

# Forecasting and observing: A cross-methodological consideration of Internet and mobile phone diffusion in the Egyptian revolt

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**Jacob Groshek**

University of Melbourne, Australia

## Abstract

This study examines the Egyptian revolt (see Zhuo et al., 2011) of January/February 2011 from two discrete perspectives. The first perspective is a contextual marker that takes into account long-term and forecast trends in democracy from 1952 through 2011. The second perspective reports the opinions and viewpoints of Egyptian citizens living in a remote fishing village and resort town through impromptu in-person interviews conducted between 23 and 30 January 2011. The statistical findings evidence that the Internet and mobile phones have helped to facilitate sociopolitical instability and democratic change over time, while the personal interviews paradoxically suggest circumspection in making generalizations about how these events have proceeded across a large population and through a period of tightly suppressed communication when Internet access was shut down. Taken together, characterizing the events in Egypt as having been just a social media revolution therefore appears to misrepresent the evolution of political change in the country through this time period.

## Keywords

Democracy, Egyptian revolt, online media, technological determinism

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## Corresponding author:

Jacob Groshek, School of Culture and Communication, Department of Media and Communications, University of Melbourne, 130 John Medley East, Parkville, VIC, 3010, Australia.

Email: [jgroshek@unimelb.edu.au](mailto:jgroshek@unimelb.edu.au)

The dramatic events that unfolded in Egypt in late January and early February 2011 have prompted unprecedented discussion of communication technologies' role in precipitating democratic change, specifically in autocratic countries. Wael Ghonim, the Google executive that administered the now-infamous *We are all Khaled Said* Facebook page stated in a CNN interview that the Egyptian uprising was 'Revolution 2.0' and also declared, 'If you want to free a society, just give them Internet access' (Watson, 2011). One feature that seems especially interesting about the specific case of Egypt is that what has been described as an Internet (or Facebook or social media) revolution was sustained through a period of time when there was virtually no Internet access in the entire country. Indeed, as I sat in the lobby of my Egyptian hotel during the waning days of January, I could not gain Internet access for nearly a week. Sitting there, unable to upload pictures to Facebook, tweet even one character, check email or search Google, it seemed evident at that point that the demonstrations taking place in Cairo and elsewhere in the country could not be *the* Internet revolution. After all, how can there be an Internet revolution with no Internet?

This question and the Internet shutdown that began with attempts to deny access to Twitter on 25 January and led to suspending nearly all Internet access across Egypt from 28 January through 2 February (Singel, 2011) seem to have been lost a bit in the panoply of debate that has followed the historic turn of events that lead to Hosni Mubarak's resignation of power on 11 February 2011. Much of that debate has proceeded from the standpoint of determining whether or not the Internet in general, combined with mobile phones and social networking sites in particular, are now the basis for anti-authoritarian revolutions. Tellingly, the debate has not been entirely dichotomous, though there have been a good number of staunch advocates like Clay Shirky and Wael Ghonim, as well as detractors such as Malcolm Gladwell and Evgeny Morozov (for a brief overview, see Al Jazeera, 2011; Beaumont, 2011).

Given the success of the demonstrations in Egypt in overthrowing Mubarak, it can clearly be noted that his strategy of denying Internet access and disrupting mobile phone services *during* a major anti-authoritarian movement was not effective to prevent his ousting from power. Nonetheless, it still remains uncertain what role Internet and mobile phone diffusion fulfilled in Egyptian political and economic development in the years that lead up to January 2011. Likewise, there has not been much attention paid to the viewpoints and perspectives of Egyptians living outside of Cairo and other areas of great protest activity (for an example of one exception, see BBC, 2011). In other words, the primary points of focus concerning the Egyptian revolt have been largely limited by both time (to January/February 2011) and geography (to Cairo, Alexandria, and other major cities).

Thus, the purpose of this study is to examine the role of online and mobile technologies in Egyptian politics through a cross-methodological approach. The results of several time-series econometric analyses, including forecasting models and Granger causality tests, are examined in conjunction with personal interviews conducted during the historic first week of the protests with Egyptians living outside of the primary conflict areas. Through these processes of investigating the Egyptian context of technological political influence in wider empirical terms, a richer understanding of the Egyptian revolt and its progress despite a thorough and largely effective Internet blackout is offered.

## **Communication technologies and democratic growth**

Like Zhang et al. (2010), many researchers and policy analysts have suggested that political movements (in the case of Zhang et al., 'the revolution') will be networked through online applications (see also Shirky, 2008, 2010). Others have importantly expanded conceptual models to also include mobile phones as democratic tools (Wasserman, 2011). In some cases, however, such conclusions follow with relatively little attention paid to other forms of development, communication, and mobilization, such as those suggested by Morozov (2011). The study reported here approaches this now re-emerging paradigm of strong media effects and accompanying debate from the perspective of media system dependency (MSD) theory (Ball-Rokeach and DeFleur, 1976) as it relates to media content, uses, and effects.

Of course, the concept that the Internet, mobile phones, or any media can act as a specific change agent is not a new one (see Lerner, 1958). Yet the argument that forms of online social media – including weblogs, Facebook, Twitter, and YouTube – might succeed in engaging and mobilizing individuals on civic and political issues is a recent manifestation that seems to be finding general support among researchers (Boulianne, 2009; Chadwick, 2009; Gil de Zúñiga and Valenzuela, 2011). Similarly, mobile phones, increasingly with the potential to integrate online data services, have also been shown to be related to positive democratic outcomes, such as voter turnout (Suarez, 2006). Such evidence is largely unique from many results studying other media platforms – notably television but also mainstream newspapers – that were determined to have less direct behavioral effects but clear implications upon presentation, process, and the experience of politics (Gurevitch et al., 2009; Putnam, 2000).

