

POLÁNYI PUBLICATIONS

RYSZARD PRASZKIER

**SINGULARITIES IN SOCIETAL DYNAMICS:
MANIFESTATIONS, EARLY INDICATORS,
AND ANTICIPATION**

I.2023/WP02

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ABSTRACT

The focus of this article is on singularities, i.e., significant, abrupt, and unpredictable events in the social arena. The first section provides a review of the various delineations of such occurrences, e.g., black swan events, cusp catastrophe theory, and phase transition. Following this, a series of five case studies are presented that epitomize profound, peaceful, and successful social movements, highlighting their related singularity moments.

Methods for forecasting possible future singularities are then provided in the beyond-the-art section. First, conclusions are drawn from case studies, leading to the development of a predictive model. Second, selected computer modeling examples are demonstrated, leading to predictions of forthcoming singularities. Third, life simulations (i.e., red and green teaming) are presented, proposing future scenarios for real-life roleplaying.

The conclusions indicate the simultaneous application of a variety of independent methods for forecasting future singularities, complementing the predictive model drawn from social movements with computer and life analyses.

Keywords: singularity; black swan event; New Social Movements; computer modeling; green teaming; prediction

Singularities in Societal Dynamics: Manifestations, Early Indicators, and Anticipation

Ryszard Praszkiar

Introduction: Abrupt Changes and Singularities

There is no doubt that we live in an age of change. Peter Drucker, a well-known business advisor and coach, encourages people to embrace change and consider it an opportunity, rather than a threat (Rosenstein, 2022). He also authored the iconic message: “To survive and succeed, every organization will have to turn itself into a change agent. The most effective way to manage change is to create it.”

Some understand change as a gradual process, parallel to actors’ learning. Others, however, claim that transformation implies radical change, because all elements of the structuring of the field are in flux (Fligstein, 2013).

There are some similarities between the social sciences and mathematics fields. For example, classical physics and mathematics, as well as classical social sciences, used to be based on the notion that change is smooth and consistent with positive feedback, where the rate of change continuously modifies the existing state of any system, leading to exponential growth or decline (Batty, 2008). However, linear change is the least likely scenario in the contemporary world, where discontinuous jumps are predominant, with multiple causes working together, starting from the bottom up and generating tipping points, catastrophes, and bifurcations.

Markets represent a classic example. These are often governed by uncoordinated bottom-up actions that have the capacity to generate abrupt change. Such change is unexpected, for it is the product of countless actions that cannot be managed and often cannot be tracked. In this sense, it is emergent and always surprising (Batty, *ibid*).

In mathematics, a point at which a given mathematical function is not defined or has strange properties (for example, one that is—at this point—infinite) is called a *singularity*¹ (see the examples shown in Figures 1a and 1b).

¹ See Wiki: <https://en.wikipedia.org/wiki/Singularity> (Accessed 25 February 2023).

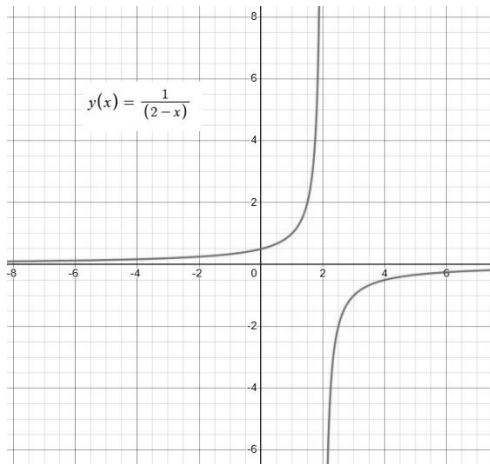


Figure 1a. Function $f(x) = 1 / (2-x)$ and its singularity at point $x = 2$.

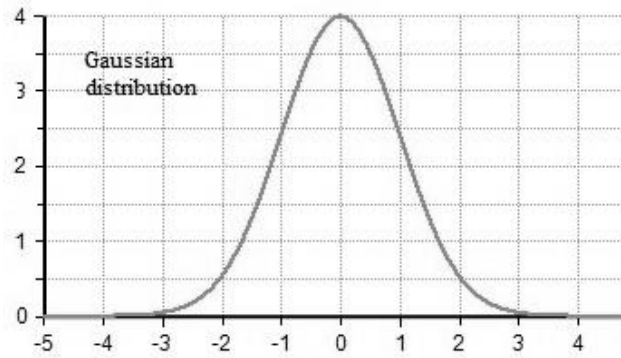


Figure 1b. Normal distribution, singularity at point $x = 0$.

