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Modeling Political Belief and its Propagation, with Malaysia as a Driving Context

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Abstract

We discuss in this paper an agent-based social simulation model that describes the propagation of political belief in Malaysia. Worldview map is used as the representational scheme for political belief. Inter-agent interaction propagates the belief throughout the agent population, subject to similarity of emotion between the interacting agents and their distances apart, and various attributes of the individual agents. Media broadcast may be used by agents in their attempt to extend their reach. Computational experiments made using the model point to its plausibility. Further, it highlights, for the ruling coalition, the importance of both a strong political propaganda machinery and a strong governance in winning the hearts and minds of the electorate.

Keywords

Agent-based simulation; social simulation; political belief; Malaysia

1. Introduction

While social simulation has in recent years been maturing as a discipline on its own, there has been relatively few work that discuss its development in the context of specific political situations especially that in the developing and under-developed countries. Such work would be beneficial in providing insight on how the politics in such countries can be better understood and administered, a benefit especially important considering the correlation between political stability and progress (Aisen and Veiga 2011). Further, it would serve to showcase the usefulness of social simulation in the context of real-world politics and the growth of nations. Towards this end,

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in this paper, we focus on Malaysia and develop a social simulation to study Malaysian political development in recent time, especially on the intense period of time leading to the thirteenth Malaysian general election (GE13), and up to a few months after its conclusion.

The GE13 saw the incumbent government in Malaysia retaining its rule by winning around 60% of the seats, yet failing to capture the economically important states of Selangor and Penang, and winning only 47.3% of the popular vote. The election, in a country of 28 million people, where the Bumiputera (ethnic Malays and other indigenous groups) forms 60.3 per cent of the population, Chinese 22.9 per cent, Indians 7.1 per cent, and various other immigrant groups making up the rest, saw a massive swing of Chinese and urban votes against the government.

The ruling coalition, the Barisan Nasional (BN), comprised of the dominant United Malays Nationalist Organisation (UMNO), the Malaysian Chinese Association (MCA), the Malaysian Indian Congress (MIC), and several smaller parties. The opposition, the People's Alliance (Pakatan Rakyat), led by former Deputy Prime Minister Anwar Ibrahim, composed of the People's Justice Party (Parti Keadilan Rakyat, PKR), the Democratic Action Party (DAP) and the Pan-Malaysian Islamic Party (Parti Islam Se-Malaysia, PAS).

The result was surprising (and disappointing) for many government supporters as the Prime Minister, Najib Razak, was seen to have spent many months carefully planning and spending for the election in an effort to reverse the trend seen in the twelfth general election, where the government lost for the first time since 1969, its two-third parliamentary majority.

Adding further to the surprise was the fact that Najib Razak was seen by many to have actively pursued reforms, and these included repealing, replacing or amending liberty-inhibiting laws such as the Internal Security Act (ISA), taking steps towards improving minority educationⁱ and educational opportunitiesⁱⁱ, and pursuing national integration through his 1Malaysia vision (Salleh 2010).

So what went wrong (for the ruling party)? Blames have been placed on the Internet, pro-BN figures pointing to its polarizing effect, and pro-PR counterparts lauding its ability to open up democratic opportunities (see, for example, Subramaniam 2011). Observers, and Najib himselfⁱⁱⁱ, noted that in spite of all that BN had actually done and was doing for the nation, it had actually lost the propaganda war, especially in cyber space and especially where the Chinese and urban community were concerned. Some pointed that regardless of the Internet, BN agents were simply hopeless against PR's far more charismatic, resourceful and committed figures^{iv}. In fact, especially in cyberspace, BN was an underdog, outnumbered and outflanked by the thousands of opposition cyber-troopers bent on breaking BN's domination. Adding further to the problem (for BN), was the numerous factors, that the people, especially the middle-class, had to grapple with then, and these included especially inflation, rising crime rate and fluctuating educational quality.

While the result was rationalized by some as a 'fair' and 'balanced' reflection of Malaysian's political reality^v, especially worrying for responsible policy makers and community leaders was the divisiveness of politics that led up to the election. Politics at times reached down to the gutter^{vi}, marked by personal attacks and smearing, virile videos, malicious online posting, and blatantly one-sided news articles. And polarization, a sinkhole for a multiracial society such as Malaysia, ensued when electorates en masse could not differentiate fallacies from sound arguments, facts from half-facts, and took side fanatically based more on emotional perception planted in by politicians rather than sound reasoning. As put by Calvin Sankaran^{vii}; “.. they will only see and hear what they want to see and hear – irrespective of the persuasiveness of argument and the strengths of facts to the contrary. To these people, truth is defined as news reports and facts that confirms and reinforces the pre-existing perception that has been deeply ingrained into their consciousness. Anything that doesn't is automatically rejected as propaganda and lies.” Hence, while politics has been further democratized or liberalized in Malaysia en route to GE13, some aspects of it have been certainly less than healthy.

Given the motivating factor being to understand the complexity of Malaysian politics within the stated time period, we state the research question being addressed in this exploratory paper as follows: Can the dynamics of Malaysian politics be captured in social simulation? Can we infer useful insight from the simulation? To address the question, we focus on the perception war in the run up to GE13. While there have been plenty of largely qualitative discussion on the subject, our hypothesis is that computer simulation would help to provide insights on the way and the factors that affect the way in which political belief spreads in Malaysian society.

2. Related Work

The work of Deffuant et al. (2002) bears some influence on this paper. In (Deffuant 2002), the authors modeled opinion dynamics in populations of agents with continuous opinion and uncertainty. The opinions and uncer-

tainties were modified by random pair interactions. They proposed a model of interactions, called relative agreement model, where uncertainty as well as opinion could be modified by interactions. An extremist agent was characterized by a much lower uncertainty. In our work, noting the complexity of actual political opinions, we need to assume a more structured form for agent's opinion, one that embodies the notion of 'certainty' and resistance to change, and as will be discussed later, we further complement to it a 'stubbornness' attribute.

Other agent-based simulation work that focuses on opinion formation includes that of Mare and Latora (2007). They studied the dynamics of opinion formation within a game theoretic framework. The process of opinion formation was considered to be a decision making process. An agent could choose to maintain its opinion or to change in accordance with that of another agent. While the work is theoretically interesting, it is unclear as to how it would map onto the context of interest in this paper. In another work, Iniguez et al. (2011) studied the propagation of opinions in a social network. An agent's opinion is assumed to be a bounded scalar value, the value of which denotes the agent's inclination (positive or negative) with regard to a particular issue. Links may be formed and deleted dynamically throughout a simulation. Links between agents may be deleted with a probability proportional to the opinion difference between the agents. Within the problem context of this paper, the incorporation of social networking would indeed be natural especially if one were to consider social media as a political medium. However, we choose in this paper to consider only broadly the role played by the *Internet*, a term under which we lump all the different communication tools: social media, news portal, blogs, forums, etc. Muis (2010) sought to explore, through simulation, the role of the media in electoral politics, and to explain as to why newer political parties find it difficult to gain ground in a democratic election. While the simulation result was consistent with empirical electoral data from a time period in the Netherlands from 1998 to 2002, he assumed only traditional media, and did not consider the broadcasting capability of the Internet.

