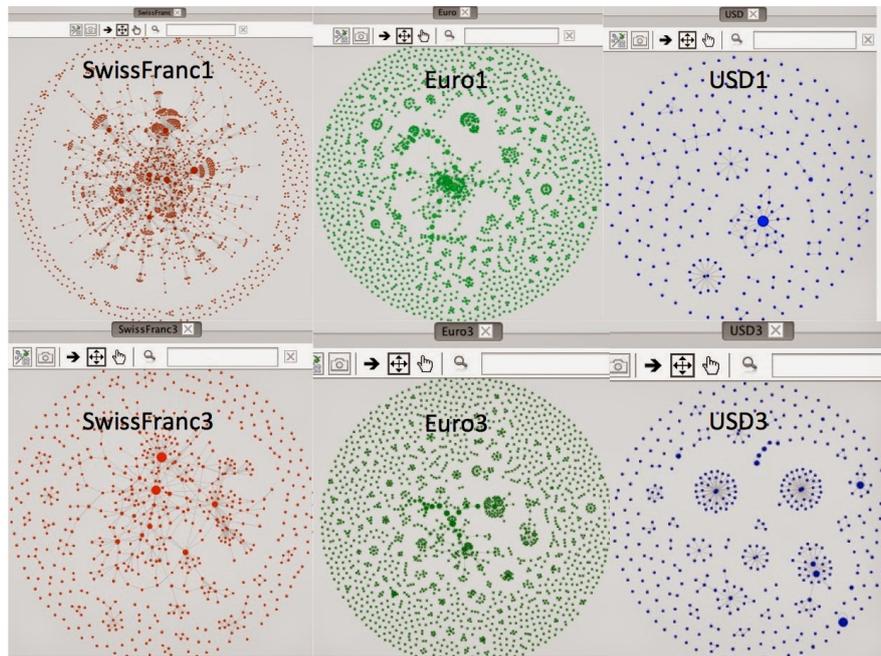
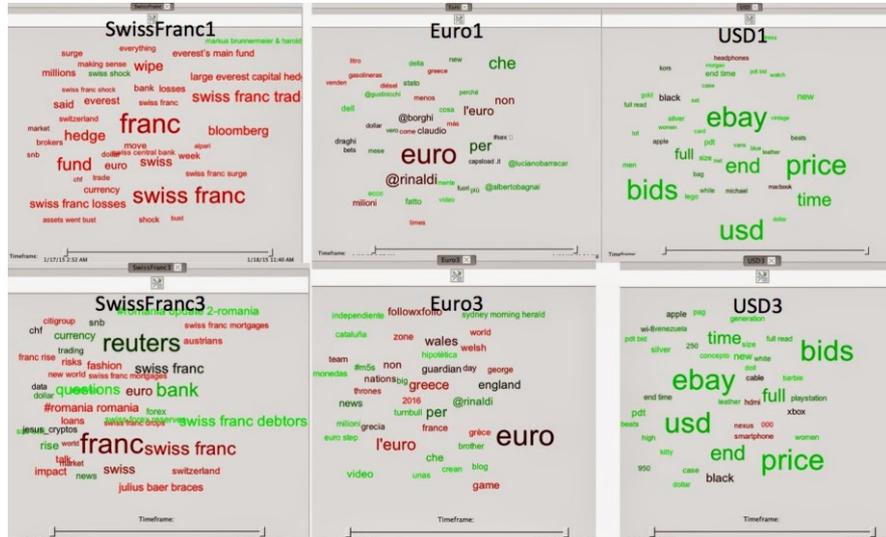


Figure 2 shows the network structure of the three currency twitter networks on January 18 and February 6. Each node is a person tweeting, a link is added between two nodes if one person is mentioned in the other’s person tweet, or one person is retweeting the other person.

As figure 2 illustrates, the tweets about Swiss Franc on January 18 form a large connected component. The Euro network (which was more influenced by the Swiss Franc) shows a somewhat smaller connected component, while the USD tweet network is very little connected which tells us that the tweeters have nothing to do with each other. On February 6 all three tweet networks have similar structures of mostly unconnected tweets with the Euro still showing a somewhat larger connected component.