James Clerk Maxwell, in the 19th century, used the term *singularity* beyond the scope of mathematics, holding that in dynamical system theory, i.e., also within social systems, singularity refers to contexts in which arbitrary small changes, that are commonly unpredictable, may lead to arbitrary large effects (Maxwell, 1882). Some authors hold that in a social context, multiple currents of change converge to a point in time where the systems become radically different in their structure (Kurzweil, 2005), and—as for our contemporary world—these singularities will fundamentally change the way we live and work, ending the world as we know it (Kurzweil, *ibid*).

Singularities may manifest as disruptive for existing homeostasis upheavals, such as riots, peaceful protests, revolutions, or—in the case of families—acute conflicts (Praszkier, 2013). They may also constitute system strengthening processes, such as commitment, propensity for cooperation, and trust (Pena-López et al., 2013; Zabłocka et al., 2016).

This article explores the singularity issue in a social context, demonstrating various ways in which it can be analyzed, e.g., from the perspective of black swan events (Taleb, 2010), dynamical rare events (King & Zeng, 2001), cusp catastrophe theory (Flay, 1978), the butterfly effect (Érdi, 2008), bifurcations (Hazy & Ashley, 2011), and phase transition (Li et al., 2012). Several case studies (e.g., the Civil rights Movement, the Peace Process in Basque Country, and the Polish Underground “Solidarity” Movement) are used to illustrate the way in which singularities may manifest in the context of societal dynamics.

Moving beyond the state of the art, conclusions from the demonstrated case studies are drawn, showing early indicators of a possible forthcoming singularity. The conjectures related

to the early indicators of singularity address the properties of networks, the role of a compelling vision, and the kinds of leadership.

Furthermore, various predictive methods are presented, such as computer and life simulations. This article then concludes with recommendations for social organizations and movements on how to prepare for potential forthcoming singularities and bifurcations.

Singularities in Different Variations

The growing contemporary interest in singularity phenomena is perhaps related to abrupt market changes. In 2010, Lucien Karpik introduced the concept of the economics of singularities, analyzing the goods and services that cannot be studied by standard methods because they are multidimensional, incommensurable, and of uncertain quality (Karpik, 2010). Karpik's conception has a particular application to studying the atypical phenomenon of the bitcoin market, which was initially predicted to be a short-term bubble and instead became a durable and significant segment of the market (Dallyn, 2017).

Beyond the market, singularities are also incorporated into various other disciplines, e.g., sociological analysis (Hamel, 1992), and, taking it a step further, the entire society is delineated as "The Society of Singularities" (Reckwitz, 2020). Moreover, singularities enter the realm of culture (Leypoldt, 2014) and even the neuroscience of love (Solnyshko & Malpuech, 2022).

Below, several paths for describing singularity phenomena are delineated. The first one, black swan events, comes from market studies, while the three that follow represent dynamical social psychology.

Black Swan Events

Nassim Taleb, who created the black swan event concept, proposed the following definition: A black swan event is a rare occurrence of enormous consequence that cannot be predicted or calculated (Taleb, 2010).

Upon closer inspection, Taleb holds that the notion of black swan events encompass the following:

- **Unpredictability:** They exist outside the realms of possibility, mainly because nothing in the past suggests that they are coming, exceeding what is normally expected of a situation.
- Black swan events have an **extreme impact**.
- After the fact, people tend to fabricate an explanation that makes it appear more predictable than it really was (Taleb, 2010); in other words, people generate

hindsight, devising explanations (after the event has happened) that make it seem plausible and predictable.

Market black swans are usually disruptive events, creating an extreme economic impact (Stodd & Reitz, 2017). One prime example is the global financial crisis caused by the stock market crash of 2007–2008, initially starting as a mortgage lending crisis and then expanding into a global banking crisis before resulting in the fall of Lehman Brothers, all leading to a global recession (Kenton, 2023).