In the review of literature, such findings should come as no surprise; Quintelier and Vissers (2008) identified four reasons why online media should have a positive relationship with political action. First, the Internet offers multiple opportunities for political engagement: for example, participating in online polls, debates, blogging, or organizing offline meetings through social networks. Second, online technologies lower the transaction costs of participation for citizens both in terms of time and effort since it is easier and faster to access multiple online news sources through the Internet rather than through traditional media. Third, there is a wealth of information about politics and public and civic life online, which has the potential to contribute to a more informed and mobilized electorate specifically when transmitted through social networks. Finally, a unique feature of online media is their interactivity: they allow direct and potentially mobile contact with politicians and each other, including instant feedback via social network sites (SNS).

Despite some variation in finding support for the positive effects of online media technologies (Groshek and Dimitrova, 2011), the majority of published research shows that the Internet does contribute to political knowledge and engagement (Dalrymple and Scheufele, 2007; Kenski and Stroud, 2006; Shah et al., 2001; Xenos and Moy, 2007). A meta-analysis by Boulianne (2009) reviewed 38 journal articles and conference papers that focused on the Internet in civic and political engagement and concluded that the evidence by and large shows a positive influence. Indeed, she identified that the number of studies with positive political findings related to Internet use significantly outnumbered

those that found negative or no effects of online media use. In a related study, Hermanns (2008) concluded that mobile phones are becoming more effectively 'used as political organisational tools across cultural and social borders' (2008: 80).

Considering the prevailing sense of optimism in contemporary research and the techno-political situation in Egypt where the Mubarak regime attempted to stem the tide of protests by eliminating Internet access, the media system dependency framework is especially useful for tracking relationships over time. As other research in the area of Internet diffusion and political change has pointed out, MSD theory accounts for instances of considerable media influence as well as moments of non-effects (Groshek, 2009, 2010). Specifically, media effects – such as those that might topple regimes – are increasingly likely when individuals or communities are more dependent on media. In linking media to content, audiences, and sociopolitical conditions, DeFleur and Ball-Rokeach (1989) indicated that media dependency increases in social systems where media are more numerous and central in fulfilling information functions as well as during times of heightened levels of social conflict and change.

These criteria were quite evident in the case of Egypt by January 2011. Nearly 65.5 million Egyptians were mobile phone subscribers by October 2010 (Le Coq, 2011), and 4.7 million Egyptians were on Facebook by December 2010 (Arab Social Media Report, 2011). The content and uses that individuals were making of these media were almost certainly central to their personal lives and political experiences (Howard, 2010), given the nature of mobile communications and the dualistically personal yet social nature of Facebook interactions (Wasserman, 2011). A sociopolitical context of conflict and change was equally apparent by early January 2011, after openly expressed doubts about rigged elections the previous November, an existing and organized opposition, the mobilizing event of police brutality regarding Khaled Said, and the successful opposition to authoritarian power in Tunisia (Giglio, 2011a). Thus, it seems that the possibility for the Internet to influence political change, specifically via social media and mobile phones, was almost undeniably high, and these communication technologies certainly played a central role in forming the protests that began on 25 January.

While this theoretical framework offers a media explanation of how and why the protests began, it does not explicitly address how a seemingly technologically dependent movement survived the Internet blackout and disruptions to mobile services. While much has been made of Google-sponsored gadgetry like speak-to-tweet (Praetorius, 2011), these tools seem to have hardly been sufficiently available as actual organizing and mobilizing tools for demonstrators themselves without regular Internet access. Nor does it seem likely that all information dependence simply shifted to traditional forms of media, such as television broadcasts by international news organizations like BBC or Al Jazeera. Still, the demonstrations actually increased in size and defiance (ignoring curfew) even after Internet access was effectively eliminated (CBC, 2011).

Clearly, there were many unique features in the Egyptian revolt of 2011, but excepting Howard (2010), relatively little empirical work has been reported about the historical context of Internet and mobile diffusion in Egyptian politics or the interpretations among Egyptians outside of Cairo during the protests. In order to address these apparent disjunctures and more thoroughly explore a remarkable sociopolitical event, this study examines the Egyptian revolt from a broader perspective. Here, the lens of technological

diffusion and political change is considered through both national-level data as well as 'outsider within' individual perspectives (Watts, 2006) of Egyptians living along the Red Sea coast. Research questions for these purposes are posed here as follows.

*RQ1:* Do the national democracy levels from 1952 to 2009 statistically forecast democratic change in Egypt by 2011?

*RQ2a:* Are Internet and mobile phone diffusion time-ordered predictors of national-level democratic growth in Egypt through 2009?

*RQ2b:* Are Internet and mobile phone diffusion time-ordered predictors of statistically forecast national-level democratic growth in Egypt through 2011?

*RQ3:* How did a group of southern Egyptian citizens interpret the role of the Internet and mobile phones during the first week of the anti-Mubarak protests?

## Methods

The first methodological perspective employed for RQ1 and RQ2 includes several econometric time-series analyses that are designed as contextual markers to take into account long-term trends in democracy and developments in online and mobile communication technologies as well as sociopolitical instability, economic growth, school enrollment, and population size in Egypt from 1952 through 2009. The second methodological approach applied for RQ3 qualitatively examines the opinions and viewpoints of southern Egyptian citizens living in a remote fishing village and resort town through a variety of personal interviews that took place from 23 to 30 January 2011. Each is addressed in turn.

### *Quantitative analyses: Variables*

This study started by looking at the distribution of national level democracy scores as these related to Internet access, mobile phone penetration, sociopolitical instability, gross national income per capita, primary and secondary school enrollment, and overall population from 1952 to 2009. While there are, of course, other variables that could be incorporated, complete and reliable data were not readily available in all instances. Considering such limitations, the data modeled here include key variables that are appropriate to examine the modern political history of Egypt in relation to online and mobile technologies across several germane dimensions that previous research has identified as important (Groshek, 2011).

