

Techies on the Ground: Revisiting Egypt 2011

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Abstract:

This article studies social media and popular social movements in the early 21st century in the Middle East and North Africa, with a focus on Egypt. Rather than ethnography or political theory exclusively, I employ a data analytics of analyzing tweets, posts, and blogs to describe the political culture of social media. And then I perform the results under the guise of the Arabic-speaking cyborg VJ Um Amel. The article argues that the Egyptian experience of revolution and counterrevolution reveals the indispensability, the promises, and the limits of digital communication across borders and languages.

Keywords:

software localization, data analytics, cyborgs, Arab spring, social media

Introduction

When activists in the Middle East and North Africa (MENA) took to social media to push for political change, digital media captured the imagination of scholars, interest groups and multiple publics. Pundits coined the Arab uprisings of 2011 “Facebook and Twitter revolutions” and the “Arab Spring.” However, *New Yorker* writer Malcolm Gladwell took a different position, downplaying the significance of new technology to the uprisings in an article he published in February, 2011:

Acts of communication, by themselves, are not especially interesting. We have always had protests, riots, and revolutions, and the people who carried them out have always found ways to spread the word. If the medium for those communications shifts from word of mouth, to printed flier, to telephone, then to texts and Twitter, what does it really matter? Technology

becomes an important part of the story only if it's changing the nature of the events – and the nature of the social groups that are carrying them out (Gladwell 2011).

For most everyone, Arab activists' use of social media became a model for other social movements immediately thereafter. These included Occupy Wall Street, From Ferguson to Palestine, the Umbrella Revolution in Hong Kong, and 12M and 15M in Spain. These movements quickly adopted similar tactics enabling people around the world to participate virtually as witnesses to contemporary events. In an act of transnational solidarity, in February 2011, an Egyptian activist ordered pizza for labor union protesters in Madison, Wisconsin (Kroll 2011). The international phone call from Egypt was just one of many messages of solidarity streaming into Wisconsin from all over the world on mobile devices and social media.

My focus on the *Arab Spring* allows us to see how that phenomenon brought to international attention – albeit in stereotyped and overstated ways – that now, the revolution also happens on social media. And secondly, this social media was created in Egypt and in resistance to dominant trends and language systems in the West. In other words, the U.S. did not create the infrastructure for this revolution. This revolution, though implicated in capitalism, also highlights mechanisms to circumvent its Western instantiations. The infrastructure was neither neoliberal nor capitalist. It was a production of what I term “techies on the ground or grassroots technological innovators.” Similar to the way in which *Our Women on the Ground: Essays by Arab Women Reporting from the Arab World* (Hankir 2019) gives voice to an often absent narrative, “Techies on the Ground” frames its narrative from the often absent voice of those who built the machine. Thus, this article seeks to recover this narrative and what it implies, showing Egyptian techies on the ground to be in advance of Zuckerberg and his entourage.

To the extent that the reputation of digital activism in the region is credited to the Facebook-ifying and Twitterizing of contemporary media, Tunisia and Egypt differ in significant ways, and in many ways, were ahead of Facebook and its followers. In 2004, the Harvard seniors were updating their online

program “Facemash,” which allowed users to objectify fellow students by comparing photos of their faces and selecting who they deemed as “hotter,” to the first iteration of Facebook, an English-based social networking site. By 2004, techies on the ground in Egypt had already begun to change the nature of the interrelation between the world of technology¹ and the humanities or social movements and non-hegemonic institution building.

Two important movements in Egypt were emergent at the time: the open-source software and localization movement to Arabic and the Kefaya political party, who used both websites and online journalism to campaign. It started when, in December 2004, more than fifty people gathered outside the attorney general’s office, making demands far beyond the established boundaries of free expression for the time. Their banners called for the cancellation of the state of emergency law and read “The Egyptian Movement for Change.”² In 2004, developers were still building applications to enable Arabic characters on a keyboard. Only in the years that followed did several open-source projects develop software for Arabic on Drupal, Yamli, Google, and other platforms, thereby enabling Arabic-language content to grow dramatically.