Along a different dimension, Kottonau and Wostl (2004) focused on the formation of political attitude strength. A stronger attitude denoted the greater the probability an agent would participate in an election. The change in position due to the communication assumed depended largely on the certainty and credibility of the agents involved, and was dictated by what they called the PASS (Political Attitude Strength Simulation) model. The role of emotion was not considered. In the context of this paper, we need to capture the role of emotion, and further, due to the high voluntary turnout (90%) in GE13, and our own observation of a very high citizen participation, the issue of attitude strength and politically awareness (Zaller 1992) plays a lesser role.

A different sort of agent-based simulation is in Silverman et al. (2006). They discussed a political strategy game that simulated ethno-political conflicts. The game involved agents that belonged to one or more groups based on norms, sacred values, languages and such, each group competing for dominance and resource control. We do not consider resource competition in this paper, though such emphasis might be very relevant when considering Malaysian politics in a broader context.

And as far as case studies are concerned, only a few work thus far can be classified as being under this category. Geller et al (2011) focused on socioeconomic issues to explain how the Afghan drug industry was sustained by its political players. Gulden (2012) applied a game-theoretic framework to study the cycle of violence in the Guatemalan Civil War, and showed, through simulations, the relationship between ethnic composition and the level of political violence in a specific zone. The work as presented in this paper, being very specific to the Malaysian political experience, may be categorized as a case study. It is important to note that while a case study might not directly contribute to the fundamentals of agent-based simulation or to political science itself, it serves to demonstrate the applicability or feasibility of using simulation to study a real-world problem, illustrating its usefulness, and possibly guiding further fundamental research.

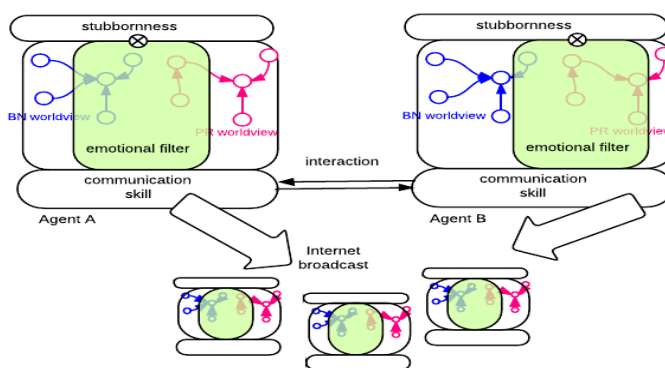


Figure 1: Proposed Framework

3. Framework

The essence of our approach is depicted in Figure 1. Agents interact with one another, and each has a number of features, pertinent among which are emotion, communication skill and influence, stubbornness, and opinions structured in the form of a worldview or mental map. Multiple opinions persist in an agent, an emotional filter determining the one which is salient. Agents interact in order to propagate its belief, locally and at times globally using Internet broadcast. More details will be exposed in the sections to follow.

3.1. Worldview Map

We model the worldview of individuals in a simulated society using graphical network notation. A worldview depicts a person's thought process about how something works in the real world. It represents the surrounding world, and the relationships between its various parts. In the context of this paper, it serves a purpose similar to the cultural network analysis (CNA) in Sieck (2010, 2011) – it facilitates studying in detail the common perspective that members of a culture bring to a situation. The specific form of the worldview that we assume is that which we consider to be the most common in the Malaysian political context, and will be presented later.

We represent a worldview map as an N -node tree. Each node, n_i , in the map represents a notion or statement. Each edge, $\{n_k, n_l\}$, connecting between 2 nodes, n_k and n_l ($0 \leq k < N$ and $0 \leq l < N$), represents a link between two notions. It has a weight, w^{kl} , $0 \leq w^{kl} \leq 1$, that represents the strength of the connection between the concepts. A stronger weight denotes a strong argument for the connection, while a weak weight denotes otherwise.

The overall weight of a map is obtained as the average over all the weights in the map, as follows: $w_{total} = \sum w^{kl} / W$ where W is the total number of edges or weights in the map.

Political conflict ensues when different sides, having different worldview maps pertaining to an issue, communicate past one another. This means that two people can experience the same situation, but pay attention to entirely different things and take away different ideas about the causes and effects of an experience. In the context of Malaysian politics, it explains the continual dichotomy between opposing sections of society^{viii}.

A network notation has two main advantages. First, it allows us to map out the thought systems of the opposing parties, allowing us to objectively understand the position of each. Secondly, the network notation, in computing terms, translates to standard tree data structure, allowing for efficient computation and simulation, enabling understanding of the macroscopic behavior that emerges in society when ideas interact.

3.2. Worldviews Assumed

3.2.1 Disclaimer and Scope

The author asserts that this paper is written with no intentional bias towards either the ruling party or the opposition in Malaysia. The goal is purely academic - to develop social simulation for the study of socio-political reality in the country and to infer insights into her political development.

The maps to be shown in the next sections were derived from various sources (mostly online) and the author's personal observation in months leading to GE13, and up to a few months upon its conclusion. The author made observations through his interactions with various individuals (including family members and colleagues) with different political orientations, participation in online forums and debates, and years of following the Malaysian political scenes. Hence, the maps are illustrative in purpose; its method of derivation a form of *political ethnography*, akin to the treatment in (Weiss 2013). A more rigorous approach, one which would be needed for an 'outsider' to understand a foreign society, would be something akin to Sieck's cultural map analysis, a method that incorporates eliciting of ideas from people in interviews, extraction of ideas from interview transcripts, analysis of common ideas and alignment and assembling of common ideas into complete maps.

In fact, the PR has been sophisticated in reinforcing the worldview in Figure 2 through the manipulation of affect, the political role of which has been well-documented (Glaser and Salovey 1998, Brader and Corrigan 2006). PR succeeded in deploying catchphrases that sum the essence of their drive. The message was conjured to stir up visceral association with its cause in fighting an 'unjust' and 'incompetent' government.