For the variables examined here, data were collected for the years 1952–2009 for fairly straightforward reasons: 1952 marked the revolution that formalized the nation as a republic and 2009 was the most recent year for which observed data were available at the time of collection and analysis. The variables themselves come from leading sources that have been used in similar studies, and while some doubt remains about macro-level figures from cross-national databases, they still provide reasonably meaningful representations that can be used to estimate actual national conditions (see Van Dijk, 2006).

The central variable of this study is democracy values that range from –10 (full autocracy) to +10 (full democracy), which are drawn from the Polity 2 scores denoted

in the Polity IV database (see Groshek, 2009, 2010, 2011; Gurr and Associates, 1978). The other key variables are Internet and mobile phone presence. Mobile phone diffusion rates are based on subscribers per 100 people from the World Bank World Development Indicators (WDI) database and Internet diffusion measures are those reported by the International Telecommunications Unions (ITU) as access per 100 people. Notably, mobile and Internet figures are zero until 1988 and 1994, respectively, when the first cellular networks were launched in Egypt and when public Internet access became viable with the creation of the Mosaic browser. Conceptually, the extent to which the joint diffusion and use of these technologies facilitated democratic change in Egypt is being examined. Thus, Internet diffusion and mobile phone subscriptions were added together and divided by two to create a simple additive index of Internet and mobile access per 100 citizens. While this technique likely underestimates the total pattern of actual technological diffusion, it is preferable to employ conservative estimates to avoid spuriously overstating their influence, particularly in examining the Egyptian revolt. These measures were also highly correlated with one another ( $r = .97, p < .01$ ) since they effectively track similar diffusion curves at different points in time. Thus, it is also practically prudent to model them jointly.

Other variables that were included in time-series models follow here: sociopolitical instability, gross national income per capita, primary and secondary school enrollment, and overall population for the specified timeframe. Sociopolitical instability was gathered from the 'weighted conflict index' that is calculated in Banks' Cross-Polity Time-Series (CNTS) database. This cumulative measure provides weighted codings of assassinations, general strikes, guerrilla warfare, government crises, purges, riots, revolutions, and anti-government demonstrations for each year (see Groshek, 2009; Weaver, 1977). Gross national income figures are based on per capita figures in current US dollars when applying the Atlas method and are drawn from Banks' CNTS database until 1962, at which point all remaining figures are those reported by the WDI through 2009. Raw educational enrollment figures for both primary and secondary schools, provided by Banks' CNTS, were used as indicators in this study by dividing by population figures to measure overall school enrollment per 100 citizens. The mean change of the five nearest years was used to substitute two missing years of these education data. Total population figures were also retrieved from Banks' CNTS database and input remained unadjusted to control for population growth.

### *Quantitative analyses: Models*

Given the case of the well-announced Arab Spring being facilitated by social media (Kaplan-Leiserson, 2011; Waxman, 2011) that is under investigation here, it is of particular importance to examine the diffusion of the Internet and mobile devices as causal-type mechanisms of democracy while accounting for other variables, including the previous democracy levels observed in Egypt. Time-series regression models provide several platforms for carrying out such examinations.

One of these applied here was an autoregressive integrated moving average (ARIMA) time-series regression model that generated statistical forecasts to examine RQ1. In the econometric method described by Enders (2004), such models can separately apply

different lag (AR) and moving average (MA) terms while also differencing variables to achieve stationarity (I) and provide accurate estimations of unobserved future values. Put simply, an ARIMA model is a regression model that considers only the distribution of past values from the dependent variable, as well as lag terms and moving averages of the series. Provided this distribution is, or can be transformed to achieve stationarity where statistical properties such as mean and variance are constant over time, ARIMA models can then be utilized to make predictions about future values, based only on past values in a given series of data points.

In this study, the distribution of Egyptian democracy scores from 1952 to 2009 was used to statistically forecast the democracy scores for 2010 and 2011. These statistical predictions employed dynamic mean squared errors that adjust for increasing error over forecast time to examine if such a change could have been expected based only on the past distribution of previous democracy scores alone. Though RQ1 was concerned only with whether or not democratic change could be statistically forecast in 2011, the same technique was used to generate forecasts that could approximate expected levels of all other variables in 2011 to explore other time-series regression models in estimating more up-to-date relationships.

Another type of time-series regressions employed here were vector autoregressions (VARs) that modeled only actual values observed through 2009 (as tested in RQ2a) as well as modeling forecast values through 2011 (as tested in RQ2b). Mathematically, a 'VAR is a  $n$ -equation,  $n$ -variable linear model in which each variable is in turn explained by its own lagged values, plus current and past values of the remaining  $n-1$  variables' (Stock and Watson, 2001: 1). As such, VARs have no explicit moving average component but offer the benefit of being able to test the joint effect of multiple variables with multiple time lags. Most importantly, VAR specifications also allow for post-hoc Granger causality testing, which determines the extent to which lags of one variable influence the distribution of another time-ordered variable, and the extent to which the second variable adds explanatory power in the dyad (Enders, 2004). Put more simply here, VARs resemble typical OLS regression models except dependent variables are modeled inclusive of their own (user-defined) time-lagged values as well as other independent variables with the same time lags applied.

