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Building a bridge from qualitative analysis to a simulation of the Arab Spring protests

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Abstract. This paper describes some work in progress – an attempt to 'bridge' between a qualitative analysis and a design for an agent-based simulation. The qualitative analysis drew on extensive fieldwork in Egypt and Morocco. Through a series of conversations and structured questions about this research, a simulation was produced in a process akin to 'rapid prototyping'. The aim was to produce the design for a simulation that included the key elements and behaviours identified from the qualitative data and as few other elements as possible. This process and the conceptual frameworks used are described, as well as the simulation that resulted. The different contexts that were a major factor in what decisions were made by individuals were largely implicit and not explicitly present in the data, so the implicit knowledge of the researchers was vital to guessing these. However these contexts were very important in the simulation. The lessons learned for such an exercise are reported.

Keywords: Protests, Arab Spring, Egypt, Morocco, Interviews, Qualitative Analysis, Context, Scope, Agent-Based Simulation, Qual2Rule.

1 Introduction

It is (or, at least, *should* be) a principle of science that one does not ignore evidence (at least not without a very, *very* good reason). If one accepts this then one should not ignore either qualitative or quantitative evidence. All kinds of evidence have their own difficulties – and qualitative data is no exception – but that is no reason to ignore it. On the other hand, agent-based simulation is flexible enough to integrate a wide range of kinds of evidence and can provide a well-founded way of integrating qualitative and quantitative data [10]. There is a lot of valuable qualitative evidence available, and if there were an accepted, systematic and transparent method for going from qualitative data to elements of a simulation, then more modellers might utilize it [6]. This work is meant to contribute towards developing such methods.

Here, we present a collaborative research project between an agent-based modeller and a qualitative researcher. The collaboration is inspired by a research project investigating the question what motivated people to participate in the Arab uprisings, large-scale protests against autocratic regimes in the Middle East between 2011 and 2012. The aim of this paper is to experience and explore the process of bridging

between qualitative analysis and elements of an agent-based simulation, as well as to illustrate the possibilities.

2   The Arab Spring

The Arab Spring were mass uprisings in the Middle East, triggered by the self-immolation of a street vendor in central Tunisia in December 2010. The uprisings involved millions of protestors throughout the Middle East and constituted the largest protests in people's memories. They had unprecedented consequences, leading to the resignation of President Ben 'Ali in Tunisia, President Mubarak in Egypt, the death of Qaddafi in Libya, the departure of President Saleh from Yemen, and civil war in Syria. In spite of this, most Arab countries returned to autocratic rule soon after.

Much of the literature examines the Arab Spring by focusing on authoritarian regimes, organized resistance against these regimes, or economic conditions. In our discussions, we focused on the complex motivations of individuals who decided about whether to join the protests or not. We also reflected on motivations of individuals who decided to refrain from participating.

Qualitative data were constructed for two countries that had opposite experiences of the Arab Spring: Egypt and Morocco. In Morocco, the main Arab Spring protests happened on February 20, 201. They led King Muhammad IV, who remains in power until today, to introduce constitutional changes. These changes were confirmed by a referendum in July 2011. In Egypt, the Arab Spring protests happened on January 25, 2011. They led to the resignation of President Mubarak in February 2011. This was followed by the first free elections in Egyptian history, which brought the Muslim Brotherhood into power. A year later, the military took over and a new, autocratic President, al-Sisi, was inaugurated.

3   The Data

The qualitative data were constructed from ethnographic interviews with non-protestors and protestors in Egypt and Morocco. In Morocco, interviewees came from Rabat, Casablanca, and Marrakech. In Egypt, interviewees came from Cairo and Alexandria. The sample included 65 males and 28 females, aged between their late teens and their 70s. Most of the interviewees (81%) were adults between their 20s and 40s. A few interviewees gave detailed accounts of several events, which were included as separate observations. In total, the qualitative analysis of these interviews identified 68 protest decisions and 34 non-protest decisions.

The qualitative analysis also included Facebook posts in which individuals responded to the calls for the main protests in Egypt and Morocco. In Egypt, the main day of protest was January 25th, 2011, and in Morocco, the main protests happened on February 20th, 2011. The Facebook groups that issued the calls for these protests are *Kulana Khalid Sa'id* in Egypt and *Mouvement du 20 Février* in Morocco. Hundreds of individuals responded to these calls, posting emojis, songs, poems, or expressions of surprise. Many posts did not refer decision about joining the protests.

In some posts, individuals said they would join the protests, but did not provide information about reasons for joining. For the analysis, only posts were identified in which an individual described why they were planning to participate in the January 25 protests in Egypt, or the February 20 protests in Morocco. In total, 19 protest decisions were identified from Facebook posts.