Figures 1 and 2. Images collected from Twitter by R-Shief in February 2011 from posts using the hashtag #Jan25 (R-Shief 2011).

Cyborgs and Bloggers Emerge on the Arab Media Scene

Much academic scholarship on the Arab world has situated its discussions on new media within the existing discipline of news journalism, and as

an apparatus of the state.³ One can place the beginning of print media in the region around the end of the Ottoman Empire. And before modern journalism, Arab societies practiced formal conventions for public communications. According to Samar Al-Roomi, for example, “Kuwait’s heavy reliance on tribal *Dywaniahs* (in which men meet regularly to talk about public and private concerns) plays a more significant role in determining Kuwait’s communication process and news’ validity than do Web pages/blogs” (Al-Roomi 2007, 148). In addition to formal spaces, throughout the Middle East, neighborhood coffee houses and other informal social spaces have also served as loci to communicate reliable public information.

Indeed, implicit in the debate about how to examine a popular, social media culturally specific to the Middle East is a distinction between media that emerged from the influence of dominant powers and media that grew out of localized practices. In a text published in 2003, Dale Eickelman made a distinction between professional journalists and bloggers. Eickelman (2003, 141) described the phenomenon by explaining that “bloggers tend to have less tolerance of conventional wisdom and less trust of governments. By the same token, some bloggers are also less concerned than professional journalists about commitments to accuracy and objectivity.” While this well-intended position to remain true to a set of professional standards, the methods from which these standards are derived are not equipped to understand the nuances of the politics of growing up Arab in the age of the Internet. Similar to Eickelman, Naomi Sakr made the point that “pronouncements about new media influence have too often been limited to observations about causality that are broadly positivist in character but without being grounded in empirical research,” in her introduction to *Arab Media and Political Renewal: Community, Legitimacy and Public Life* (Sakr 2007). As bloggers became citizen journalists – playing an active journalistic role, sending instant messages and images on mobile phones or blogging their views on the Internet – their power grew. At the 2010 Arab Media Forum Dubai, Ali Al Karni, Director, Al Jazirah Newspaper Chair for International Journalism, King Saud University, was famously quoted as saying, “the new tribe has emerged as the ‘Fifth Estate,’ achieving a coup d’état against the traditional Fourth Estate” (Dhal 2010).

However, the transnational scale of media circulation has posed serious challenges to feminist scholars eager to understand how media are decoded and translated as they travel from one cultural context to another. The decentralized, sometimes autonomous, collective, and networked nature of culture production requires academic accounts that are themselves decentralized, collaborative and networked. It is critical to implement a feminist digital humanities method and its focus upon effect, networks, scholarship, and practice; and to insist on applying it to Middle East social media, particularly in the same fashion that feminist digital scholars understand venues, spaces, archives as computers that store and process most of its data as embodied, interactive, and live.

Over the past decade, I have expanded my work in new media and design to include interactive visualization and digital performance and have produced a combination of scholarly and creative projects that include publications, interactive artworks, and online media systems. My interest in creating VJ (video jockey) Um Amel (Arabic for “Mother of Hope”) is to bring together seemingly disparate groups of audiences: those interested in motherhood, those interested in VJ’ing, and those interested in transnational culture.

From A VJ Manifesto

(1) I call upon the early work of techno-feminist Donna Haraway, “A Manifesto for Cyborgs: Science, Technology, and Socialist Feminism in the 1980s,” here she described a cyborg as a “creature that skips the step of original unity in a postgender world and does not dream of community on the model of organic family, this time without the Oedipal project.” A cyborg is free from biological, technological, or physical determinism.

(2) Using a method described by Chela Sandoval as “oppositional consciousness,” I then ask: what does the child of a cyborg look like? What does it mean to us that a cyborg procreates?