Typically, the results of Granger causality tests are more informative and frequently reported than VAR coefficients or  $R$ -squares themselves (Stock and Watson, 2001) because they provide more clear evidence of causal-type relationships. In these tests, should the  $F$ -statistic testing the null hypothesis indicate that a variable with a specified series of lags (as denoted by a number of conventional statistical criteria including final prediction error [FPE], Akaike's information criterion [AIC], and Schwarz's Bayesian information criterion [SBIC]) is statistically significant, then that variable can be said to have Granger-caused changes to the level of the related variable (see Groshek, 2011; Sayre et al., 2010). Strictly speaking, Granger causality tests only provide specific statistical evidence of when a change in one variable (for example, Internet and mobile diffusion) precedes a change in another related variable (such as democracy) that improves the explanatory capacity of the distribution of past values for the related (democracy) variable alone.

In other words, the time-ordered significance denoted by Granger causality tests identifies explanatory mechanisms but does *not* prove actual causation, as Atukeren (2008) demonstrated in a study of Christmas cards, Easter bunnies, and Granger causality (see also Sayre et al., 2010). Stated more simply, Granger causality testing is in some ways similar to interpreting bivariate correlations, with the notable exception that Granger models identify more clearly when a time-ordered change in one variable precedes a change in a related variable. The significance of Granger causality testing is thereby derived from the extent to which the variance in the related variable cannot be explained by its own previous distribution of past values. When the other variable in the dyad does statistically account for an amount of variance that is beyond chance alone, it can be considered to have Granger-caused the amount of variance, or change, in the related variable.

In constructing both ARIMA and VAR models, all variables had to achieve stationarity without over-differencing to ensure statistical validity. A series of augmented Dickey–Fuller (ADF) tests with a time trend were carried out for each variable for this purpose. ADFs test for the presence of a unit root in the distribution of values over time that can signify non-stationarity. With the exception of sociopolitical instability, all variables required a first difference to achieve stationarity. A natural logarithmic transformation was uniformly applied to all variables for VAR modeling and Granger causality testing because these transformations are standard practice by convention and they helped normalize data distributions.

### *Qualitative analyses: Context*

The second methodological approach of this study is based on the unexpected experiences of the author during vacation from 23 to 30 January 2011 that had been planned months in advance of the Egyptian revolt. Here, it should be pointed out that this journey was not an intentional fieldwork activity. The explicit purpose of the trip to Egypt was for vacation, not to collect data. Nonetheless, once it became clear (by 26 January) that the situation was becoming historic, all reasonable efforts were made to meet with and discuss the ongoing situation with numerous Egyptian citizens at or near their place of employment – a resort on the Red Sea coast near the remote area of Marsa Alam.

This mode of interaction, of course, introduced certain limitations, and it is not the intention of the report here to claim generalizability on the discussions that took place. The responses and viewpoints offered here primarily add additional and unique context to a monumental event that occurred in unanticipated fashion. Interviews were conducted in impromptu and informal settings, some more regular (daily) and long-lasting (several hours) than others, with five Egyptian citizens to which the author had direct and regular access. Three interviewees worked directly for the resort hotel and the other two interviewees worked for separate agencies outside of the hotel whose clientele were still largely hotel guests. Due to an overwhelming majority of employees at the resort being men, all respondents were male except for one woman.

Interviews took place in English, and it should be noted that the majority of workers associated with the resort in this village were multilingual. Questions and answers were unstandardized, and in order to make the most of possible interactions, were conducted

over several days in most cases. Altogether, the interviews that took place could be best described as free-form constructions of ‘social worlds’ between interviewer and interviewee (Miller and Glassner, 2004). Respondents reported here were simply identified by nationality and convenience. In other words, though numerous other interviews and discussions took place with non-Egyptian citizens and hotel guests, those are not included here. Again, the main purpose in reporting the interviews and personal experience is to juxtapose the econometric macro-level findings from this study with those of the qualitative individual viewpoints of a population connected to but also removed from the dramatic events that were taking place elsewhere in the country at the time.

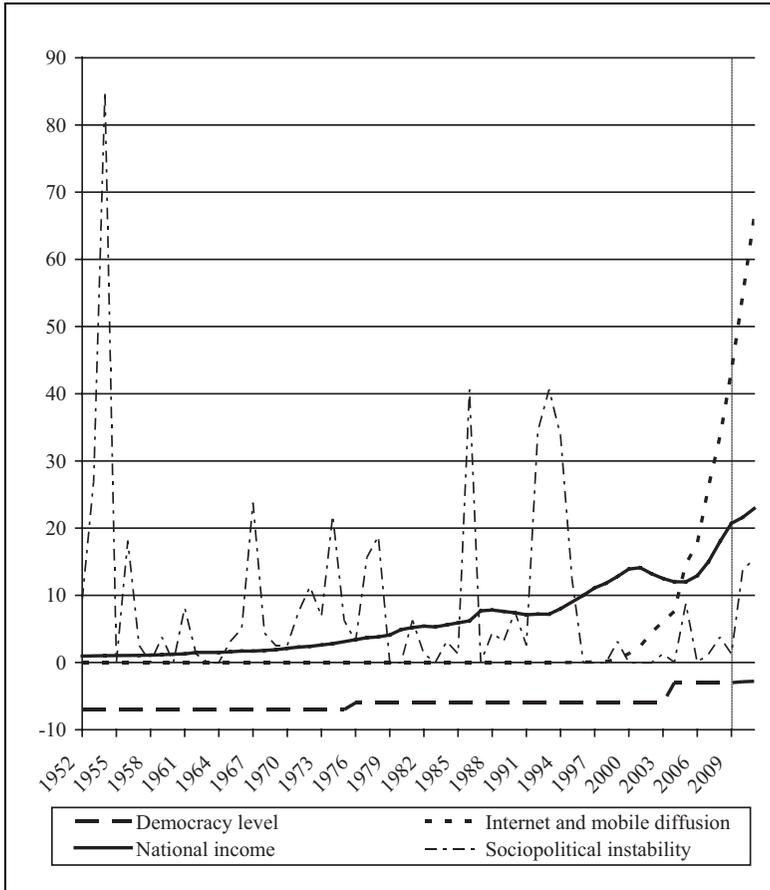
## **Findings**

Before specifically reporting on the outcomes of time-series analyses, it is useful to examine the prevailing trends in Egypt from 1952 to 2009. Over this time period, the democracy level changed very little, and through the timeframe analyzed, Egypt remained an autocratic country. In 1952, the democracy level was  $-7$  (on a scale of  $-10$  to  $+10$ ), and there was no variation in that score until 1976 when the democracy level increased to  $-6$ , where it remained until 2004. At that point, the democracy level improved to  $-3$  and remained stable through 2009. Comparatively speaking, all other variables were much more dynamic and all but sociopolitical instability showed general increases over time.