**Fig. 3.** Word cloud of tweets on January 18 and February 6 2015 for search strings “Swiss Franc”, “USD”, and “Euro”.



The six Word Clouds depicted in figure 3 show what people are tweeting about. While the sentiment about the Swiss Franc on January 18 is overarching negative (the darker the red of a keyword, the more negative its context), it is somewhat negative for the Euro tweets, and almost exclusively positive for the USD. The Swiss Franc tweets on February 6 are becoming more positive, but still mostly negative, as a lot of people in Eastern Europe, particularly in Poland, but also in Rumania and Austria, complain about taking out mortgages in Swiss Franc, which now ballooned against their local currency. A look at the USD tweets on both January 18 and February 6 shows that they mostly consist of retweets of items auctioned on eBay. This illustrates that the US tweeters do not care much about Francogeddon. Tweets about the Euro are somewhat negative, but the concerns – which are growing on February 6 – are more about Mario Draghi and the possible Grexit, i.e. the exit of Greece from the Eurozone.

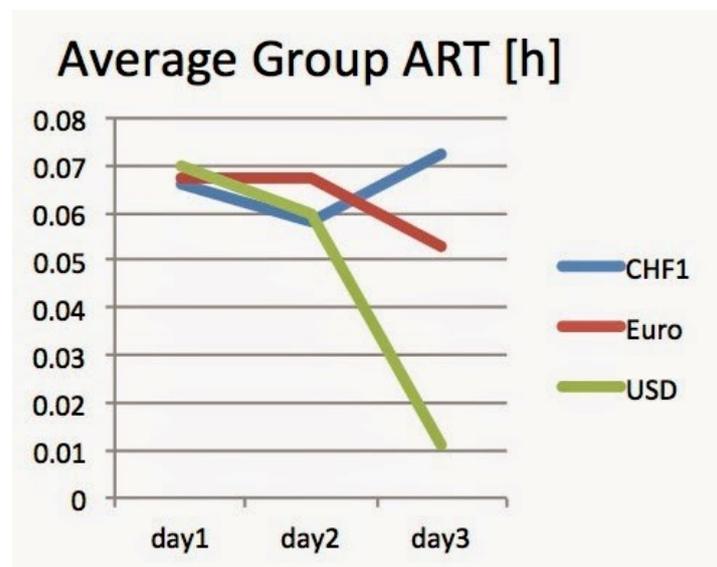
We calculated the six honest signals of communication for the nine datasets:

- (1) Group betweenness centrality (how centralized are the tweet networks),
- (2) oscillation in group betweenness centrality (how much is the centrality of individual tweeters in the network changing over time, measured in 15 minute intervals),
- (3) average weighted variance in contribution index, i.e. how much are individual tweeters being retweeted over time,
- (4) average response time and nudges, which tells how long it takes for a tweet to be retweeted, and if people are mutually retweeting each other,

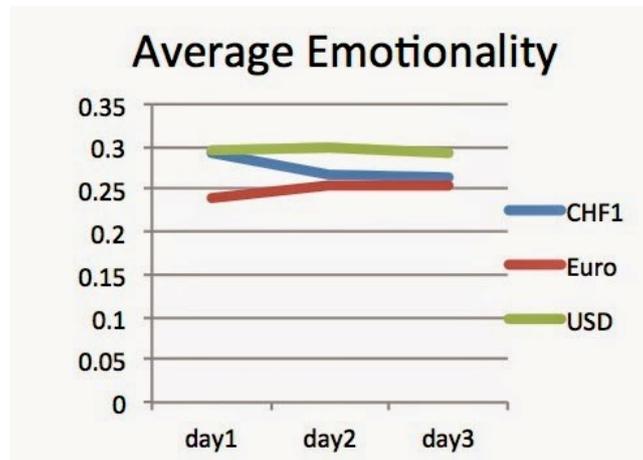
- (5) sentiment and emotionality, which shows how positive and negative the tweets are, and
- (6) complexity of language.