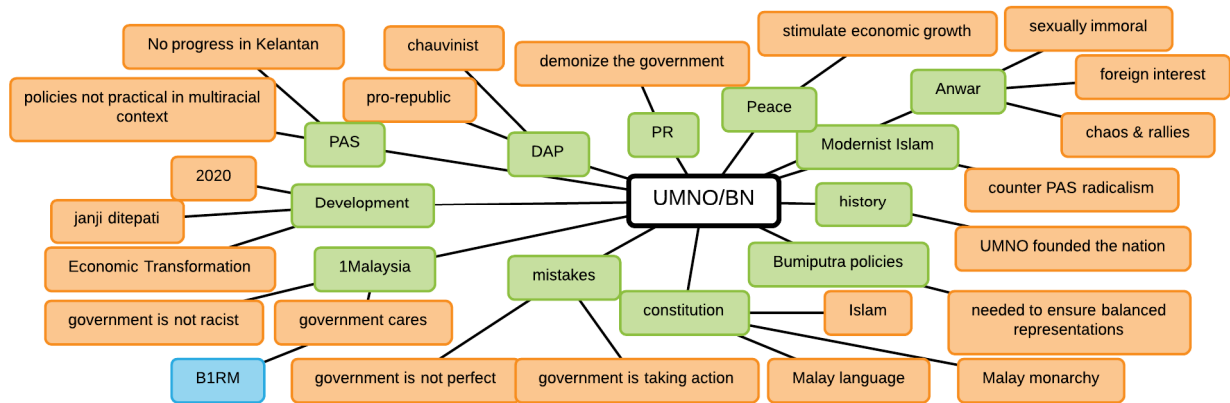


Figure 3: BN Worldview

3.2.3. The BN Worldview

In the mind of a typical BN supporter, the dominant worldview is as shown in Figure 3. The primary points in this worldview are that BN should continue to rule as:

1. The Bumiputra-oriented policies are needed to ensure balanced representations in critical sections of the economy^{xxiii}.
2. Historically, UMNO played the main role in fighting for the country’s independence (Adam et al 2004).
3. UMNO protects the constitution, specifically where the position of the Malay language, Islam and the Malay monarchy are concerned^{xxiv}.
4. BN has ensured peace and harmony in the country, and this peace has stimulated continual economic growth^{xxv}.
5. Development in Malaysia, under BN, is directed towards Vision 2020, with the Economic Transformation Programme as the primary driver. Further, the government has made it a point to fulfill whatever promise, social and such, made to the people (Najib's “Janji Ditepati” or “Promises Fulfilled” slogan)^{xxvi}.
6. UMNO offers a modernist form of Islam that counters PAS’s radicalism^{xxvii}.
7. The government acknowledges that there have been mistakes before, in the form of scandals and such committed by BN politicians and ministers. However, the government has been taking actions to correct the mistakes^{xxviii}.
8. The BN government through its 1Malaysia social initiative, has been reaching out to all regardless of race, color and creed. Through nationwide initiatives such as B1RM, the government has shown that it cares for all^{xxix}.

Further, arguments have been put forth as to why PR cannot or should not be allowed to take over the government:

9. Anwar Ibrahim should not be made the prime minister, as he is sexually immoral, has vested foreign interest, and champions his causes through rallies and chaos^{xxx}.
10. All that PR is good at is in demonizing the government, and it has no concrete alternative to show for all its criticism and condemnation.
11. DAP is chided for its Chinese chauvinism, and its pro-republic stanch (opposed to the monarchy system in Malaysia)^{xxxi}.
12. PAS offers policies which are not compatible or practical with the multiracial, multi-religious context in Malaysia. Further, they have brought no visible progress to Kelantan, the only state in Malaysia where they have been ruling uninterrupted for the past two decades^{xxxii}.

In reinforcing its worldview, it is interesting to note the primary affect targeted by BN campaigners has been 'fear for the unknown', a powerful political tool (Hatemi 2013). Malaysia has never been ruled by any party oth-

er than BN ever since independence, and the specter of the nation being torn apart once PR is in power proved to be overwhelming for many.

3.3. The Simulation Framework

In essence, the simulation framework is influenced by Zaller's (1992) Receive-Accept-Sample (RAS) model; a person keeps multiple views in its head, what kept being determined by her past consideration. At any particular moment, when its opinion is being called for, that which is salient at the moment will be retrieved and effective. We adapt the RAS model to fit in with Malaysian political reality, in particular, as mentioned before, reality as observed on the ground.

Hence, in our simulation, an agent has both positive and negative schema in its mind - "UMNO/BN is bad", denoted S_b , and "UMNO/BN is good", S_g . The former is an anti-establishment position, and the latter pro-government. Both are latent in an individual. The scheme which is dominant, that is has more weight, determines whether the agent is a PR or a BN supporter.

An emotional filter determines the scheme that is salient at the moment. In fact, in a number of studies (Schemer et al 2007, Healy et al 2009), emotion has been shown to be an important determinant of political orientation. While most of the studies were conducted in the context of developed nations, the author noted that it plays a significant role among the Malaysian electorates too, though not quite the same way as with an American electorate for example. A Malaysian with a high stress level, frustrated at the bureaucracy, angry and disappointed, for example with perceived ethnically-driven unfairness or at the ever degrading public transport system, is likely to detach himself from the establishment and side with an opposition party even though he or she might not actually fully endorse the party's position. He or she is likely to start reading only opposition media channels from then on, searching for government's wrong-doing to convince himself or herself that the government is 'bad'. Hence, the negative schema emerges especially in times of 'stress'. Still, the positive schema might re-emerge in "better days".

We further note that the 'stress' experienced by an agent may not be real, in the sense that it might not come from actual experiences, but it may in fact be imparted by propagandist media. In fact, the Internet can be used for both information and intentional misinformation. News articles, especially in the Internet, can be articulated to invoke certain emotion and circulated with little consideration for truth, with sometimes adverse effects on the emotion of the electorate. Hence, while the Internet certainly makes it easier for the activists involved to pursue their goals (Farrell 2012, Aday et al. 2010, Conover et al. 2010), through lowering of the cost of certain kind of collective actions, it allows as well for easier manipulation of the masses, and the materials produced in the words of (Drezner and Farrell 2008) can have a "knock-on consequence for the media and for politics". And hence the distaste for it by some government figure, not just in Malaysia, but elsewhere as well, and notably the Turkish Prime Minister, Recep Tayyip Erdogan quipped, "There is now a scourge that is called Twitter. The best examples of lies can be found there. To me, social media is the worst menace to society."

We therefore associate with each agent an emotional state, e , – the level of emotion that it has for the government. The higher the emotional state, the happier the agent is with the authority. This is further illustrated below in Figure 4. As shown in the figure, we assume for each agent an emotional value between 0 and 1. A value above 0.5 indicates a pro-BN emotion, while that below an anti-BN (or pro-PR) feeling. A value of exactly 0.5 can of course be construed as a totally neutral feeling.