Internet and mobile phone diffusion, of course, were non-existent until 1988, when 0.01 persons in 100 could use a cellular phone. These figures drastically increased through 2009, when 20.04 citizens in 100 were able to access the Internet and 66.69 of 100 Egyptians were mobile phone subscribers. When taking the combined average of these two data streams, the growth is remarkably strong over the past two decades. Likewise, the economic figures show a strong and general upward trend with income per capita figures increasing from \$96 in 1952 to \$2070 in 2009. Sociopolitical instability demonstrated considerable variance over time, with a maximum value in 1954 of 8502 units on the CNTS weighted conflict index and peaks of 4064 units were observed in 1986 and 1993, respectively. In 2009, the sociopolitical instability level was 127 units on the CNTS scale. School enrollments generally increased through 2009 to 25.51 children enrolled per 100 citizens, and the size of the overall population grew steadily, increasing by 256.89% from 1952 to 2009.

The results of the key variables of this inquiry are summarized in Figure 1 but also point to a larger observation of the political conditions in Egypt. Generally upward trends, including Internet/mobile diffusion and economic development are situated alongside an unstable and wide-ranging level of sociopolitical instability that all contrast the nearly static data stream of limited and decidedly slow democratic growth. In terms of explanatory capacity, with only minor variation in the democracy measure – and owing to the fact that Egypt was an autocracy until February 2011 and then entered a transitional period – it is unlikely to see incredibly strong, predictive relationships emerge with regard to democratic change (Groshek, 2009, 2010).

Even with the limitations imposed by the restricted variance of democracy scores, several time-series analyses identified interesting predictions and relationships. In examining RQ1, the national democracy levels from 1952 to 2009 did not statistically forecast



**Figure 1.** Linear relationships between observed and forecast levels of democracy, Internet and mobile phone diffusion, income, and sociopolitical instability in Egypt from 1952 to 2011.

Note: All figures after 2009 are statistically forecast values. Internet and mobile diffusion figures are scaled in terms of users per 100 citizens. National income and sociopolitical instability are also scaled by a factor of 100 for comparability.

meaningful democratic growth in Egypt by 2011. This is to say that the ARIMA (1, 1, 0) model estimated here using Box–Jenkins specifications only forecast an increase of 0.14 and 0.07 units on the Polity IV democracy scale for 2010 and 2011, respectively. When combined with the observed democracy values from 2009, these forecasts resulted in increases in the democracy level from  $-3.00$  in 2009 to  $-2.86$  in 2010 and  $-2.79$  in 2011. Since the forecasting models employed here were shown to be highly accurate in confirmatory analyses that modeled previous democratic changes in Egypt, it seems that the political upheaval simply could not have been statistically predicted based on the previous distribution of democracy levels in Egypt through 2009.

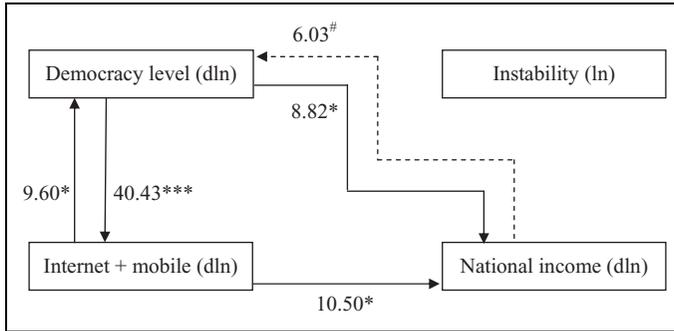
However, when forecasts were calculated for other variables analyzed here, all followed visually expected trends in producing minor, incremental increases through

2011 except the forecast values of sociopolitical instability. As also shown in Figure 1, these forecast figures rose sharply from an observed 127.00 weighted conflict units in 2009 to 1381.45 units in 2010 and again to 1538.13 units in 2011. While these predicted forecasts are likely far less than the actual level of conflict present in Egypt in January and February 2011, which almost assuredly were the highest in Egypt since it became a republic, they still signify that previous levels of sociopolitical instability in Egypt could predict increased conflict in 2011. Estimated with an ARIMA (1, 0, 10) model that was highly effective in confirmatory analyses that modeled previous patterns of sociopolitical instability, these findings suggest that although meaningful national-level democratic change could not be forecasted by 2011, higher levels of sociopolitical instability indeed could.

RQ2a and RQ2b further examine the extent to which Internet and mobile phone diffusion were causal mechanisms for both democracy and conceptually related factors included here as both observed and as forecast. These analyses began by estimating the most appropriate lag structure for a VAR to model the extent to which Internet and mobile phone diffusion were time-ordered predictors of national-level democratic growth in Egypt through 2009 as suggested in RQ2a. This model included all of the variables that were observed for this time period, and based on the joint distributions of these variables, the SBIC, FPE, and AIC lag-length selection criteria indicated lags of 1, 2, and 4 years as most suitable. These lags were thus applied to the VAR and to all post-hoc Granger causality tests (see Ozcicek and McMillin, 1999).