(3) The concept of “Arab” or a unified sense of “Arab” culture has been a point of debate since before the mid-century. Arab migration and histories of Arab Diasporas are rich and range from the late nineteenth century to the present. I believe that trends in migration and the emergence of a new Arabic speaking Diaspora over the last few decades have given rise to a reemergence of “Arab” as a symbol of culture. A brief glimpse of this work includes Ilham Khuri-Makdisi, Sarah Gualtieri, Nadine Naber, and Evelyn Alsultany. Being situated in a post-911 United States, I feel the urgency to bring up the subject “Arab” again. As scholars have shown, the very formation of Arab as a modern identity as both regional and national has a long history. See Hourani’s *Arab Thought in the Liberal Age*, and more recently, the reassessment of Arab liberalism in the two volumes by Jens Hanssen and Max Weiss. See also Omnia El Shakry’s *The Great Social Laboratory*, as well as Marwa Elshakry’s *Reading Darwin in Arabic, 1860–1950*. However, implicit in the debate on how to examine that which is culturally specific to the Arab world is a distinction between what emerges from the influence of dominant powers and what grows out of localized practices in the region.

(4) On the issue of materiality, in *My Mother Was a Computer*, Katherine Hayles articulated that words are pre-material. She argues that we need to think of text as being simulated from nothing – that there was nothing to deconstruct. Her argument, though, concentrated on seeing words through navigation, instead of investigating narratives as embedded in topical environments. I think it is necessary to see the word as interwoven within a world of layered images and simulated documents; and then an integrated piece of all components become signifying practices. Now the exciting thing for me is to perform Arab, Mother, and Cyborg all at once – as VJ Um Amel (VJ Um Amel 2017).

Throughout the remainder of this article, I will include a second narrative voice, a first-person narrative of events as told by the cyborg VJ Um Amel. Her words will appear in italics and against the right-side margin.

The approach to analyzing data emerged from an intention to remix discourse in order to include the input of a “community–author” rather than a single subjectivity – whether expert, popular, or imaginative. The configuration of a “community–author,” a subjectivity that is virtual and hybrid, by definition, activates landscapes of discourse that present a virtual embodiment of what can only be a 21st century “virtual” imagination. These analytics of Internet data are not claims about material bodies or the intentions of communicators, but traces of an embodied moment of intentional use of digital media. Every data point has an embodied analog at some moment. And blogs have a very particular (historically specific, geo-specific) moment of origin that is exceedingly tangled with material bodies. My aim here is to determine what the emerging patterns tell us about the Arab media scene.

Egyptian Bloggers



Figures 3, 4, 5, 6. Screenshots from famous Egyptian blogs taken in 2011.

A Year after Iraq War

How did a generation of people under thirty maintain themselves as a state-oppositional presence on a global platform, and find the

resources to do so? Born into a corrupt system under Mubarak's regime, this new generation of activists in Egypt began to fashion themselves as part vigilante, part technological expert, in order to expose the irreality of Mubarak's "leadership." In so doing, they crafted mutable identities for themselves – Blogger–Activist, Techie–Activist, Blogger–Journalist–Artist, Artist–Techie, Artist–Techie–Scholar, et cetera. Their technological sophistication and political sensibilities were reinforced by a 1990s culture jamming, guerrilla aesthetic – a refusal to be one single thing. In many ways, these are the theorists who have guided much of my research through genuine friendship and collaborations mainly in Egypt.

Challenging Mubarak's leadership was always central. It was March 20, 2004 when Alaa Abdel Fattah and Manal Bahey el-din Hassan first went live with their blog: "Manal and Alaa's Bit Bucket" in Cairo. They were exploring and experimenting with web publishing platforms that would facilitate the web presence of other groups and small initiatives. Alaa and Manal's "Bit Bucket" was one of the earliest blogs to come out of Egypt and the Arab world. Its content was born of a public event: March 20, 2004 was the first anniversary of the massive global protests against the war on Iraq. At the time, I was a fellow open source designer building Arabic and English websites for academic and activist communities in Washington D.C. I met Alaa and Manal in 2007 through the Arab network of designers and programmers on Drupal while building the BETA version of the R-Shief software.⁴