4 Constructing Narratives

To identify narrative elements, the analysis applied qualitative coding procedures developed by Strauss and Corbin [1]. This analysis broke down the actors' direct speech into three main components: 1) beliefs about external or internal factors, 2) direct and indirect inferences between beliefs, and 3) decisions (to protest or to stay at home). Beliefs and decisions represent the semantics of the narrative elements, whereas inferences represent the narratives' structure. In total, we constructed 121 belief systems that contain narratives about participation in the Arab Spring.

To break down direct speech into beliefs, we applied open coding [1, p. 61] and grouped parts of sentences (words, sub-clauses, main-clauses) or entire sentences according to similar and different factors addressed by their propositional contents. In this way, we identified 145 separable beliefs.

We then used elements from axial coding [1, p. 96] to create belief types based on the factors they addressed. When assigning codes, we used the actors' own vocabulary to help preserve meaning ("in vivo" codes [1, p. 69]). For example, one belief about improving living conditions was identified from quotes such as: "People in the villages have better salaries now," and "Life is much better now."

To identify inferences, we examined linguistic connectors, such as "therefore" or "if…then", as well as temporal and logical order. For example, we identified two beliefs connected by an inference from the quote "When I heard about the revolution in Tunisia, my heart was overwhelmed with solidarity for the protestors." We identified the first belief from the sub-clause, B1 "revolution in Tunisia", and the second belief from the main clause, B2 "solidarity with protestors." We identified the inference connecting the two beliefs from the temporal connector ("when") and logical reasoning, $B1 \Rightarrow B2$.

5 From Analysis To Simulation Elements

5.1 Analytic Framework

The project applies the CSNE analysis framework [4]. C stands for Context and addresses the kind of situation one is in that determines the 'bundle' of knowledge that is relevant to that kind of situation. S stands for Scope. It addresses what is and is not possible given the current situation and observations. NE stands for Narrative Elements. It refers to the narrative elements that are mentioned assuming the context and scope. The hope is that such a framework combines a number of characteristics

that make it suitable for this task. It has roots in cognitive science/AI and thus may reflect some of the realities of how humans construct and communicate narratives. It results in structures that have computational correlates within an agent in a simulation. Finally, it is sufficiently flexible to accommodate some of the variety of recorded narrative. We started with this framework in mind when we attempted the bridging process.

5.2   Towards rule abstraction

The narratives in the qualitative data consist of very large numbers of beliefs that are connected to decisions by very large numbers of inferences. Therefore, it is not immediately clear which narrative elements might apply in an agent-based model. A computational model was developed to identify the main beliefs and inferences inspiring participation and non-participation in the Arab Spring [2], building on past work by the qualitative researcher [3]. The results of this computational analysis were then applied to construct the agent-based model. Specifically, they provided knowledge about causal stories, differences between agents and contexts. The analysis did not provide knowledge about scope, and we believe that when programming one does not code for the impossible.

5.3   Causal stories

In past work [8], it was found that explicitly writing down the 'causal stories' we had in our minds was helpful. 'Causal stories' are simplified accounts of a single chain of events that typify the processes known to be occurring. They do not include how different processes may interact, nor the complex enabling or frustrating factors that may impact on the processes. These give an indication of the range of processes that would need to be included within the simulation. Making these explicit can help bring attention to their evidential support (or otherwise).

In this case, there were the following causal stories.
- Some stay apart from protests by fear of consequences or worry about family
- Some agents are initially motivated by conditions or seeing an attack
- Others may join motivated by positive emotions of (optimism, solidarity…)
- Emotion is most catching when sharing the same physical space
- Emotion builds (and decays) over time
- Knowledge is cumulative
- When protesting people tend to gather in readily identifiable locations

These did not directly inform the simulation design in any simple manner, but as a constraint. The simulation has to display examples that would correspond to these.

In the qualitative analysis, we first derived information about causal stories from our coding of sentences into beliefs, inferences, and decisions: Beliefs captured the major factors that constitute a story, and inferences capture how these factors are connected to each other in a story. The story's end is a decision to engage in protest or to stay at home. The qualitative data was very rich, and included very large numbers of beliefs and inferences. We applied a computational model to identify the most

meaningful elements of causal stories from these data [2]. This analysis showed that the main factors addressed by the stories were positive emotions (protest stories) and safety considerations (non-protest stories).