Through the 1952–2009 time period, a limited and gradual increase in democracy levels Granger-caused increased Internet and mobile phone diffusion ( $\chi^2 = 40.43, p \leq .001$ ) and, somewhat surprisingly, this effect was reciprocal ( $\chi^2 = 9.60, p \leq .05$ ). Similarly, however, minor increases in Egypt's democracy level also Granger-caused economic growth ( $\chi^2 = 8.82, p \leq .05$ ), and economic growth reciprocally predicts democratic augmentation ( $\chi^2 = 6.03, p = 0.11$ ) but only at a relatively weak level of statistical significance. Internet and mobile diffusion also Granger-caused economic growth ( $\chi^2 = 10.50, p \leq .05$ ), as did population ( $\chi^2 = 8.97, p \leq .05$ ) but there was no reciprocal relationship observed in either dyad. With the exception of population ( $\chi^2 = 9.13, p \leq .05$ ), no other variables Granger-caused sociopolitical instability as modeled here, and sociopolitical instability did not add any statistical explanation to changes in other variables. School enrollment had no significant Granger-causal relationships at all to report.

At this point it is worth noting that Internet and mobile diffusion was a statistically significant predictor of democratic growth through 2009, and economic growth very nearly achieved significance in this respect at the  $p < .10$  level. While these findings are not compelling evidence that the Internet and mobile phones would play a central role in the democratic changes that did occur in January and February 2011, they are at least suggestive of such a possibility, dating back to 2009. The relationships between national-level democracy measures, Internet and mobile diffusion, economic development, and sociopolitical instability are summarized in Figure 2. Within this model that captures several dynamic time-series relationships, it is noteworthy to observe the positive relationships where relatively small increases in democracy positively predicted Internet and mobile diffusion as well as economic growth. The lack of relationships associated with sociopolitical instability is equally interesting to find, especially considering its high level of variation across this time period.

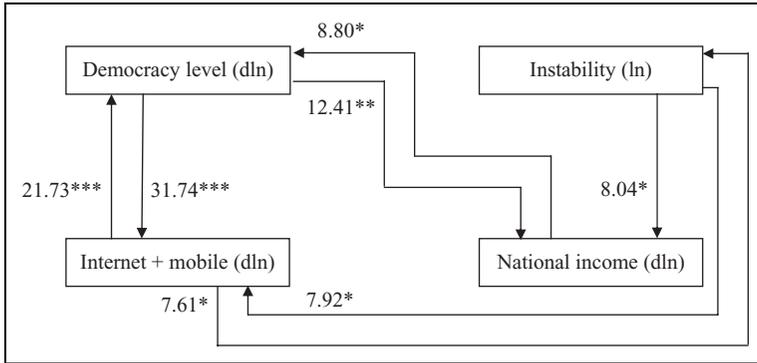


**Figure 2a.** Significant Granger-causal relationships between observed levels of democracy, Internet and mobile diffusion, income, sociopolitical instability, school enrollment, and population in Egypt from 1952 to 2009.

The forecast values generated for each variable in examining RQ1 are now applied in extending the reach of the available data. Specifically, those statistically forecast values are entered for the years 2010 and 2011 to analyze RQ2b and the extent to which Internet and mobile phone diffusion were time-ordered predictors of national-level democratic growth in Egypt through 2011. As with the previous VAR, this model included all six available variables and an appropriate lag length was determined by SBIC, FPE, and AIC output. In this case, the most prudent lag structure incorporated lags of 1, 2, and 3.

Through a forecast of 2011 values, similar but more prominent patterns could be observed. Here, the increasing democracy levels were Granger-caused by Internet and mobile phone diffusion ( $\chi^2 = 21.73, p \leq .001$ ) and national economic development ( $\chi^2 = 8.80, p \leq .05$ ). In both cases, the democracy level reciprocally Granger-caused Internet and mobile phone diffusion ( $\chi^2 = 31.74, p \leq .001$ ) as well as economic growth ( $\chi^2 = 12.41, p \leq .01$ ). Notably, Internet and mobile diffusion Granger-caused sociopolitical instability ( $\chi^2 = 7.61, p \leq .05$ ) and that effect was also reciprocal ( $\chi^2 = 7.92, p \leq .05$ ). Sociopolitical instability interestingly also predicted economic growth ( $\chi^2 = 8.04, p \leq .05$ ). As with the previous series of Granger causality tests reported for the observed values through 2009, population Granger-caused sociopolitical instability ( $\chi^2 = 7.55, p \leq .05$ ) and national income ( $\chi^2 = 9.88, p \leq .05$ ), and school enrollment was unrelated to all other variables in a Granger-causal sense.

Though the figures reported in these tests are based only on statistically forecast estimates, the results again point to a reasonable understanding that Internet and mobile diffusion are likely to have contributed to the Egyptian revolt of 2011, as well as gradual democratization since that time. Importantly, Internet and mobile diffusion did not only Granger-cause institutionalized democratic growth in these tests, they also Granger-caused a relatively high level of sociopolitical instability in the form of protests, which were the most clear driver of Mubarak's departure in February 2011 and democratic governmental reforms that remain underway. Sociopolitical instability has generally not, however, been related to precipitating democratic growth in modern Egypt, and sociopolitical instability did not Granger-cause democracy in either model reported here. That said, the statistically significant role that the diffusion of Internet and mobile



**Figure 2b.** Significant Granger-causal relationships between *forecast* levels of democracy, Internet and mobile diffusion, income, sociopolitical instability, school enrollment, and population in Egypt from 1952 to 2011.