The charts below illustrate the changes over the three points in time in emotionality (figure 5), average response time (ART) (figure 4), and number of nudges per tweeter (figure 6). For example, the response time (ART) drops considerably for USD from January 18 (day 1) to February 6 (day 3), while it goes up for Swiss Francs. This means things are cooling down for tweets about Swiss Francs, and it takes more time until they are retweeted.

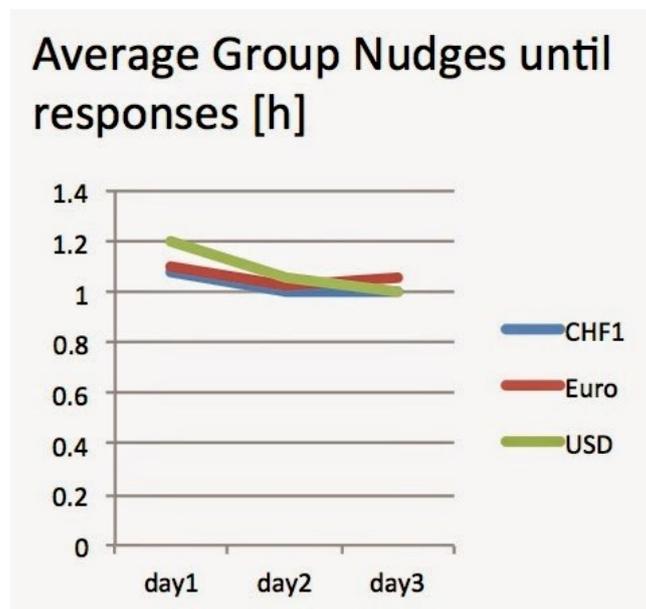
**Fig. 4.** Average response time (ART) of tweeters using search strings “Swiss Franc”, “USD”, and “Euro”.



**Fig. 5.** Average emotionality of tweets containing search strings “Swiss Franc”, “USD”, and “Euro”.



**Fig. 6.** Average number of nudges (retweets) of tweeters using search strings “Swiss Franc”, “USD”, and “Euro”.



Comparing the six honest signals of communication for the three currencies, we see that even for this small sample, using the Mann-Whitney U-Test, tweeting

behavior about Swiss Franc is different from tweeting about Euro and USD, with regards to the number of nudges as well as the variance between nudges until one tweeter responds to another tweeter. To put this in other words: comparing the three twitter networks about the three currencies over three points in time, there seems to be higher global consciousness by people tweeting about Swiss Franc compared to people tweeting about Euro and USD – a glimpse of global consciousness of currency traders related to Francogeddon?

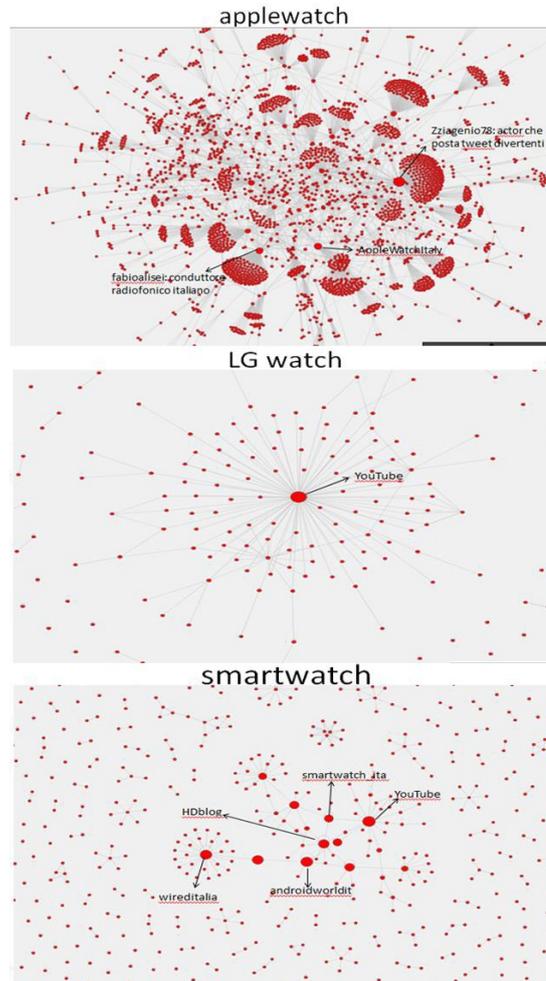
### ***3.2 Launch of the Apple Watch in Italy***

The launch of the Apple Watch in Italy provides our second illustration of global consciousness. As previously noted, although the intrinsically motivated swarm will provide the best information quality, tracking the right hashtags on Twitter might lead to the swarm.