5.4   How agents may differ

One of the key advantages of moving from a generic (e.g. statistical) to an agent-based account of events is that one can include some of the heterogeneity of individuals [11]. Thus, it is important to identify the ways in which individuals in the population can differ. This informs what variable characteristics agents are given.

- Employed/unemployed
- Susceptibility to emotion and their current level of emotional arousal
- Whether on facebook
- What personal friends they have (others they would text/phone)
- Where they are physically
- Current knowledge of attacks, protests happening
- Whether protesting and whether attacked

Some of these are unchanging characteristics determined by parameters (e.g. proportion of population that is employed), whilst others quickly vary with events and interactions within the simulation (knowledge, level of emotion).

In the qualitative analysis, we identified these characteristics from the beliefs expressed by the interviewees, which addressed factors including employment status, emotions, Facebook activity, prior protest, and numerous other external and internal factors. In the computational analysis of the data, we identified beliefs that were addressed by significantly different proportions of protestors versus protestors. In the agent-based model, we included beliefs with significant differences (employment and emotion) as well as non-significant beliefs that have been considered important by previous studies of the Arab Spring and protest more generally (Facebook, location, social network).

5.5   Different contexts

Context is a key factor affecting behaviour in the CSNE framework [4]. Thus, we tried to identify what the key differences in context were. This is slightly tricky since context is often implicit in qualitative evidence, and so might not appear directly within the data. Language presumes a common knowledge of things like context so their identification involves the background knowledge of the researchers. Here we determined upon two aspects: location and time of day.

Different *locations*:
- **Home** – away from active involvement, but still in contact via phone and Facebook
- **Street** – socialising area, vulnerable to attack, face-face emotional influence, start of protests
- **Square** – where critical mass is achieved, protests persist

Different *times of day*:
- **Waking** – calmer at start of day but with variation, clean slate as to knowledge of protests, attacks
- **Daytime** – unemployed socialise on street, might move to square
- **Evening** – all socialise in street, might move to square
- **Night** – employed go home, unemployed might go home

This does not mean that these are the only contextual aspects that might be used by individuals in determining the saliency of knowledge, but these are the accessible ones. It might well be that the identification of context requires further development in terms of some specific techniques or interventions during the interviews or some kind of feedback of these to subjects to check for their relevance.

5.6   Scope

Scope (in the CSNE framework – see 5.1) is the constriction on action (reflected in narratives) due to what is (or is not) possible in any given situation. However this did not come up explicitly in the bridging process because simple programming styles (such as used here) do not bother to code for what is known to be impossible. The scope is thus implicit in the coding. This means that such a simulation will not capture any of the decision-making or frustration that agents might experience in trying things that do not work. This aspect probably needs more consideration.

6   The Simulation

The simulation was designed to be as directly informed by the qualitative analysis as possible. In other words, to include the elements, processes and decision making as revealed in the narrative data, but to add as little as possible otherwise. Thus the strategy roughly followed that of 'KIDS' (Keep it Descriptive Stupid) – aiming for a simulation that reflected the (qualitative) evidence as a starting point [5]. The purpose of the simulation was to explore the process of building a bridge between qualitative analysis and simulation specification, and thus understand it better. Thus, the simulation is just an illustration of what might result from such a process.

6.1   Outline Description

As described above, there is a daily cycle of possible events concerning a population of agents, representing citizens. All agents start the day at home, and attacks on them and protests (as well as knowledge of these) develop over the day depending on the phase of the day (morning, daytime, evening, night). Broadly, agents progress to the nearest street locations to socialise (unemployed during the day and additionally employed in the evening). Over night, the agents' emotional arousal drops a bit, but unevenly. During a new day, agents may be emotionally influenced if they know of an attack then, subsequently, influence each other if on the same patch. If their level

of emotional arousal goes above a personal critical level, they might start protesting and move to the square. Their critical level represents that individual's propensity to an emotional (rather than safety-oriented reasoning) as described above so that this process resembles Granovetter's threshold model [9].

Many aspects of agent behaviour are context-sensitive, depending on the agent's location (home, street or square) and the phase of the day. At the moment, these kinds of restrictions on behaviour are simply hard-coded into clusters of if…then… rules for the different times of the day. For example:

```
if context = street [
      …
    if know-of-protest
        and positive-emotion > safety-prop
            [goto-square]
```