Many drastic events, such as 9/11 (11 September 2001), Hurricane Katrina, and the BP Deepwater Horizon oil spill and disaster (20 April 2010), either did not register on anyone's radar as incoming or the indications were disregarded as implausible, resulting in various post-event explanations (Nafday, 2009).

People tend to underestimate black swan risks, likely because they overestimate one's knowledge and focus too narrowly on one's field of expertise (tunnel vision), ignoring other sources of uncertainty and mistaking fictitious models for reality (Nafday, 2009).

The black swan event perspective is helpful for analyzing various occurrences, e.g., the coronavirus pandemic in 2019 (Antipova, 2021), which caused a global stock market crash in 2020.² Consequently, investors had limited opportunities for investment, providing reasons for panic buying and selling (Ahmad et al., 2021).

Interestingly, this perspective may also be applied to the dynamics of animal populations: Researchers have found black swan events to occur mostly within bird, mammal, and insect species. Such events develop mostly as descending processes due to unexpected population collapses (Anderson et al., 2017).

Rare Events

Rare or extreme events are infrequent, high-severity occurrences that have far-reaching consequences and might destabilize entire systems. They are identified via stock market analysis (Sornette, 2017), ocean wave intensity (Dysthe et al., 2008), and society (King & Zeng, 2001). Moreover, rare events address natural phenomena, e.g., earthquakes, tsunamis, hurricanes, floods, asteroid impacts, and solar flares, as well as man-made dangers, such as violent conflicts, terrorism, industrial accidents, financial and commodity market crashes, and global warming effects.³

² In one month, S&P 500 lost over 30% of its value.

³ See Wiki: Wiki: https://en.wikipedia.org/wiki/Rare_events#cite_note-4 (Accessed 11 March 2023).

Analysis of 200 papers on extreme events revealed that researchers tend to view such events within a particular temporal context, quite often in terms of rates of change, also highlighting that these occurrences are typically researched in terms of risks, vulnerabilities, and impacts (Stewart et al., 2022).

Rare events analysis is predominately based on statistical models and computer modeling of the processes (King & Zeng, 2001). It may relate to extreme situations, e.g., analyzing how statistical prognostic models estimate the probability of a single vote in a U.S. election being decisive. For example, in the period 1900-1992, there were 20,597 U.S. House elections, out of which six were decided by fewer than 10 votes, 49 by fewer than 100 votes, 293 by fewer than 500 votes, and 585 by fewer than 1000 votes (Gelman et al., 1998).

Cusp Catastrophe Theory

A cusp catastrophe represents a sudden destabilization of the equilibrium, causing a “jump” from one state to another. This concept is used for modeling several dynamical occurrences, e.g., sudden crowd traffic jams (Zheng et al., 2010). Additionally, cusp catastrophe models have been proposed for many psychological phenomena (Flay, 1978; Sussmann & Zahler, 1978; Zeeman, 1976). A key example is the riots in London, where the control variable was the level of discontent and anger met by police brutality. The response to this brutality involved demonstrations, maintaining the stability of these dynamics. However, an isolated shooting acted as a catalyst for the rioting to occur; the threshold (singularity point) of behavior change had suddenly been met and rather than seeing a gradual (smooth) change through an increase in the frequency and intensity of the protests, a sudden jump from a peaceful demonstration to rioting occurred (Flay, 1978).

Another example is a dog’s response to stressful stimuli, called the fight-or-flight response (Cannon, 1963; Sussmann & Zahler, 1978). When a dog encounters a stranger, it experiences a mixture of fear and aggression. Driven by aggression, it moves toward that person, though fear makes him step back; there is a balanced fear–aggression distance taking place during this “dance.” This equilibrium is maintained as long as that person walks far enough in front of the dog (lines X–Y and X₁–X₂ in Figure 2). However, if that person moves closer (lines A–B–C and A–D–C), they may cross the singularity point, in which case, the dog’s aggressiveness will predominate, and he will jump at them. This “jump” is represented by the fold on the graph’s surface, otherwise called a “cusp catastrophe.”