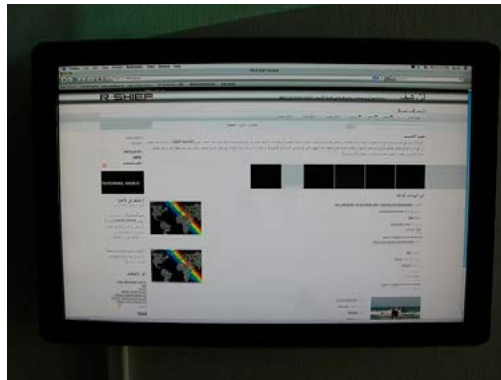


Figure 7. R-Shief Beta installation at the Santa Cruz Museum of Art and History, 2009.

From its inception, R-Shief was conceived at the intersection of art, technology, and scholarship. R-Shief was built to attend to critical gaps in computational and textual analysis on social media, addressing emerging shifts in cultural productions. A growing number of posts in Arabic by bloggers in the Arab world used digital space as a site of information distribution and organizing, and the emergence of social media personas throughout the Arabic speaking world gave voice. In Gaza, activists like @Gazamom rose into the public eye through her tweets on the 2008 war. She introduced me to Twitter.

The use of creative commons licensing and praxis of Free–Libre–Open Source Software (FLOSS) production using social networking programs such as Drupal, MediaWiki, Ning, and WordPress emphasized a commitment to a new model of media production. It was free and open access and grew from the contributions from a forum of developers worldwide. That is when I first encountered, and ultimately, participated among the network of Arab techies and activists in the region. I chose to build the prototype (or BETA version) in Drupal because of its large network of programmers who has already developed Arabic localization modules. Software localization is a process of translating an application to local languages (for example, making sure string wrapping supports various grammar rules), cultures (dialects), and legal requirements (ownership and censorship laws widely vary).

There was a time, as the Arab blogosphere was emerging, when we could not get the Arabic glyph encoded properly onto web interfaces. Nor could we program the web interfaces to read from right to left. These two basic limitations presented quite a challenge from both technological and visual design perspectives. It took many months to resolve. One problem was that the Arabic glyph appeared much smaller than the Roman glyph. In the case of R-Shief, a bilingual site, it was very difficult to design the Arabic legibly without having English looking dramatically large. Allegorically ironic, it was much like the power the English language had in the early years of the Internet.

There were many localization issues concerning right-to-left non-roman script languages. Drupal's network of Arabic language developers continued to find design solutions. For example, Drupal developer

@Amr released the FireFox Yamli extension, an Arabic search engine with a smart Arabic keyboard, and spent some time packaging a Drupal module to integrate the Arabic comma as a separator for Drupal tags (Yamli 2019). Drupal development in Arabic (right-to-left programming and UTF-8 encoding for Arabic script)⁵ grew tremendously, as I mentioned earlier in this article, with over fifty software developers contributing to Drupal's open-source platform. One of the Arabic Team administrators for Drupal is the same Alaa of "Manal and Alaa's Bit Bucket" blog (Drupal Translations 2019). He posted the following biography on his profile in 2004:

From his work with children using Facebook to ridicule their teachers in the Arab digital expression camps, to his work with pro-democracy activists using blogs to mobilize thousands of Egyptians against the government in the Kefaya movement, Alaa just loves helping people use ICTs to stick it to the man. By day he works as a Free/Open Source Software developer, by night he dons his mask and cape and patrols the streets of Cairo, jumping from campaign to campaign, building websites, providing support and training, looking out for activists in need. He likes to pretend that his work on the Egyptian Blogs Aggregator helped bring in a new era of citizen journalism and usher in a new generation of digital activists, while the rest of the world acts as if his blog is relevant (Drupal 2019).

One thing Alaa was mistaken about was that his work did not "pretend" to "bring in a new era of citizen journalism." In fact, this on the ground techie work did usher in a new generation of digital activists. Between 2004 and 2011, the rise of the Arab blogosphere demanded rigorous attention. Alaa's blog posts swayed like a pendulum between issues on RSS aggregators – a method of distributing websites – and the 2005 Egyptian constitutional referendum to establish direct elections for the presidency.