*Notes for figures 2a and 2b:* All variables except sociopolitical instability were transformed with natural logarithm (ln) and a first difference (d) to achieve stationarity. Sociopolitical instability was stationary when transformed with a natural logarithm (ln). Population was shown to Granger-cause sociopolitical instability and national income in both models but those relationships are not visually charted. School enrollment is not shown since no significant relationships were observed. \*\*\*  $p \leq .001$ , \*\*  $p \leq .01$ , \*  $p \leq .05$ , #  $p < .15$ .

technologies had in cultivating (forecast) democratic change and sociopolitical instability should be noted, and is graphically depicted in Figure 2b.

When considering the sum of these findings, increased Internet and mobile diffusion has been associated with limited national-level democratic growth in Egypt, at least statistically. Altogether, it is thus possible to position the demonstrations and political changes in January and February 2011 as integrated within larger Egyptian sociocultural and political trends in recent (post-Second World War) history. In other words, the results of this study suggest that while a meaningful increase in democratic growth could not be statistically forecast, it is likely that the increased diffusion of the Internet and mobile devices along with increasingly relevant cultural content such as social network sites was a contributing factor in engendering political change in Egypt, precisely through predicting vastly increased levels of sociopolitical instability. Thus, while the results reported here do not explicitly predict the departure of Mubarak and the initiation of democratic reforms by 2011, they nonetheless identify a socio-technological basis and forecast trends in sociopolitical instability that help explain those remarkable events.

These findings are taken into consideration in examining RQ3: namely, how a very small group of southern Egyptian citizens interpreted the first week of the anti-Mubarak protests. For that purpose, the results of personal interviews carried out by the author while visiting Egypt from 23 to 30 January 2011 are reported. This timeframe allowed for the formation of a number of semi-personal relationships with members of the hotel and affiliated staff members before the demonstrations began. Once the demonstrations were underway in Cairo and other major cities, informal discussions continued with several members of the hotel and affiliated staff, largely in a free-form, informal, and impromptu fashion. No attempts were made by the author to directly influence the responses of the

interviewees to encourage a certain perspective on the demonstrations and political uncertainty, which is to say respondents were not led to consider the Internet or mobile phones as specific causal mechanisms of the protests or their outcome.

The results of these ongoing interviews identified several key themes that seemed especially pertinent to the interviewees. First among these was the possibility for violence and concerns for their safety or the safety of their families. In many cases, the employees or affiliated staff came from hundreds of miles away and would stay at the resort location for longer periods of time (typically several weeks) and then return to visit their families. Thus, the most prevalent answer was one that had to do with the potential for violence, and several expressed fears that the violence would come from not necessarily the Mubarak regime but also from other Egyptian citizens. A hotel waiter in particular remarked on his concerned belief that many Egyptians owned weapons and that if the situation became too unstable, the country could become very dangerous due to armed citizens acting rashly and emotionally.

While the other respondents reported similar but less drastic safety concerns, another related theme that came from the interviews was the issue of economics. Since all five worked in the tourism industry, all were expressly concerned that the demonstrations and the possible removal of Mubarak could have negative consequences for the Egyptian tourism industry and economy as a whole. As such, their collective position on the protests was not altogether positive, nor was it centrally concerned with the Internet or mobile phones. They all expressed a hope that everything would be handled in a manner that would not diminish Egypt as a tourist destination. Parts of these interviews consistently included phrases encouraging me to return again to visit Egypt and that the disruptions to Internet access and electronic forms of payment we were experiencing were only temporary.

Along those lines, it was a well-known fact among the guests and workers affiliated with the hotel that Internet and mobile phone access had been interrupted. First, it was only Twitter and Facebook that were affected, and then Internet access was shut down completely. Here again, staff members attempted to mitigate the negative experience but admitted after 28 January that Internet access had been eliminated across virtually the entire country, and that this disruption in service was complicating some processes for them as well (such as exchanging money or processing electronic payments). Interestingly, one of the key findings that can be reported here is that none of the respondents voluntarily mentioned the Internet, social media, or mobile phones insofar as being directly related to the burgeoning demonstrations.

The viewpoints of Egyptians outside Cairo have been largely unconsidered in most accounts but those reported here add a vital dimension of understanding to the role that media fulfilled elsewhere in the country. Thus, when considering RQ3 and how the role of the Internet was interpreted and described by southern Egyptian citizens during the first week of the anti-Mubarak demonstrations, it can be observed that none of the interviewees brought up 'Revolution 2.0' or other related concepts. Indeed, their only mentions of social media were to inquire if I had Facebook, and that it would be a good way to keep in touch, but none openly discussed such online platforms as being central to the cause of the protestors. It was clear that most of these interviewees were using social media but also that they seemed fairly far removed from the locus of engagement in those spaces – especially once Internet access was severed and their dependence on traditional media (such as BBC and Al Jazeera) increased.

## Conclusions

As a whole, the findings reported here certainly suggest a strong likelihood that the diffusion of Internet and mobile phones was related to the initiation of the Egyptian revolt but that this eventuality was one that was not necessarily embraced by the entire country, at least as it began. While the statistical measures thus clearly evidence the possibility of an Internet-facilitated and economic-engendered revolt, the personal interviews paradoxically suggest circumspection in making generalizations about how these events proceeded across a large population and through a period of tightly suppressed communication. Nonetheless, both quantitative and qualitative approaches reported here align in identifying that the events that took place in Egypt during January and February 2011 were more than *just* the Internet or social media and mobile phones – and that hypodermic conceptualizations of media effects fit no better now than they did at the birth of the communication discipline.