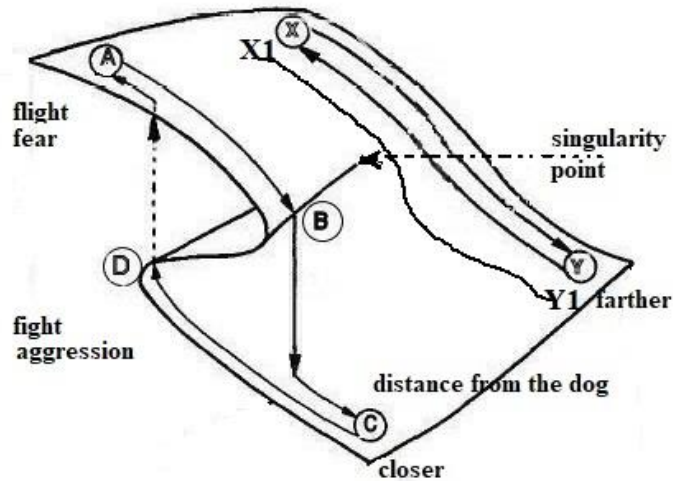


Figure 2. Distance from the dog: The closer the subject gets, the more the dog’s fight-or-flight response moves toward “fight,” crossing the singularity threshold and, consequently, causing the dog to jump at the subject.

Butterfly Effect and Bifurcations

The butterfly effect is a metaphor reflecting the idea that small things can have a non-linear impact on a complex system. The popular idea that the flap of a butterfly’s wings in one place can have a major effect on weather conditions in a distant location illustrates how small changes at the outset lead to greatly different results or outcomes (Érdi, 2008).

The term “butterfly effect” was coined in the 1960s by Edward Lorenz, a meteorology professor at Massachusetts Institute of Technology (MIT), while studying weather patterns. His insight was that some complex dynamical systems exhibit unpredictable behaviors such that small variances in the initial conditions could have profound and widely divergent effects on the system’s outcomes (inspiring the so-called “chaos theory”). As for the weather forecast, when comparing two close starting points to indicate the current weather, they might drift apart and instead end up with completely different weather predictions (Gleick, 2008).

In line with this finding, there should be a momentum of embranchment, when a slight change decides on which direction dynamic processes tend toward. This embranchment is called bifurcation, visible in the dog’s fight-or-flight response in the previous section: There is a bifurcation point, which separates “fight” from “flight.”

As another example, one can imagine a bottle drifting in the current of the North Atlantic Drift, encountering its bifurcation point (see Figure 3). At this point, a very slight breeze may determine whether the bottle ends up near the North American coast or closer to Norway (Praszkier & Nowak, 2012).

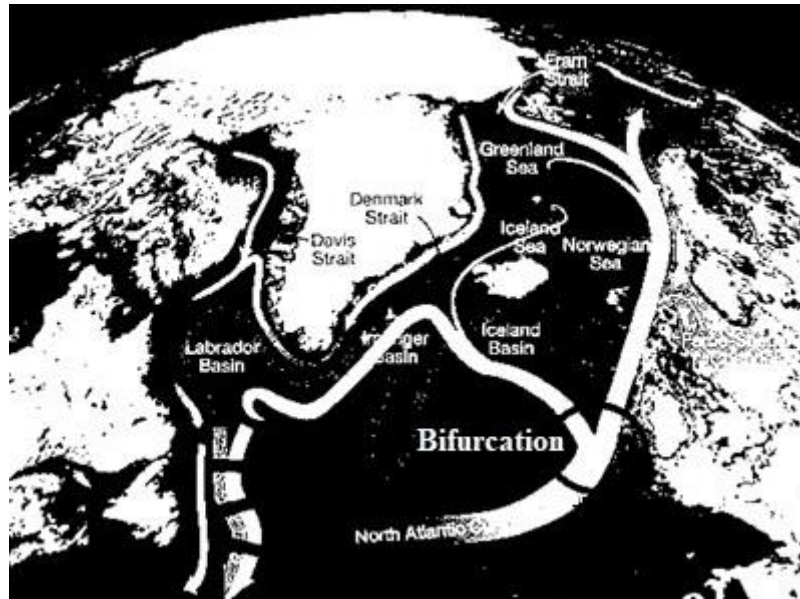


Figure 3. The North Atlantic Current splits into western and eastern branches.⁴

Phase Transition

The discontinuities and rapid jumps from one state to another (e.g., the previous example of London’s non-rioting to rioting) are sometimes compared to the phenomenon of phase transitions in physics, such as when water transforms into gas at a temperature of 100 °C or into ice at a temperature of 0 °C (see Figure 3).