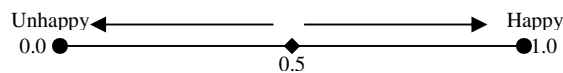


Figure 4: Agent's emotion

Further, we associate a certain stress level in each of the areas populated by agents. The stress level denotes the environment under which the agent is living, and this stress affects the agent's emotional state. In our experiments, we assume two primary areas – urban and rural. Assuming a Malaysian scenario (might be true anywhere else), urban areas are more populated, and have a higher stress factor, and rural areas are relatively 'stress-less'. The extent to which environmental stress affects an agent's emotional state depends on its 'stubbornness'. Stubborn agents will maintain its happiness or unhappiness despite the change in the environmental stress.

Agents are spatially distributed, each with a position $\{x, y\}$. And every agent attempts to influence other agents. Different agents have different level of influence, ifl , measured by a certain radius of influence. Influential agents, to be understood as politicians or individuals with high political interest and engagement, have a

higher radius of influence compared to others (the general public). In the actual Malaysian context, they would attempt to assert influence through various medium (Weiss 2013) - flags, posters, banners, billboards, political rally, walkabouts in markets, neighborhoods, etc., religious services, dinners, and so on. Further, we note the role of the Internet in allowing global communication - broadcasting to the entire population rather than just within a localized target; hence, in the simulation, at each interaction cycle, if an agent, with a probability $bcast_i$, uses the media, its influence is set to be arbitrarily large.

When an agent, the propagator, attempts to influence another agent, whether locally or globally (through Internet broadcast), the chances of engagement depends on the similarity of emotional status between the two. An agent happy with the government is likely to engage with another of similar emotion, and similarly with an agent unhappy with the government. Consequently, a stressful agent is not likely to respond to a 'positive' influence - BN-oriented agent or view BN material, and likewise an agent already happy in "the way things work" is not likely to make itself interact with 'negative' material - PR-oriented agent or believe in PR material. Hence, emotion is assumed to affect attention, a relation documented in a number of works (for example Vuilleumier et al. 2003, Blanchette & Richards 2009).

We further associate the notion of mobility with agents. Most agents are static; that is, they will stick to their spatial location, a situation akin to actual society where individuals have work and family to attend to and politics are not central in their life. But some agents are politically-centered individuals or "opinion leaders" (Lazarsfeld et al 1944), and they will move from one place to another in a direction $\{d^x, d^y\}$, wherever they see a chance to spread their influence. Preferential mobility together with selective openness to political discourse, facilitated as noted by (Sunstein 2002) by the Internet, lead people to become more "inward looking and extreme".

The schema that the propagator engages the receiver on, either S^b or S^g , depends on the emotional states of the two. If both have the same emotional orientation, they will interact using the schema that matches its emotion. For example, if both have PR-oriented emotion, then the schema chosen will be S_b . If they have different emotional orientation, then the active schema will be the one that matches the schema of the agent with the stronger emotion. If the emotional strengths are equal, the schema chosen will be randomly decided upon with equal probability.

With the schema decided upon, the issue, $\{n_k, n_l\}$, within the chosen schema, is then randomly chosen, and the outcome of the interaction probabilistically depends on the communication skill, $commsk$, of each. If the receiver loses, it will be drawn closer to the opinion of the propagator. The actual amount of increase or decrease of conviction of the receiver on a particular issue depends on its emotional state. Specifically, if the interaction is over S^b , the receiver will be more inclined to reduce w^{kl} if it is in a good emotional state, and to increase the value otherwise. On the other hand, if the interaction is over S^g , the receiver will be more inclined to reduce w^{kl} if it is in a bad emotional state, and to increase the value if otherwise.

It should be noted that due to the way we compute the overall weight in a map, as the average over all the weights in the map, the smaller the map, the greater would be the effect of any adjustment of weight. A simple example is as follows: Compare a map, S_0 , with just a single weight, that is with just 2 nodes, to a map, S_1 , with a hundred weights. A change of Δw in the single weight in S_0 would affect its overall weight more than the same change on a single weight in S_1 . Hence, the more complex a map, which means the more complex the predisposition, the slower will be the impact of any change of weight on it, a property in line with Zaller's resistance axiom (1992): People tend to resist, to some extent, arguments that are inconsistent with their political predispositions.

Finally, it is important to note that in our simulation, we assume that any agent, even the staunchest supporter or party strongman, can be converted to the opposing side. While studies such as that done by Norris et al (1999) asserted that due to selective exposure and attention (or confirmation bias), at best, campaign can only reinforce, rather than change partisanship, to "reduce defections from the ranks", the goal of many campaigns in Malaysia has been exactly that - to increase defections from the ranks. In fact, defections can involve even the most hardcore supporters^{xxxiii}; individuals who used to be top party officials, or even top government leaders, have been known to defect to opposing parties. Hence, any agent, even the mobile ones, can be converted to the opposing side.

In all, an agent, a_i , has the following key attributes:

- schemas: $S_b(negative)$ and S_g (positive)
- emotional states, e_i
- communication skill, $commsk_i$

- stubbornness, $stub_i$
- radius of influence, ifl_i
- Internet broadcast probability, $bcast_i$
- direction, dir_i
- position, $\{x_i, y_i\}$

At each time step, our agent simulation then works as shown in the following algorithm:

For each time t :

For each agent, a_i

Set direction dir_i to zero vector

Based on its media broadcast probability, $bcast_i$, determine randomly if a_i is to broadcast.

if a_i is to broadcast, temporarily set its ifl_i to infinity.

For every other agent, a_j

Compute the probability, $p_d(a_i, a_j)$, of a_i engaging a_j based on their distance apart:

$$p_d(a_i, a_j) = 1 - \text{dist}(a_i, a_j) / ifl_i$$

Compute the probability, $p_e(a_i, a_j)$, of a_i engaging a_j based on the emotional similarity:

$$p_e(a_i, a_j) = 1 - |e_i - e_j|$$

Based on p_d and p_e , determine randomly if there is interaction between a_i and a_j .

If there is no interaction, continue to the next agent, a_{j+1}

Based on emotional status, determine the schema, S , (either S^b or S^s) that the agents will interact on.

If both agents with similar emotion, accumulate to dir_i the direction from a_i to a_j

Randomly decides on an issue $\{n_k, n_l\}$ within S to be discussed.

Compute the difference in opinion on the issue: $d_j = w_i^{k,l} - w_j^{k,l}$

Determine the probability, $p_{win,i}$, of a_i successfully influencing a_j :

$$p_{win,i} = \text{comm}_i / (\text{comm}_i + \text{comm}_j)$$

Determine (in a similar way) the probability, $p_{win,j}$, of a_j successfully countering a_i .

Based on $p_{win,i}$ and $p_{win,j}$ randomly compute a boolean flag win_i : win_i is true if a_i managed to influence a_j , and a_j did not succeed in countering back the influence.