Data were collected in three different datasets between June 21 and July 11, which included the Apple Watch launch in Italy on June 26. One dataset was specifically for the Apple Watch, one for the collection of tweets on the smartwatch in general, and finally a dataset to collect tweets about a competitor of the Apple Watch, the LG Watch Urbane. Using Condor to analyze the three datasets we were able to make comparisons between them based on measures of network structure, network dynamics, and network content. The tweet collection was restricted by geocode to Italy only.

We first observed the number of actors collected in each dataset. In the dataset “applewatch” there are 4970 actors. The number drops dramatically in the other two datasets: “smartwatch” has 907 actors and “LGwatch” 203 (figure 7). The theme Apple Watch involved a large number of Twitter users between June 25<sup>th</sup> and 26<sup>th</sup> corresponding to the delayed launch of the Apple Watch. In the other two datasets there are far fewer actors, suggesting that the themes were not as “hot” or compelling as “applewatch”.

**Fig. 7** Twitter Network search structure for search string “Apple Watch”, “LG Watch” and “Smartwatch”.



In comparing the sentiment between the three datasets there is relatively little variation. Overall, values were high as seen from the large number of green (positive) words in the word cloud. However, there is a decreased value for sentiment for “LGwatch” in the days prior to and shortly after the launch of the Apple watch. It is possible that conversations in the network were negatively affected by the arrival of the LG watch competitor. In the word clouds (Fig. 8) for “smartwatch” and “LGwatch” many of the words that appear are related to the Apple watch, indicating how this event affected Twitter users that would not typically be tweeting about the Apple watch.



### 3.3 The Greek Referendum

The Greek Referendum on July 5, 2015 provides the third illustration of global consciousness. From June 26 to July 7, the tweets with the search strings “GRoxi” and “GRnai” were collected. “Oxi-No” and “Nai-yes” stand for or against the austerity requirements of the EC, with a No-vote rejecting the austerity requirements of the EC, and risking a possible Grexit from the Eurozone. While the polls were predicting a close exit of the vote, the Greeks in fact soundly voted for “oxi”, rejecting the austerity requirements.

Figure 9 illustrates the twitter network of the two hashtags. The “GRoxi” network is much more dense, illustrating that in this case Twitter was a much better predictor of the exit of the vote than the official polls.