The results reported here suggest that these participatory movements and media fit with historical trends and (non)media uses that emerged. During the course of the demonstrations, online media access was effectively suppressed and then uses appeared to transition between interpersonal and traditional media, along with a mix of analog-to-digital gadgets. Thus, characterizing the events in Egypt as having been determined by online media seems to misrepresent the evolution of political and technological changes that preceded the Egyptian revolt as well as the actors implicitly or explicitly involved therein. Without question, the communicative environment shifted over time during the revolt and protesters were prepared for that eventuality (Giglio, 2011b). It is, of course, difficult to say with confidence that the revolt would have occurred without Internet and mobile diffusion or without social media. What can be clearly observed is that the demonstrations continued without Internet access, which perhaps best identifies the role of online and mobile technologies as being vital components of the revolt but not the principal fulcrum that leveraged increased sociopolitical instability in a way that was historically unique.

Importantly, the forecast VAR model demonstrated that Internet and mobile diffusion Granger-caused sociopolitical instability. Though such sociopolitical instability has been generally linked to democratic growth (Groshek, 2009, 2011), that was not the case in the analyses conducted here. Thus, the most exceptional feature of the Egyptian revolt is that, by all reasonable accounts, sociopolitical instability brought about democratic change in Egypt from January to February 2011 by hastening the removal of Mubarak from power. While it is crucial to note that Internet and mobile diffusion rates were shown to have Granger-caused the forecast sociopolitical instability rates through 2011, there was still no direct linkage between sociopolitical instability and democratic growth.

This finding aligns with Howard's (2010) and Morozov's point that Egypt had experienced similar protests, also organized with the use of Facebook in 2008, that did not lead to the overthrow of the Mubarak regime (Al Jazeera, 2011). The question then becomes one of difference in examining what changed from 2008 to 2011. The MSD framework is illustrative here as the number of Internet and social media users increased (Arab Social Media Report, 2011), created more relevant content, and the sociopolitical situation became more unstable. The protests that started on 25 January appeared to have formed large cascades of influence, not only by influentials (Watts and Dodds, 2007) or social media alone but by the confluence of socioeconomic factors and a critical level of coordinated opposition.

Nonetheless, based on the findings shown here, the Internet in Egypt had a strong relationship to the national democracy level. Most notably, the very limited increases in the democracy level (in both observed and forecast models) were shown to have demonstrated a reciprocal Granger-causal relationship with the Internet and mobile phone diffusion. The case of the dictator's dilemma (Kedzie, 2002) appears to have been writ large in Egypt, where it is also important to note the positive relationships of Internet and mobile diffusion to economic development, which was also a key predictor of increased democracy.

The economic growth materialized through investment in Internet and mobile diffusion eventually as shown in the observed VAR model through 2009 seems certainly to have contributed to the downfall of the Mubarak regime, whether through a direct relationship from economy to democracy or through augmented sociopolitical instability. However, based on the interview data reported here, it also seems probable that if left only to integrated online and mobile technologies activating weak (or not offline) ties alone (Granovetter, 1983), the anti-Mubarak movement would have likely been far less successful.

Thus, this finding raises the point of media dependence. Clearly, the Internet and mobile social media were crucial factors in initiating the demonstrations, but that dependence was not uniform across the country, even though Internet diffusion in Egypt was shown here to have culturally fulfilled a highly dynamic and statistically influential role. This is not the case in many countries, particularly autocratic ones (Groshek, 2010), but the convergent-analog adaptability of the protestors was crucial to their success when Internet access itself (as a potentially government-dependent good) was restricted. While it seems fairly clear that traditional media began to fill some dependency gaps during this period, the interviews reported here especially speak to not treating national-level changes as monolithic or in oversimplified terms. The eventual – and still being negotiated – outcome in the Egyptian case also suggests that movements no longer exist in only physical terms but also in online spaces that can potentially be separated and fragmented (Demchak and Dombrowski, 2011).

From all the perspectives reported here, it is lastly worth noting a personal one. Even considering all of the 'Internet revolution' discussions that emerged post-Mubarak and through the Arab Spring, it is difficult to fully comprehend that terminology knowing that the Internet was, for all intents and purposes, dead for almost a week during the Egyptian revolt itself. For myself, this meant no emails or pictures to friends and family, no clever status updates, and feeling isolated and tense as the situation unfolded with a great deal of uncertainty.

For demonstrators, of course, the Internet shutdown likewise meant virtually no tweet-ups, no online coordination, no mash-ups of maps and locations, and no Facebook causes or announcements to be put into meaningful use. And from the perspective of those interviewed in this study, there was evidence of a somewhat divided – or at least differently concerned – body politic. Yet as Benhabib (2011) wrote, something transnational, transcultural, and transreligious took place in Egypt at this time. It was bigger than social media and the Internet and mobile-based tools of the protestors, even given the historically positive relationships of Internet and mobile diffusion reported in this study.

Transformative as all of these technologies have been, especially in the case of Egypt (and other countries in Northern Africa and the Middle East around this time), they

remain extensions of human potential that can be differently used and understood. The Internet and mobile phones did not, of course, precede revolution or democracy, but in 2011 online social media may well have facilitated a revolution in Egypt – but even then not as the only primary factor and not with a similar interpretation among all citizens (see also Howard, 2010; Zhuo et al., 2011).

To be clear, there is no reason to diminish the role that the Internet and mobile phones fulfilled in the remarkable events that took place in Egypt, but there is good reason to situate them into proper context. Though the democratic change resulting from the Egyptian revolt could not be (statistically) predicted, the sociopolitical instability of the revolt could, at least partially. Across both instances, it is critical to note that Internet and mobile phone diffusion were shown to add a statistically explanatory dimension, but the agency of media technologies should not be oversimplified or immediately generalized. Nonetheless, this case also introduces the possibility of greater democratic effects through media in autocratic countries than previously identified (Groshek, 2011), even when not fully explicated statistically with sociopolitical instability as an indirect mechanism of democratic change.

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