A description of the simulation along with the program code can be found in [7] an illustration of what the world looks like is below in Figure 1.
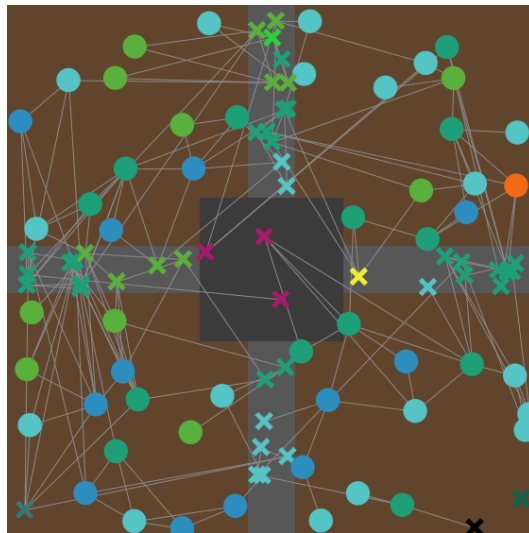

Figure 1. The snapshot of the world from a run of the simulation. The brown patches are residential districts, the grey are streets where people might socialize, the dark grey patch is a gathering place for protest. Citizens are shown as crosses (unemployed) or circles (employed). Their phone-based social links are shown as lines. The colour of agents indicate: if attacked (black); if protesting (magenta); otherwise the more blue their colour the lower their emotional state, the more red the higher their arousal (also slightly greyed if they know of an attack).

6.2   Illustrative Simulation Behaviour

Given that the point of the simulation is only as an illustration, we will not present a sensitivity analysis – that may become relevant after we have developed the simulation further into one that attempts to explain observed aspects of the protests.

Here we just show some illustrative simulation behaviour, so the reader gets some idea of how the model that resulted from this bridge-building exercise can behave.

In the graphs and illustrations below, we show the results of one run as the outcomes develop over 40 simulation ticks (representing three and a half days). Figure 2, and Figure 3, below, show the developing actions, and knowledge of these (respectively) over this period of time. One can see a strong daily cycle since each day starts afresh in terms of protests and attacks happening that day. What carries on from one day to the next is the level of emotional arousal shown in Figure 4 – although agents level of arousal decreases during the night phase, it does not enough (in this particular run) to offset the growing level of emotion in the population, resulting in increasing number of protesters each day (Figure 2).
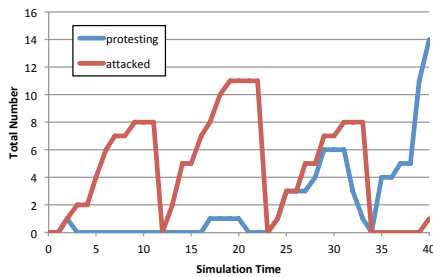
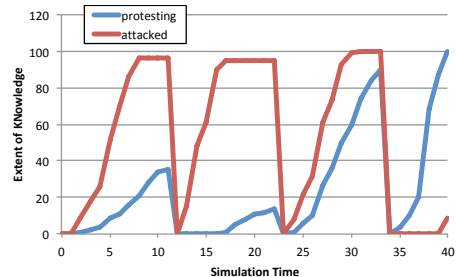Figure 2. Number of Citizens Protesting (Blue) and Attacked (Red) over 3.5 days

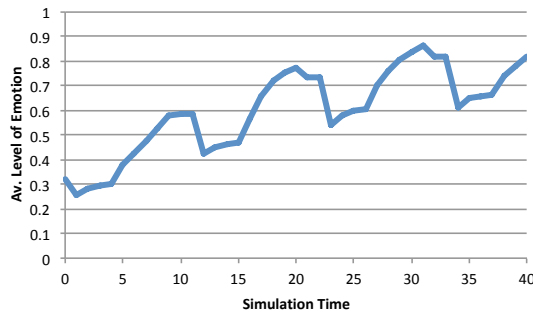Figure 3. Number of Citizens with Knowledge of Protests (Blue) and Attacks (Red)

Figure 4. Average level of emotion as simulation time progresses. Agents (on average) 'cool down' over night, but face-face meeting may increase levels of emotion by a contagion process.

The end result of these processes is shown in Figure 5 below. Here one can see that, although the level of arousal is generally high (indicated by the red colouring of agents) this is highly clustered by location. In this case, an agent at the top has been attacked and many of those around it and a few elsewhere are aware of this fact (shown by a slight darkening of the agent colour), but none of those at the bottom.