**Fig. 9** Twitter Network search structure for search string “GRnai” and “GRoxi”.

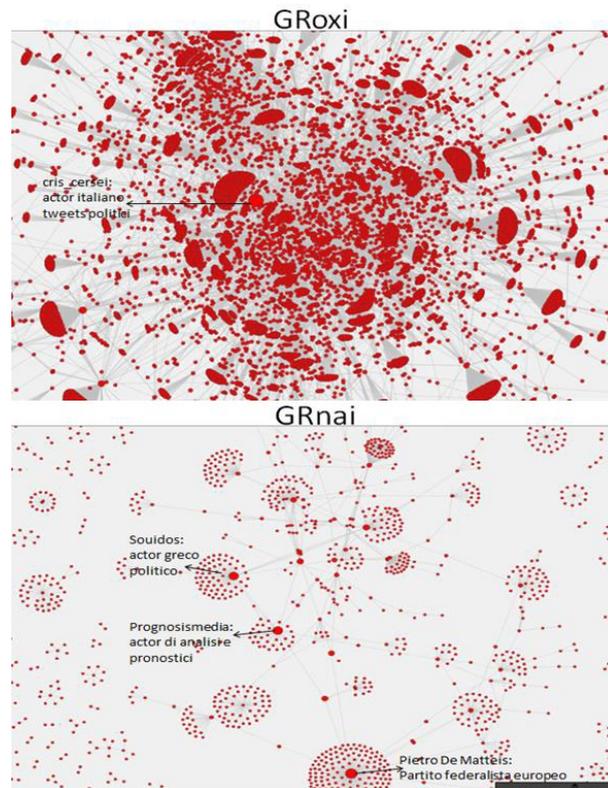
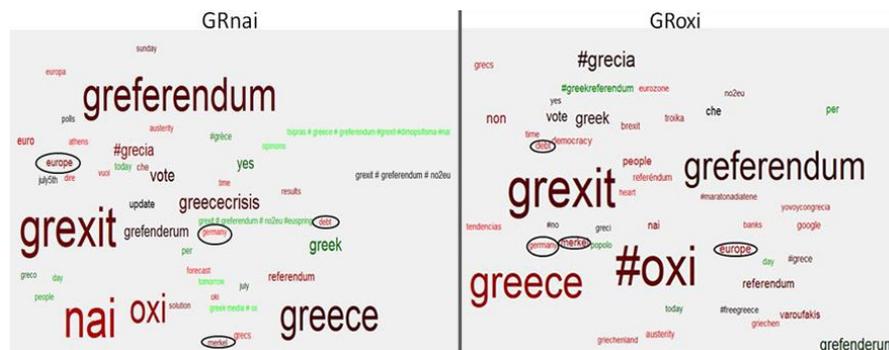


Figure 10 shows the word clouds for the two hashtags. As the Greeks were quite pessimistic in these times, it is not surprising that the words are mostly red –

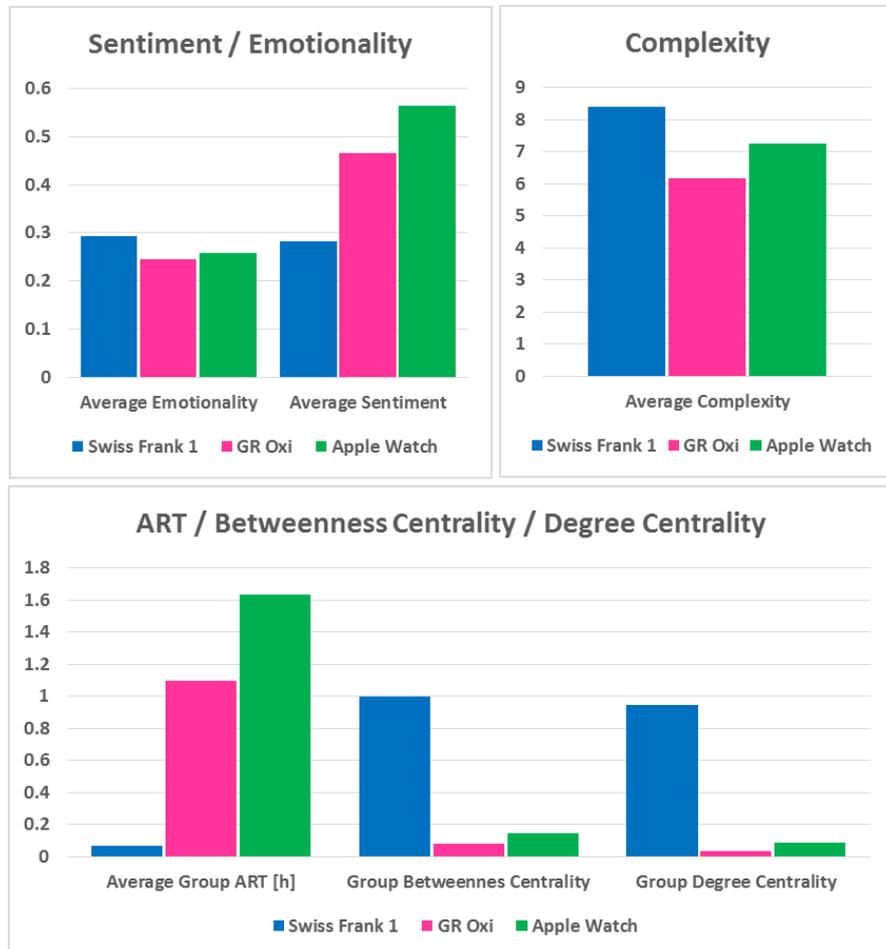
meaning they were used in a negative word context, as automatically measured by Condor’s sentiment analysis tracking software. As an additional indicator of the outcome of the vote, the word cloud on “GRnai” includes “nai” almost as large as “nai”, with size indicating the frequency of the word. The GRoxi cloud does not prominently show “nai”.