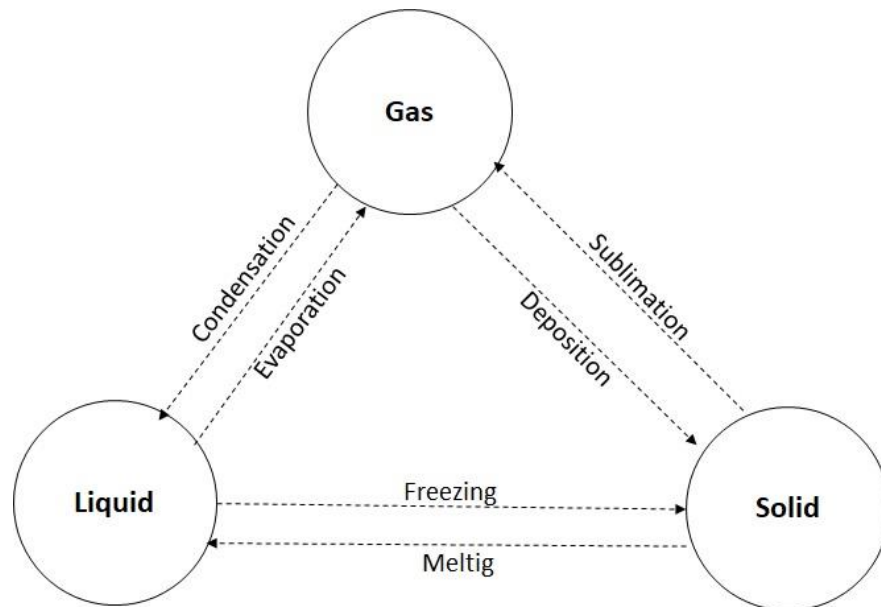


Figure 4. Liquid–gas–solid phase transitions.⁵

⁴ Source: https://en.wikipedia.org/wiki/Atlantic_meridional_overturning_circulation (Accessed 22 April 2023).

⁵ Inspired by: www.shutterstock.com (Accessed 17 March 2023).

While the water temperature grows, small nucleus bubbles appear, which connect, grow, and burst out of the surface; the bubbles in these dynamics are a metaphor for social clusters and groups growing and, finally, leading to a substantial transition (Nowak & Vallacher, 2005, 2018).

The phase transition model allows analysis of several societal dynamics, e.g., how gossip spreads and influences public opinion, up to the point of a jump into radicalization (Li et al., 2012). Similarly, some cases of opinion formation may be seen as a phase transition in analogue to the jump from the “paramagnetic” to “ferromagnetic” phase (Hołyst et al., 2000). Interestingly, analyzing the brain’s reactions while moving from a state of liking to a state of love may be viewed as a naturally occurring phase transition (Solnyshkov & Malpuech, 2022).

Singularities: Recapitulation

The abovementioned *singularities* may be visible in various dynamics, e.g., in the real estate market. Sometimes a *rare event* occurs when the price of a very low value, unkept, underdeveloped, and underserved urban area suddenly starts skyrocketing. The mechanisms driving this change may start with a group of Scouts initiating street cleaning, someone else designating a space for a clean kindergarten, and a group of residents planning a baseball field. Others might form a choir, while another group works on opening a gym.

All of those bottom-up initiatives are initially unrelated and isolated. The *bifurcation* point opens up two possible paths: Either these initiatives remain isolated (maintaining the low value of the community), or diverse connections between the groups appear and grow, e.g., some Scout leaders meet with the kindergarten principal and the baseball coach; then, the choir director and fitness activists join the meeting. They deliberate on how to increase the safety and quality of their neighborhood, launching a proud-of-our-community initiative. This network of ideas and connections, in a feedback loop, attracts other inhabitants who are supportive of this new approach to community enhancement. People organize themselves, setting new safety and health paradigms. At some point, a sudden *phase transition* occurs, as the community turns into a neat, desirable location, and its market value breaks through the ceiling (Praszkie, 2018a). This rapid transformation may be perceived as a *cusp catastrophe*, initiated by the *butterfly effect*, i.e., by those few Scouts cleaning the streets.