Open Source and Arab Fem-Tech meet Twitter

This is also the era when one of the largest forums on the World Wide Web (as the Internet was first termed) was a community for Egyptian women called Fatakat. Originally established as a forum among three sisters, mainly sharing recipes, in the summer of 1997, it quickly grew into the largest hub of Internet communication for MENA women, emerging alongside forums for gamers as well as techies before the advent of social networking sites (Al-Shagra 2010).



Figure 8. Fatakat Forum has been in operation since 1997.

Through an ongoing process of collaboration between techies, artists, activists, youth leaders, educationalists, and others, what has been established as the Arab Digital Expression Foundation (ADEF) unfolded over the past decade. On its website, ADEF describes itself as committed to “open culture that freedom of expression and right to knowledge thrives and becomes a force that drives us to explore and discover our endless potential.” The foundation emerged when its cofounders, Ranwa Yehia and the late Ali Shaath, began hosting Arab Digital Expression Camps in 2007. Here young people, from across the Arab world, gathered in a residential camp and embarked on an experiential educational journey where technology and art became fertile avenues for self-expression and identity exploration. Among the first cohort of trainers were fellow techies from the Drupal forum including Ahmad Gharbeia, known for Arabizing Wikipedia, bloggers like Alaa and Manal, founder of SuperMama, independent journalists from Egypt Independent, a blog on Torture in

Egypt,⁶ and a network hub of progressive, feminist programmers and designers, many of whom worked at an Egyptian web-publishing company, Open Craft.

At the same time, that Mark Zuckerberg launched Facebook in 2004 and Jack Dorsey launched Twitter in March 2006, academic institutions were already analyzing this Egyptian blogosphere. In 2007, Harvard’s Berkman Center for Information and Society published a groundbreaking article: “Mapping the Arab Blogosphere: Politics, Culture, and Dissent.”

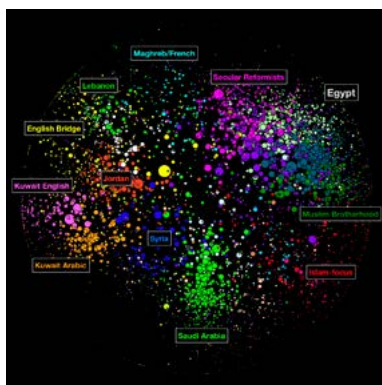


Figure 9. The Arab Blogosphere (Etling et al. 2009).

However, nowhere in the article do they reference the blogs themselves, which were written in casual Arabic. Unfortunately, these two trends – one organized by activists and one by academics – seemed to run parallel to each other rather than converging. By providing both tools and analysis through R-Shief, this work attended to critical gaps between academics and activists.

In December 2008, the Arab Techies⁷ collective convened for the first time in Cairo around the objective of promoting techies’ support and engagement with community-based projects and initiatives. At the first meeting, a cohort of techies engaged with digital activism and citizen media initiatives, media aggregators and social web portals managers, techies providing training for activists, artists and social entrepreneurs, software developers involved in innovative startups, graphic designers, and more discussed Arabic content

on the web, citizen media, open-source software, digital activism, mobile telephony, aggregators, and social networks. At its conclusion, evaluation forms revealed significant criticism of the lack of women techies at the meeting. The same criticism emerged at the following Arab Techies event, a workshop focused on programmers working to solve Arabic language support issues and Natural Language Processing (NLP)⁸ problems and to improve issues such as search normalization and text indexing. Out of sixteen assembled software developers, only two were female – and hence emerged the idea of organizing a women-only Arab Techies gathering. As part of the Arab Techies initiative, the crux-goal of the women gathering was to promote the contribution of female techies to communities concerned with social change and who are in dire need for technical support. The feminist ethos developed from within this eclectic community.



Figure 10. Screenshot from VJ Um Amel's website in 2010.