The role of employed agents is interesting – although they do not protest (due to fear of losing their job if they do), they play an important role in terms of transmitting knowledge and emotion to others who might protest.
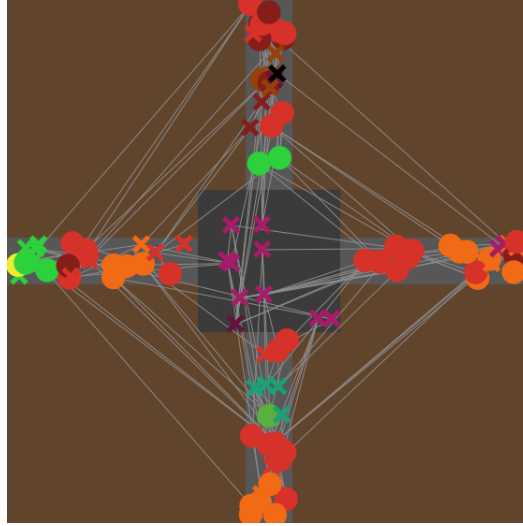
Figure 5. Snapshot of the simulation at the end of the processes shown in Figure 2, Figure 3 and Figure 4. Note some of the unemployed protesting in the square as well as others in the streets and that agents are clustered with similar levels of emotional arousal.

7　Reflections, Conclusions and Future Work

The result of this collaboration is an agent-based model of political protest that integrates qualitative evidence gathered from accounts of protestors during the Arab Spring. Both authors benefitted from this collaboration. The qualitative researcher discovered opportunities to explore the social interactions that can follow from the cognitive processes she identified in her analysis. The agent-based modeller was able to implement new qualitative evidence, and to explore this evidence in conversations with the qualitative researcher. Below, we outline a few steps that facilitated the collaboration in **Error! Reference source not found.**.

7.1　Reflections on the process

Reflecting upon the process of bridging between qualitative analysis and simulation design, we identified a number of factors that helped. *Firstly*, it seemed important that the process of discussion between the two authors was iterative, that is we both increased our understanding each time we had a conversation that alternated with periods of analysis, design or reflection. *Secondly*, it helped a lot that both had some knowledge of the other's point of view. *Thirdly*, it helped that the agent-based modeller asked the qualitative researcher specific questions about the rules to be implemented by the model, such as questions about branch points or the locations captured by the model. *Fourthly*, it helped that the agent-based modeller wrote a preliminary model based on early conversations. This helped the qualitative

researcher to explore what could happen in the ABM environment, and make further recommendations, based on her data. *Fifthly*, it helped that the authors presented their collaboration and were asked questions about their project by both qualitative and quantitative researchers (at the workshop in Leiden).

7.2 Future work

There are many possible additions to the model that are suggested by the qualitative analysis and other sources. For example, the literature on protest suggests that negative emotions of anger or outrage can mobilize people to revolt against the government even when there is no visible resistance movement. We may therefore wish to add negative emotions of anger or outrage to early stages of protest, and investigate how these negative emotions contribute to mass uprisings together with the positive emotions we have already included in the model.

Another direction would be to explore the effects of different responses by the government, assuming it wished to dampen or supress the protests. These could include: 1) Making it more difficult to travel (to streets or to the square), 2) Making access to Facebook impossible, 3) Changing how and when protesters are attacked.

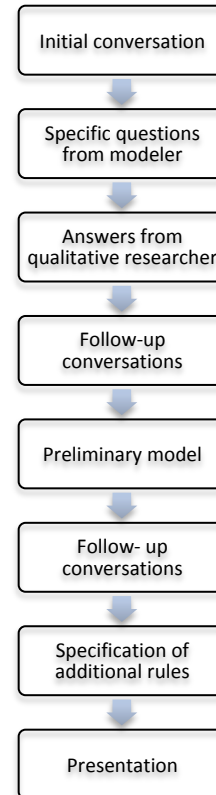We could also apply the model to explore the effects of governmental attacks in particular, which

Figure 6. Some of the steps in the collaboration in the bridging between qualitative analysis and the presentation of the simulation (at the workshop).

are known to vary between dampening or spurring resistance movements. Our model can contribute to the literature exploring these effects by allowing agents to respond to various levels of attacks by 1) developing positive emotions, such as courage or solidarity with victims, and subsequently joining the protest, or 2) considering their safety and going home instead.

At the moment the qualitative analysis still informs the simulation design at a fairly generic level. One possible future development of the model could be to input all the decision trees identified in the computational analysis of the interview data and then initialise each of the agents of the simulation with a tree randomly selected from these. This would require a more sophisticated and generic inference method so that each agent could apply the indicated reasoning in terms of possible actions they could take. It would also necessitate some 'grounding' for each of the identified beliefs (the leaves of the trees) so that they could be triggered in different circumstances.

Another application of the model could be to investigate the level of detail that is needed from the qualitative research when building an agent-based model: By varying the number of narratives included by our model, it could be shown how many narratives and narrative elements are needed to match behaviour in the real world.

Acknowledgements

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