In this paper, the terms *singularities* and *black swan events* represent the above-mentioned concepts.

Case Studies: Social Movements and Singularities

There are several examples of peaceful social movements having a significant, durable impact. This impact occurs after an initial development phase, when an inflection point (i.e., singularity) is reached.

Social movements are understood here in accordance with the New Social Movement (NSM) theory, as participating in pursuing a “big idea” that emphasizes social issues, accomplished through social relations, symbols, and identities based in the culture (Buechler, 1995, 2011; Scott, 1990). An important component is networks, generating a new kind of identity, called a “project identity” (Castells, 2010). Jürgen Habermas added that critical for the NSM theory is “communicative action,” through which people communicate, interact, exercise trust, cooperate, and share information; people reach a consensus through public dialogue rather than an exercise of power (Habermas, 1985).

Below are examples of five social movements, diverse in terms of the time, location, and issues addressed. The subsequent analysis focuses on the associated singularities and, in line with the above NSM definition, on four dimensions:

- The big idea: A far-reaching, compelling vision;
- The properties of networks;
- The culture and identity;
- The kind of leadership enabling bottom-up initiatives.

The Civil Rights Movement, USA, in the 1950s and 1960s⁶

With millions of Black and White citizens participating in civic actions, marches, boycotts, sit-ins, etc., the Civil Rights Movement finally succeeded by achieving judicial transformation, liquidating the legal grounds for segregation. The turning point (final singularity) was the implementation of two legal acts: The Civil Rights Act (1964), explicitly banning all discrimination based on race, including racial segregation in schools, businesses, and public accommodation, and the Voting Rights Act (1965), assuring voting rights in areas with an historic under-representation of minority voters.

The movement’s inception (initial singularity) is attributed to Rosa Parks, who, on 1 December 1955, while riding a bus, refused to comply with the driver’s order to leave her seat in the “colored” section for a White passenger once the “White” section was full. As a result,

⁶ The Civil Rights Movement in the USA was a non-violent social movement of the 1950s and 1960s, aimed at abolishing legalized racial segregation and discrimination throughout the country. It was successful in the mid-1960s, causing the introduction of anti-racist and anti-segregation legal acts.

Rosa Parks was imprisoned.⁷ After 44 years, the U.S. Congress honored her as “the first lady of civil rights” and “the mother of the freedom movement.”⁸

Rosa Parks’ struggle sparked public unrest and activity, e.g., the Montgomery Improvement Association (MIA) was formed in the days following her arrest, playing a leading role in fighting segregation in the city.⁹ MIA oversaw the civic bottom-up initiative of boycotting buses as a reaction to Rosa Parks’ incarceration (Williams & Bond, 2002). During the bus boycott, MIA organized a carpooling system to provide transportation to boycotters. White members of the Montgomery community also participated by offering rides. City officials and police attempted, without success, to disrupt the carpooling service, which continued operating even after being declared illegal in June of 1956 (Killian, 1984).¹⁰ Martin Luther King commented that a miracle had taken place: Instead of riding buses, boycotters self-organized a system of carpools (King, 2001).

An example of a civic bottom-up initiative is the Club from Nowhere, founded by Georgia Gilmore, a midwife from Montgomery. The club raised money, sold food to beauty parlors, and designated the profits to support the anti-segregation initiatives. The success of this venture led Gilmore and her friends to produce entire meals, including chicken dinners, cakes, and pies, to sell to the boycotters, having White clients as well. Moreover, Club from Nowhere participants enjoyed their activities, singing songs such as the well-known “Keep Your Eyes on the Prize.”¹¹ The money from these sales went toward helping to sustain the carpool system and, as a result, supported the bus boycott (Barnett, 1993; Nelson, 2020).