In May 2010, the Arab Techie Women gathered in Jounieh, Lebanon. It was a workshop with around thirty participants. We were asked to collectively create the agenda and lead workshops. Over the course of five days, there was so much information circulating that we decided collectively to use Twitter to document the conference. The common id we used was hashtag #ATWomen. A few weeks after the conference, we tried to capture the Twitter feeds in order to make meaning of the data through visualizations or otherwise. However, since we were not storing the tweets soon enough, we were unable to retrieve past tweets because Twitter only stores the prior seven days. Frustrated by the loss of the documentation of our Arab Techie Women's conference, I started researching various ways to capture data from Twitter. I discovered that once captured, there is a lot that can be done with Twitter data – from artistic visualizations to materials for practical research. I have only begun to think through how to use Twitter as a research tool, specifically for scholarship on the region.

From this departure point, R-Shief developed methods for capturing and parsing digital feeds such as Twitter, blogs, RSS feeds, and their applications to behavioral and social sciences. The purpose has been to provide researchers with a communication of abstract data (large and unwieldy hashtags), through the use of interactive visual interfaces for creative and scholarly works. And so began R-Shief’s “Information Mappings” of Twitter with these four hashtags: #gaza, #flotilla, #abdulemam, and #KhaledSaid. All of these topics trended on Twitter are in some way related to censorship or larger systems of oppression. For example, the hashtag #abdulemam signifies Ali Abdulemam, a blogger and the founding editor of BahrainOnline.org. He was arrested on September 5, 2010 for “publishing false news” on the popular portal.

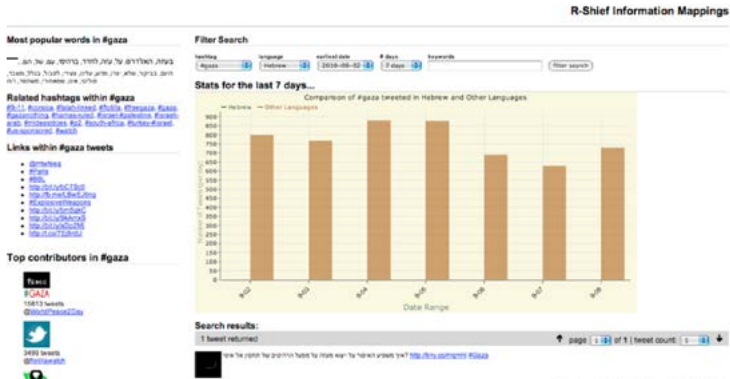


Figure 11. Screenshot of R-Shief’s first Twitter Data Analytics Dashboard in 2010.

#Jan14, #Jan25

This informal network of Arab techies developed over the years as we forged new relationships and initiatives. These included the Jordanian blog 7iber, TakeBackTech feminist collective in Lebanon, and my own Twitter archiving project using R-Shief. Authoritarianism, poverty, social and economic injustice, and state brutality fueled the Arab uprisings, which we conventionally think of as beginning in 2010 when Tunisian street vendor Mohammed Bouazizi set himself on fire to protest the police’s arbitrary seizure of his vegetable stand. It was in Tunisia that the original call “the People Demand the Fall of the Regime” first permeated the streets

and captured imaginations. It would not be long before the contagion of hope would spread to Egypt. Earlier that year, in the summer of 2010, the Egyptian police brutally beat an Alexandrian blogger, Khalid Said, to death. His brother photographed his mangled face at the morgue; Khalid would inspire a Facebook page titled “We are all Khaled Said” and his brutalized image would become the face of the revolution.

Several months later, as a student who had been working with other open-source developers on Arabic software localization, at the request of the State Department, I found myself at the U.S Secretary of State’s office explaining to her my predictive Twitter analytics of the fall of Qaddafi in Libya in August 2011. A month earlier, at a rooftop restaurant in downtown Cairo locally known as the Greek restaurant.