If win_i is true:

get random $rval$, $rval$

compute $unhappiness_j = 1 - emo_j$

if S is equal to S_b

if $d_j < 0$

compute $incr = 1 - unhappiness_j$

else

compute $incr = 1 - happiness_j$

else

if $d_i < 0$

compute $incr = 1 - happiness_j$

else

compute $incr = 1 - unhappiness_j$

compute $w_j^{kl} = w_j^{kl} + rval * incr * d_j$

After each time step, we perform the following updates:

- each agent, a_i , is moved according to its accumulated motion direction, dir_i
- the emotion, e_i , for a_i is perturbed based on the current environment stress factor, $stress$. The adjustment, $incr$, is randomly proportionate to the inverse of the stubbornness, $stub_i$, of the agent, as shown below:

$$emo = 1 - stress$$

$$emoDiff = emo - e_i$$

$$incr = \text{random fraction} * (1 - stub_i)$$

$$e_i = e_i + incr * emoDiff$$

A brief note on the implementation: We implemented the algorithm above in the C language. While the majority of social simulation work appears to rely on higher-level tools such NetLogo (Gilbert and Troitzch 2005), we chose a lower-level language in order to take full advantage of the multicore platform where we run the experiments. Running in parallel on the multicore platform, we were able to execute thousands of runs of the sim-

ulation in a reasonable amount of time. The experiments are described in the next section.

4. Experimental Results and Discussion

The central political plot in the period of time surrounding GE13, as described early in the paper, pit an embattled BN against a PR side manned by more competent politicians. Hence, we ran simulation experiments to explore various scenarios within that context. The key agents manipulated in the experiments were the mobile, politically-centered agents - *ntBN* and *proBN*. The stubbornness values, and the initial values for emotion and positive opinions (which are proportional to the edge weights in the positive schema, and inversely to that in the negative schema), shown in Table 1, are chosen to differentiate between the two sides. The population sizes for both groups were variable, ranging in the experiment from 100 to 500. In conforming to the desired context, *ntBN* agents in general were assumed to have better communication skills compared to *proBN*; the average communication skills for *proBN* ranged with a value no more than 60 (out of 100), while that for *ntBN* at a value always higher than that for *proBN*.

The general population, regardless of their political inclination, PR- (*oppType*) or BN-inclined (*proType*), had relatively low communication skill. The positive opinions of both *oppType* and *proType* were assumed to be completely random, with a uniform distribution in the range between 0 and 1. As can be seen in the table, there were more *proType* compared to *oppType* in the general population, with an approximate ratio of 60 to 40^{xxxiv}. The differences between *proType* and *bnType* were namely where stubbornness and emotion were concerned, factors that we might loosely here attribute to political genes (Hatemi 2012). In fact, aside from differences due to background (Hing and Ong 1987, page 137 for example), BN-type and PR-type individuals, as with liberals and conservatives in American politics (Amodio et al. 2007), can sometimes be recognized based on differences in outlook or thinking style^{xxxv}, with the opposition-type individuals often perceived as being more likely to be more motivated (Weiss 2013) and entrenched in their position^{xxxvi} (hence the higher stubbornness value). In spite of the predisposition, it is important to note that, subject to the right setting, each individual may incline herself to either side, in the course of a political campaign.

For all continuous random attribute values used in the experiment, the value for each agent was chosen randomly using a Gaussian distribution that centered on the stated values and with a standard deviation 10% of the values. The total population was fixed at 10,000 and the number of time-step was limited to 50, indicating the time constraint under which either camp had to win over the other side.

Table 1: Agent Parameters

	popsize	mobility	emo	positive	commsk	stub
ntBN	100 – 500	TRUE	0.2	0.2	> proBN	0.8
proBN	100 – 500	TRUE	0.7	0.7	<= 0.6	0.5
oppType	40% of others	FALSE	0.2	*	0.2	0.7
proType	60% of others	FALSE	0.7	*	0.2	0.5

Table 2: Urban & Rural Setting

	radius	percent popsize
Urban	1000	0.7
Rural	7000	0.3

The size and population distribution for urban and rural areas were as shown in Table 2. As indicated in the table, more of the population was within the smaller urban area, creating an area with a population density much higher than that for the rural area. The figures in the table more or less reflected the actual figures for Malaysia^{xxxvii}.

Table 3: Experimental Setup

	BN with more		
	ifl	bcast	gov
Exp-1			
Exp-2a	x		
Exp-2b	x	x	
Exp-3a			x
Exp-3b	x		x
Exp-4	x	x	x

Table 4: Experimental Results

	PR-vote	BN-vote	PR	BN
Exp-1	9552	448	945	55
Exp-2a	9416	584	928	72
Exp-2b	6323	3677	477	523
Exp-3a	8623	1377	939	61
Exp-3b	8381	1619	917	83
Exp-4	4302	5698	401	599

We performed 6 sets of experiments, each set comprising of 1000 runs. The factors being manipulated were indicated in Table 3; *infl* corresponding to the influence level of the agents, *bcast* its broadcasting probability and *governance* corresponding to lower stress level in urban (*citystress*) and village area (*vlgstress*). In experiment 1, we made it be such that *ntBN* always had higher *infl* and *bcast*, and BN governance was poor (*citystress* being always more than 0.5). In experiment 2a, we made it be such that *proBN* always have higher *infl* compared to that for *ntBN*. In experiment 2b, we increased BN's advantage by making *proBN*'s *bcast* average being always higher than that for *ntBN*. We repeated the sequence of experiments in experiments 3a, 3b and 4, but with BN governance being always good in these rounds (both *citystress* and *vlgstress* less than 0.5). The results, to be elaborated upon in the subsections to follow, are shown in Table 4.

Experiment Set 1: Resourceful *ntBN* vs Less Resourceful *proBN*

The scenario was that of highly skilled and stubborn PR engaged agents, *ntBN*, up against less resourceful (lower influence range and broadcasting probability) BN agents, *proBN*, in a context where BN governed poorly. As shown in Table 1 (Exp-1), PR won emphatically. Two representative cases are shown in Table 5; though PR won 945 out of 1000 experimental runs, we chose one case where PR lost and one where it won.

Table 5: Representative Cases for Experiment 1

Run	citystress	vlgstress	ntBN				proBN				PR	BN
			popsize	infl	Commsk	bcast	popsize	infl	commsk	bcast		
1	93	79	168	368	52	37	414	286	47	21	3994	6006
2	83	91	424	382	38	31	260	238	13	24	10000	0

While it may appear from the table that the number of agents (*ntBN* or *proBN*), *popsize*, played a significant role in determining the outcome, the value was actually randomly generated, and *ntBN* *popsize* was greater than *proBN* *popsize* in 499 out of the 1000 runs. Figure 5 shows for *run 1* the number of conversion to PR made by each of the first 1000 agents during the first simulation iteration. A negative value indicates a conversion to the other side, i.e. to BN. Figure 6 shows the PR voters population dynamic during the first iteration. As can be seen in the figures, the key politically-active agents – *ntBN* and *proBN* –, forming the first few hundred agents (along the horizontal axis), played the major role in determining the dynamics of electoral conversion. Similar graph profiles are noted for the different runs in different experimental cases, and these will not be reproduced.