Another form of peaceful fighting for racial justice was “sit-ins,” documented in Baltimore, Maryland (1955), Durham, North Carolina (1957), Wichita and Oklahoma City (1958), and Greensboro and Nashville (1960). Black protesters simply occupied places in “only for Whites” restaurants. These sit-ins drew public and media attention, especially when the police tried to remove the protesters from restaurants (Wynn, 1991).

After the Civil Rights Movement succeeded, Georgia Gilmore, said: “I was glad it was a success and nobody didn't get killed or injured or anything and uh, after the boycott we had a lot of white friends that we didn't realize that were really and truly interested...” (Williams & Bond, *ibid*).

⁷ See: <https://www.archives.gov/education/lessons/rosa-parks> (Accessed 22 March 2023).

⁸ See: <https://www.govinfo.gov/content/pkg/PLAW-106publ26/pdf/PLAW-106publ26.pdf> (Accessed 22 March 2023).

⁹ See: <http://encyclopediaofalabama.org/article/h-2567> (Accessed 22 March 2023).

¹⁰ See: <http://encyclopediaofalabama.org/article/m-5146> (Accessed 22 March 2023).

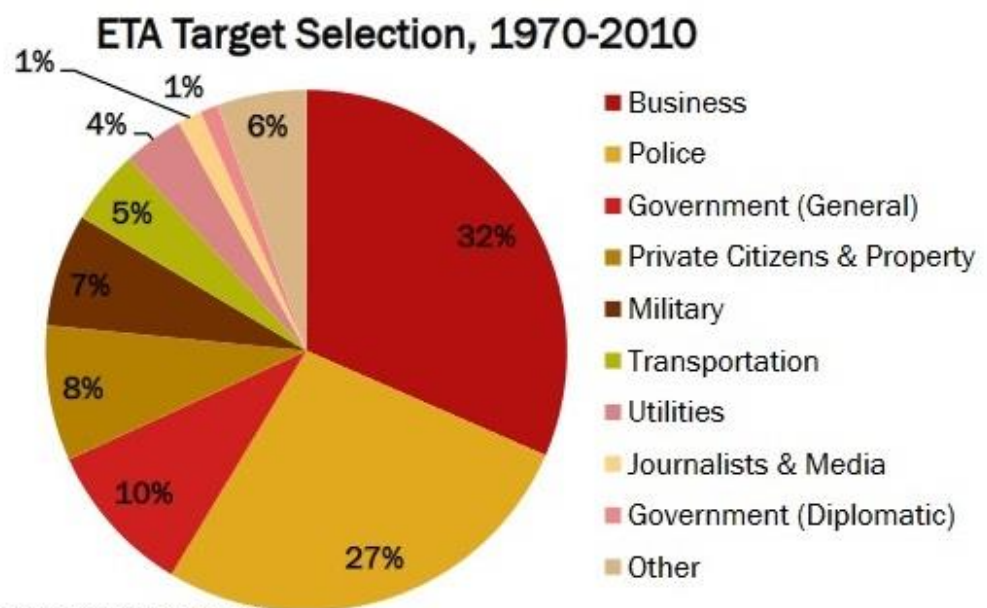
¹¹ See: https://www.youtube.com/watch?v=xbq4vDG65_A (Accessed 30 March 2023).

The Peace Process in the Basque Country, Spain, in 2011¹²

In 1959, ETA, an offshoot of the Basque culture preservation movements, started its insurgency against the Franco regime, which aimed to eradicate Basque culture, language, and remaining autonomy. ETA strikes also continued after the Franco era, as the anti-Basque cultural pressure continued for decades (Astrain & Stephens, 2013; Llera, 1999; Llera et al., 1993).

ETA initially attacked the Spanish government's representatives, although they began to increasingly impact the Basque nation, both physically and mentally. For example, they targeted Basque independence groups such as the Basque Nationalist Party (PNV), whose leaders were attacked and often killed (Loyer, 1998). Moreover, common targets were private businesses. From 1959 to 2011, ETA was responsible for killing 829 people, injuring thousands more and even kidnapping dozens (Hammer, 2007) and they were perceived as the most violent insurgent group on the European continent (Clark, 1984).