I was chatting with Alaa and Manal about another invitation I had received to give an open lecture at the State Department on my work on semantic analytic software. We were excited about community building that we were engaged in shaping through the efforts of open source developers globally – Arabic speakers building community through Facebook pages, or Iranian election campaigns on Twitter. In 2011, we did not know where we were heading; we were building platform infrastructure and growth.

The confluence of accumulating injustice and the political possibility of a free and active civil society catalyzed uprisings from Cairo to Libya, Syria, Yemen, Bahrain. Regimes fell and new ones emerged. It was not long before the forces of counter-revolution would take hold bringing in a civil war, reconsolidation of authoritarianism, military recalcitrance, and the imprisonment of activists and bloggers.

The charge – it appears – is that I participated in inviting people to protest yesterday, in front of the Shura Council building, against placing – for the second time – an article in the constitution legitimizing the court-martial of civilians

The strange thing is that both the Prosecutor and the Ministry of the Interior knew that I was present for 8 hours at First Police Station New Cairo in solidarity with the people arrested yesterday on the same charges. But neither

the Prosecutor nor the MOI ordered my arrest at the time or demanded that I be questioned. This probably means that they intend to put on a show where I play the criminal-in-hiding (Abd El Fattah 2013).

A framing that upends the literature that portrays the “Arab Spring” as a Facebook revolution, contrasted against literature analyzing the media infrastructure empowering Arab digital activism, can broaden our understanding of the networks operating in (and behind) contemporary debates on the social media tools of counterrevolutionary bots and fake news. “Techies on the Ground” thus provides an alternative to both analysis of social media as a progressive tool of revolution, or as a technological platform for the counterrevolution and ultra-right conservatives in the Trump–Putin era. “Techies on the Ground” lays a foundation for critical inquiry into technical semiotics and politics.

This article is a node in a larger project that lies at the intersection of all these disciplines as a site of digital humanities. It asks us how we might think of the digital humanities as a bridge–site for bringing together different ways of knowing. While it may be tempting to dismiss media such as Twitter as corporate structure, we must also recognize how techies like Alaa Abd AlFattah developed software to destabilize the corporate form to realize revolutionary content. The key here is to recognize the Internet’s potential to both reify and challenge dominant economies of knowledge production; but, and, also, to recognize how that interrelation between infrastructure and content varies. These varying relationships enable different political effects in the Middle East and in the US, a non-global understanding of locality that ostensibly speaks globally.

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Notes

¹ The history of Egypt's technological infrastructure emerged from a broader political and economic condition that grew over decades. Internet started in Egypt in 1993 with a cable connection to France of a 9.6 kbps bandwidth to the Egyptian Universities Network and the Cabinet Information and Decision Support Center (IDSC), with the National Telephone Organization (predecessor of Telecom Egypt) providing the infrastructure. The number of users at that time was estimated to be between two and three thousand, which is about 35 percent of its population.

² Kefaya is a coalition of loosely knit diverse political parties and perspectives. Similar to Ukraine's Orange Revolution and Poland's Solidarity movement, the Kefaya movement drew its support from urban intellectuals from Nasserists, Islamists, Liberals, Marxists, to Secularists. They came of age in 2005.

³ See Eickelman and Anderson (2003) and the *Journal of Arab Media and Society* (2007–present), which was founded in 1998 as *Journal of Transnational Broadcasting Studies*.

⁴ At UC Santa Cruz, L. Sakr built a prototype of this bilingual Arabic digital archive towards completion of MFA.

⁵ Computers read fonts through various encoding–decoding software: ASCII for is English, UTF-8 is for Arabic. Translation in digital medium happens semantically as well as programmatically.

⁶ Accessed October 7, 2016, <http://tortureinegypt.net/>. The website is no longer available.

⁷ Arab Techies was a collective that started with the goal to bring together a varied group of techies who vigorously utilize their IT skills to support their communities on the route of development and social change, to share experiences and knowledge, learn from each other and collaborate on solving common problems.

⁸ Natural Language Processing (NLP) is a field of study combining linguistics, computer science, information engineering, and artificial intelligence to understand the communication and interaction between computer languages and human (natural) languages.