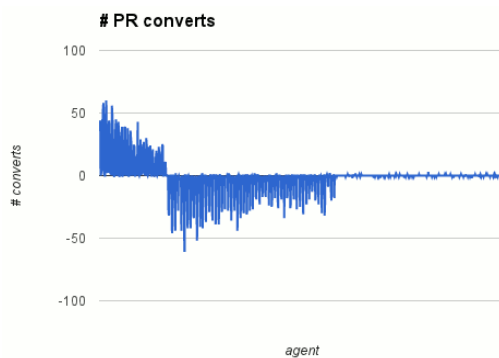


Figure 5: PR conversion

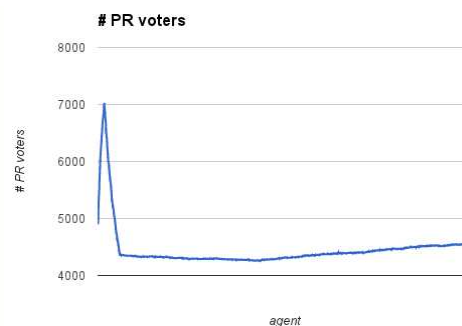


Figure 6: PR population dynamic during first iteration

In reality, the PR routing of BN as depicted in Experimental Set 1 might be reflected in what Najib referred to as the 'Chinese tsunami'^{xxxviii} in GE13, an en bloc voting by the Chinese against the ruling coalition. MCA being at a low point was seen to have failed to campaign effectively among the Chinese population at a time when the community was seen to peak in its agitation and frustration, rightly or wrongly, with the government.

Experiment Set 2a: BN improves Local Propaganda Machinery

The situation in this set was similar to that in Experiment Set 1, but with *proBN*'s radius of influence being always greater than that for *ntBN*. This would in reality be achievable for BN through greater investment in campaign (propaganda) resources – more party workers, longer campaigning period, more banners, posters, more door-to-door visit, more gifts, etc. As shown in Table 4 (Exp-2a), while BN managed to increase the number of

times it wins – average of 584 votes per run up from 448 in the previous case, in general, it was still routed by PR. In spite of the greater *infl*, the less charismatic (lesser *commsk*) *proBN* in the absence of good BN governance, managed to gain only a little more ground for BN.

Table 6: Representative Cases for Experiment 2a

run	citystress	vlgstress	ntBN				proBN				PR	BN
			popsize	infl	commsk	bcast	popsize	infl	commsk	bcast		
1	58	75	431	282	59	22	403	367	57	13	4141	5859
2	55	33	313	406	68	42	345	495	52	15	9945	55

Two representative cases are shown in Table 6. Note that in *run 1*, though BN won, it won thinly compared to PR in *run 2*. Further, note that PR won big in *run 2* even though rural stress (*vlgstress*) was only 33.

Experiment Set 2b: BN improves Local and Global Propaganda Machinery

The situation was similar to that in Experiment Set 2a, but with *proBN*'s *bcast* average being always no less than that for *ntBN*. In other words, BN through certain media practice, fair or unfair (not unusual in a semi-democracy like Malaysia – see Schedler 2006, Heryanto and Mandal 2003), dominated and got to channel its propaganda further compared to PR, especially in the Internet.

The effect was dramatic for BN, winning 523 out of 1000 runs, despite still losing the 'popular' vote, scoring 3677 against PR's 6323 votes. Two representative cases are shown in Table 7. For *run 1*, note that even though *proBN*'s *bcast* value was high, BN won only narrowly compared to PR for *run 2*. The margin with which BN was able to improve its win in this experimental set confirms the significance of the Internet in determining electoral swing, as per the discussion in Section 1.

Table 7: Representative Cases for Experiment 2b

run	citystress	vlgstress	ntBN				proBN				PR	BN
			popsize	infl	commsk	bcast	popsize	infl	commsk	bcast		
1	73	93	489	45	66	9	401	62	27	40	4446	5554
2	79	79	146	43	77	7	217	243	47	7	7073	2927

Experiment Set 3a: Repeat Experiment 1 but With BN Governing Better

In this set, we considered a situation similar to that in Experiment Set 1, but with urban stress factor (*citystress*) and rural stress factor (*vlgstress*) both lower than 0.5 (or 50 in the table). This corresponds to the situation where the BN government manages to govern the country well enough to ensure low stress level in both the rural and the urban areas.

Table 8: Representative Cases for Experiment 3a

run	citystress	vlgstress	ntBN				proBN				PR	BN
			popsize	infl	commsk	bcast	Popsize	infl	commsk	Bcast		
1	41	24	250	132	33	10	444	47	27	9	3556	6444
2	29	37	146	243	77	7	217	43	47	7	5328	4672

While we would expect good governance to translate into votes for BN, simulation results indicate otherwise. As shown in Table 4, BN won only 61 out of 1000 runs and had an average of only 1377 votes, an improvement though over its score in Experiment Set 1. The result shows is that though good governance may help BN, it will not do for the party if its *proBN* agents are inferior to *ntBN*. Two representative cases are shown in Table 8. Note that in *run 2*, BN still lost despite having larger *popsize* and with low *citystress* and *vlgstress*.

An actual situation that paralleled the result here (at least contextually) might be the Worker Party victory in Singapore's Punggol East by-election in Jan 2013. In spite of the ruling party highly regarded governance, it failed to outdo the superiority of the opposition's skilled election machinery.

Table 9: Representative Cases for Experiment 3b

run	citystress	vlgstress	ntBN				proBN				PR	BN
			popsize	infl	commsk	bcast	popsize	infl	commsk	bcast		
1	20	24	148	300	85	32	339	333	55	22	5216	4784
2	47	43	301	249	62	24	358	396	42	23	3657	6343

Experiment Set 3b: Repeat Experiment 2a but With Better Governance

In Experimental Set 3b, in a way similar to Experiment Set 3a, we repeated Experiment Set 2a but with BN showing better governance. A slight improvement was made over its result in Experimental Set 2a; BN registering 1619 average votes and winning 83 runs. Two representative cases are shown in Table 9. In *run 1*, PR edged past BN in spite of its smaller population size. In *run 2*, a strong BN size with an almost equal *bcast* measure overran PR.

Experiment Set 4: Repeat Experiment 2b but With Better Governance

Finally, we ran experiments where BN had both better campaign and media machinery, and recorded better governance. In this experimental set, *proBN* always had *infl* and *bcast* than that for *ntBN*, and the stress levels in both the urban and the rural areas were always less than 50 (out of 100).