**Fig. 10** Word clouds for search string “GRnai” and “GRoxi”.



### 3.4 Comparative Analysis – Measuring Collective Awareness

In this section we compare the results of the three different global events, comparing the magnitude of the signal for each of the events on the day when the event happened. Figure 11 shows sentiment, emotionality, complexity, average response time (ART), group betweenness centrality and group degree centrality for the search term “Swiss Franc” on January 15, 2015, “Apple Watch” on June 26, 2015, and “GRoxi” on July 5, 2015.

**Fig. 11** Measuring the honest signals of the swarm to assess collective awareness

We find the strongest signals of global awareness for Francogeddon. Emotionality is highest, and sentiment is most negative (sentiment is positive if its value is bigger than 0.5). This is quite surprising, as the Greek were quite unhappy with the austerity measures introduced by the EC also, but it seems taking a large loss in one day leads to stronger expressions of frustration. Most of the negative tweets on Francogeddon came from currency traders and hedge fund managers who had to digest multibillion losses in one day, in some cases even leading to their bankruptcy and dissolution. In the case of the Greek, there was a lot of talk, but the tragedy was unfolding much more slowly, and in the end nothing drastic happened. Francogeddon also leads in complexity of language, and it beats the other two events by far in speed of response, as the average response time (ART) is less than a 5 minutes, while it takes more than an hour on average until a tweet

about GRoxi or the Apple Watch is retweeted or responded to. Group betweenness centrality and group degree centrality are much higher also for Francogeddon, meaning that a few key tweeters, mostly currency traders, dominate the twitter sphere and are retweeted feverishly. In conclusion, we maintain that global awareness can be measured tracking the six honest signals of communication presented in this paper, monitoring online conversations on media like Twitter. Francogeddon is clearly the event that generated the biggest global awareness on Twitter, showing a stronger negative sentiment, with more variance in peoples' feelings (emotionality) and with a more heterogeneous language used (complexity). Network metrics confirm the results of the semantic analysis: people interacting on the topic of Francogeddon are fare more dynamic – i.e. they rotate more – and centralized; they are also much more engaged and responsive. A numerical comparison of our measurements is presented in Table 1.

**Table. 1** Comparing the six honest signals of communication for the three events

	<b>Francogeddon</b>	<b>Grexit</b>	<b>Apple Watch</b>
<b>Average Emotionality</b>	0.293	0.244	0.258
<b>Average Sentiment</b>	0.282	0.466	0.563
<b>Average Complexity</b>	8.405	6.177	7.265
<b>Average Group ART [h]</b>	0.066	1.099	1.636
<b>Group Betweennes Centrality</b>	0.998	0.077	0.146
<b>Group Degree Centrality</b>	0.943	0.035	0.087

## 4 Conclusion

In this paper we have demonstrated that our approach, using the six honest signals of collaboration, offers a novel way to measure global awareness. While our sample set is very restricted, it still has shown the validity of our method. However, Twitter is not making it easy for researchers to study such events, as there is no simple way to get large archives of Twitter data of events after the fact, as we can only collect the last ten days of Tweets on any given day. This means that our analysis can only go forward and we have to catch events and start collecting tweets on the day they happen.

Based on our three case studies we found evidence to support the argument that, building on each other through tweets and retweets, actors are creating global awareness of key events. While all three events have left a recognizable footprint in global awareness, a sudden unexpected event with deep impact close to the bottom line such as Francogeddon leaves a much deeper impression in global

awareness, than a carefully orchestrated marketing event such as the launch of the Apple watch, or a week-long litany of complaints about bad times such as the Greek vote on the Grexit. It seems that to leave a deep impact in global awareness, the surprise element is key.

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