The result shows a stunning reversal of fortunes for BN; it won an average of 5698 average votes against PR's 4302, winning 599 runs and losing 401. Two representative cases are shown in Table 10. Note that in *run 1*, the *vlgstress* (rural stress) was very low (3 out of 100); but PR won. In *run 2*, a bigger *proBN* population helped turned the tide against PR; it is unclear though if population size was the key determinant.

Table 10: Representative Cases for Experiment 4

run	citystress	vlgstress	ntBN				proBN				PR	BN
			popsize	Infl	commsk	bcast	Popsiz	infl	commsk	bcast		
1	41	3	244	250	46	24	142	294	21	44	8523	1477
2	29	15	140	246	88	23	314	355	41	43	3903	6097

4.1. Insight from the Computer Experiments

As noted in (Sodaro 2004, page 71), “the purpose of a model is not to represent reality perfectly but to enable us to understand reality by allowing us to compare it against some standard or pattern”. In fact, though a simulation that is only loosely based on actual parameters cannot be expected to mirror the reality exactly, from the results, we can draw the following conjecture:

A ruling political party (or coalition) with agents less skilled in communication can maintain its position provided:

1. *it provides good living condition or good governance*
2. *its agents make good use of the media (or media policy), especially the Internet, to reach out to the general public further than the opposing parties.*

To conclusively prove the conjecture, field work and empirical analysis would certainly be required, and this is beyond the scope of the paper. However, there are evidences hinting at its truth. BN had its biggest electoral victory since 1978 in the 2004 11th General Election, a year marked by former prime minister, Abdullah Badawi, as “a transitional period, a time of high hopes”^{xxxix}, and also the year when Malaysian Internet usage was only 42.3 percent (compared to 65.8 percent in 2012). Considering the Internet to be the enabler for the opposition in Malaysia, it is evident that the “feel good” factor together with the opposition's lack of media access then allowed a convincing win for BN. A further example is to the south of the country, in Singapore, where Shiang

Nee^{x1} noted that the ruling PAP seems to have recognized that for it to maintain its support base, it needs taking “a harder line against dissent and resisting pressure for political reforms, but giving out more economic benefits for voters that count the most – the middle class”. “Harder line” here inevitably implies censoring of Internet media.

5. Limitation and Future Work

One limitation of the work is that we assume that everyone has access to the Internet. While the importance of the Internet has been highlighted by many in the literature and in the political circles, and confirmed in the simulation experiments, in actuality, not everyone in Malaysia has easy access to the medium. Those in the deep rural areas are not likely to tune to it, even if they do have the opportunities to do so, either out of cost concern or out of a simple preference for traditional, low-technology lifestyle. Hence, future work should consider low-technology group of agents.

Also, we could have conducted a statistically more rigorous data analysis of the experimental results. For example, it would be interesting to study the statistical correlation between the various parameters manipulated within the experiments. We feel however that such analysis would be meaningful only when tied to an actual field study.

Further, we note that the agent-based simulation as presented here can be extended to capture more of the political complexity in Malaysia. The role of political networking for example can be better captured in the simulation, that being a significant factor especially in the rural electorate (Weiss 2013).

Finally, though the use of worldview maps makes explicit the structure of the opinion of individual agents, to make the simulation more realistic, there should be an individual bias in the way in which an agent chooses and communicates on a topic when it is trying to influence another agent. It would then be interesting to see how the semantic of the opinion can possibly affect the simulation results.

6. Conclusion

We have presented an agent-based simulation model that describes the propagation of political perception or belief in Malaysia. Worldview map is used as the token that represents political belief. Computational experiments were made using parameters inspired by the situation “on the ground”. The results obtained do point to the plausibility of the model, at least in the qualitative sense. In essence, the work shows that it is possible to capture the dynamics of Malaysian politics in the form of social simulations.

The results suggest a complex interrelation between the various parameters in the political setup, and it highlights the importance of the Internet in determining electoral swing. And most importantly, it suggests the importance, for the ruling coalition, of both a strong political propaganda machinery and a strong governance in winning and maintaining the hearts and minds of the electorate.

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Footnotes

i	See for example “PM Announces RM30mil Grant for Chinese Schools”, The Star, 21 October 2012
ii	See for example “PM: Full Scholarship for Top 100 Indian Undergrads”, New Straits Times, 18 March 2012
iii	Najib was quoted as saying: "If there is any weakness in the Government, it could be that we are not so good in dealing with the war on perception," 3 June 2013, The Star.
iv	See for example: “Kit Siang gets rock star treatment in NS”, 29 April 2013, The Edge
v	See Marina Mahathir, “GE13; A Very Malaysian Result”, The Star, 13 th May 2013
vi	See for example: see for example “It's Gutter Politics, says Mahathir”, The Star, Feb 20, 2009. Also “ <i>Sex, sabotage and videotape in Malaysian campaign</i> ”, 21 April 2013, <i>Agence-France Presse</i> .
vii	Calvin Sankaran, GE13; How BN lost the battle for perception, 16 May 2013, Malaysia Today, http://www.malaysia-today.net/mtcolumns/letterssurat/56792-ge13-how-bn-lost-the-battle-of-perception
viii	“Malays may feel they are still weak economically and still require government’s assistance through policies. At the same time the Chinese may have different considerations,” said Najib. “So, one of our challenges is to manage this political dichotomy in our community,” he added. The Malaysian Insider, Aug 20, 2010.
ix	“Crime fears go viral in Malaysia”, AFP, 10 Aug 2012.
x	“Can Malaysia beat the Middle-Income Trap?”, Vikram Nehru, Carnegie Endowment for International Peace, http://carnegieendowment.org/2013/02/22/can-malaysia-beat-middle-income-trap/fj9z
xi	“Cost of living, jobs and wages top Malaysians' worry list”, The Straits Times, Apr 20, 2013
xii	“Lowest Chinese and Indian representation in the civil service in the 53-year history of Malaysia – 5.8% Chinese and 4% Indians as at end of 2009”, Lim Kit Siang blog, http://blog.limkitsiang.com/2010/04/07/lowest-chinese-and-indian-representation-in-the-civil-service-in-the-53-year-history-of-malaysia-%E2%80%93-5-8-chinese-and-4-indians-as-at-end-of-2009/
xiii	“Big spender Najib splurge RM58 billion for election, top in region”, Harakahdaily, 23 April 2013
xiv	See “Solar deal fiasco latest proof of BN cronyism and corruption”, http://www.topsecretwriters.com/2012/07/solar-deal-fiasco-latest-proof-of-bn-cronyism-and-corruption/#more-18499
xv	Blog post such as this is typical - “BN's latest tactic: Big fish, small case”, http://malaysiansmustknowthetruth.blogspot.com/2010/12/bns-latest-tactic-big-fish-small-case.html
xvi	See comments by <i>Enlightenment</i> in “Bring Down Government”, http://chedet.cc/?p=991
xvii	See for example “MIC,MCA are dumber than you imagined” http://johorpk.blogspot.com/2013/04/mic-mca-are-dumber-than-you-imagined.html .
xviii	“Why we should change the government”, Free Malaysia Today, February 18, 2013 http://www.freemalaysiatoday.com/category/opinion/2013/02/18/why-we-should-change-the-government/
xix	“PAS: We did lose rural Malay votes but...”, Free Malaysia Today, Oct 15 2013, http://www.freemalaysiatoday.com/category/nation/2013/10/15/we-did-lose-rural-malay-votes-but/
xx	See “Nik Aziz says it again: No to cooperation with UMNO”, 20 June 2013, Harakahdaily, http://en.harakahdaily.net/index.php/headline/7428-nik-aziz-says-it-again-no-to-cooperation-with-umno.html
xxi	See “Mahathir's buzz on Islamic State”, Aug 22 2012, http://anotherbrickinwall.blogspot.com/2012/08/mahathirs-buzz-on-islamic-state.html . See also, “Will DAP remain 'secular first'?”, MalaysiaKini, Dec 17 2010, http://www.malaysiakini.com/letters/151098
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xxiii	“Dr M warns NEP removal could lead to revolution”, The Malaysian Insider, Aug 30 2010, http://www.themalaysianinsider.com/malaysia/article/dr-m-warns-nep-removal-could-lead-to-revolution . Also, see: “Agenda ekonomi Bumiputera hak keadilan sosial”(Bumiputera economic agenda as a social justice), 22 Sep 2013, Juhaidi Yean Abdullah, Berita Harian(http://www.bharian.com.my/bharian/articles/AgendaekonomiBumiputerahakkeadilanSosial/Article)
xxiv	See “Pemeriksaan Ekonomi Bumiputra: Pembangkang Pertikaikan Hak Bangsa Melayu Dalam Perlembagaan?” (“Strengthening Bumiputra Economy; Opposition Questioning Malay Right in Constitution?”), September 16, 2013, MyKMU.net, http://www.mykmu.net/?p=34993 . See also, “UMNO perlu pertahan hak dalam kontrak sosial” (“UMNO must defend right in social contract”), 25 Nov 2008, http://matahati3.blogspot.com/2008/10/umno-perlu-pertahan-hak-dalam-kontrak.html
xxv	See for example “Voting for BN will ensure peace and stability – Taib” 27 April 2013, The Borneo Post, http://www.theborneopost.com/2013/04/27/voting-for-bn-will-ensure-peace-and-stability-talib/
xxvi	See for example “Opposition doesn’t deserve a second chance, says Najib”, April 30, 2013, The Malaysian Insider, http://www.themalaysianinsider.com/malaysia/article/opposition-doesnt-deserve-a-second-chance-says-najib
xxvii	See for example “In concert protest, PAS youth says not like Taliban”, The Malaysian Insider, 31 Oct 2011, http://www.themalaysianinsider.com/malaysia/article/in-concert-protest-pas-youth-says-not-like-taliban . Also see: “PAS at the crossroad”, 6 May 2009, The Nutgraph, http://www.thenutgraph.com/pas-at-the-crossroads/
xxviii	“Najib apologises for BN’s mistakes in last election”, 3 Mac 2012, The Star
xxix	See information on BR1M at http://www.barisannasional.org.my/en/br1m
xxx	Anwar Ibrahim & “The Johns Hopkins’ School of Advanced Terror” ?? 17 Mac 2013, http://syedsoutsidethebox.blogspot.com/2013/03/anwar-ibrahim-johns-hopkins-school-of.html
xxxi	See for example “A sample of when chauvinist Chinese rules Malaysia!” http://barkingmagpie.blogspot.com/2013/02/a-sample-of-when-chauvinist-chinese.html And “Butcher of Malaya return: DAP chauvinism true colors: bigdogdotcom.wordpress.com/2009/11/23/butcher-of-malaya-return-dap-chauvinism-true-colours-shown/ . Also see: DAP of today like PAP of 1965, April 14 2013, http://helenang.wordpress.com/2013/04/14/dap-of-today-like-pap-of-1965/
xxxii	See for example: “Muhyiddin gives F to Kelantan PAS”, 2 May 2013, MalaysianDigest.com, http://www.malaysiandigest.com/news/36-local2/332712-muhyiddin-gives-f-to-kelantan-pas.html
xxxiii	For an example of high-profile PR-to-BN defection, see “‘Repented’ Mat Taib now tells Malays to back DAP”, 25 April 2013, The Malaysian Insider, http://www.themalaysianinsider.com/malaysia/article/repented-mat-taib-now-tells-malays-to-back-dap . For an example that goes the other way round, see “Two former PKR leaders to join UMNO”, 30 May 2013, The Star.
xxxiv	This figure more or less reflects the percentage of the general population who was agreeable with the direction of the country towards the end of 2012, according to the survey report “National Public Opinion Survey October 2012; Top Issues of Concern”, Merdeka Center
xxxv	Kassim Ahmad commented on Shanon Ahmad as having “PAS-type of thinking” in “Writer of swear book is a life member of PAS”, New Straits Times, 22 April 1999 . Anes Zubady commented on Shen Yee Aun being “obviously MCA” and Kee being “perceptibly a DAPster” in “Kee Thuan Chye and Shen Yee Aun” , 15 Mar 2013, http://www.malaysia-today.net/mcolumns/letterssurat/55126-kee-thuan-chye-and-shen-yee-aun
xxxvi	PAS supporters are seen as being more difficult to win over, in “PAS hardcore supporters urged to wise up”, 26 April 2013, Bernama. Also, PR rallies tend to attract bigger, more motivated crowd, compared to BN rallies, as noted in “BN Merdeka Rally at Bukit Jalil versus PR People’s Uprising Rally” , http://weehingthong.wordpress.com/2012/09/02/100000-for-bns-merdeka-day-rally/
xxxvii	Figures in http://www.geohive.com/earth/pop_urban.aspx
xxxviii	Najib was quoted “There was a tsunami among the Chinese community which supported the Opposition,” GE13: It’s 133 for BN and 89 for Opposition, 6 May 2013, The Star. While opposition leaders especially have the claim, there have been substantial arguments that point at the fact – see , for example Calvin Sankaran’s <i>Mathematical proof of Chinese Tsunami</i> , 31 July 2013, Free Malaysia Today.
xxxix	Abdullah Badawi as quoted in “BN can’t repeat 2004, says Prime Minister Abdullah Badawi”, 22 Jan 2008, Malaysia Kini
xl	See Chiang Nee’s column, “PAP plan to retain support”, 31 August 2013, The Star