In response to pressure from the Basque civil society, ETA's tactics shifted, transitioning from ceasefires to violence and back (see Figures 5 and 6). The violence came in many different forms: Killing, kidnapping, and blackmailing (Clark, 1984; Hammer, 2007; Loyer, 1998).



Source: Global Terrorism Database

Figure 5. Euskadi Ta Askatasuna's (ETA) targets from 1970 to 2010 (Miller & Smarick, 2011).

¹² The Basque terrorist organization ETA (an acronym for Euskadi Ta Askatasuna, Basque Homeland and Freedom) fought for full independence from 1959 to 2011, both attacking Spanish representatives and terrorizing Basque citizens. Most of Basque society was peace- and nonviolence-oriented, regardless of their opinion on maintaining autonomy or achieving independence.

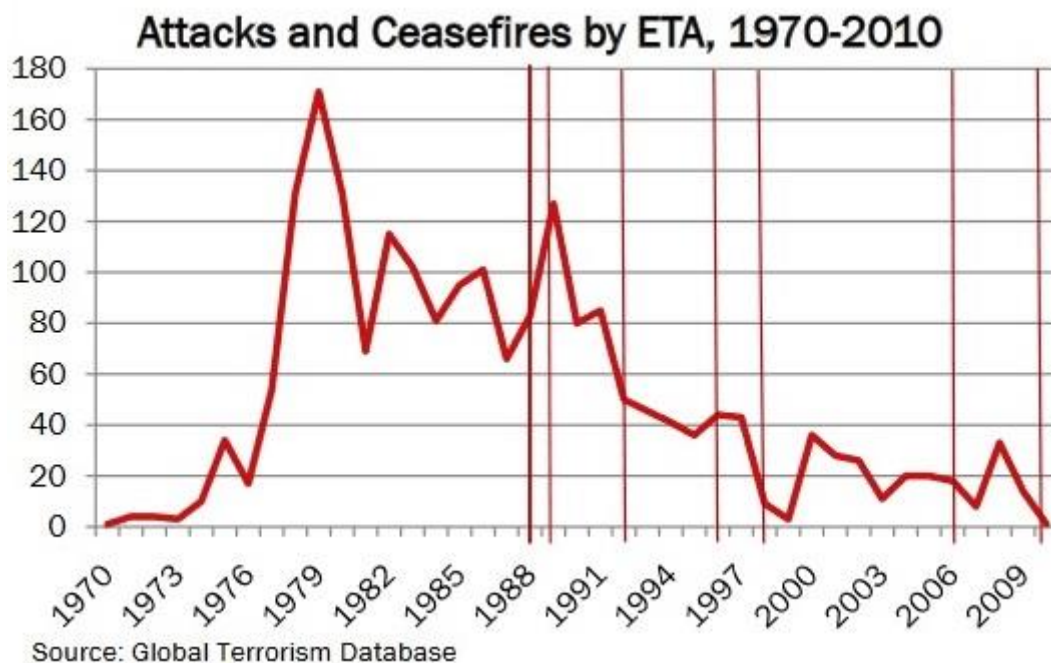


Figure 6. Attacks and ceasefires by ETA from 1979 to 2010 (Miller & Smarick, *ibid*).

The violence was intensified by the Spanish government’s terrorist attacks, especially in the 1980s, when GAL (Grupo Antiterrorista de Liberación), an illegal group secretly formed by police officials, began attacking the supporters of ETA. GAL killed 27 people, including women and children (Alonso, 2010; Diditwister, 2012; Woodworth, 2003).

As people were generally scared, the frequent outbreaks of violence were predominantly hidden through “the spiral of silence,” understood as an attitude of intimidation, fear, and self-censorship that prevents an open conversation about terror, even after the abandonment of violence (Noelle-Neumann, 1974; Noelle-Neumann & Petersen, 2004; Spencer & Croucher, 2008).

On the contrary, the Basque people did not support violent methods. A University of the Basque Country survey revealed that 64% of people completely rejected ETA; 13% identified as former ETA sympathizers (mainly during the Franco dictatorship); 10% agreed with ETA's ends, but not their means; 3% felt fear towards ETA; 3% expressed indifference; 3% were undecided or did not answer; 3% were supportive of ETA, but still criticized some of their actions. Strikingly, only 1% gave ETA total support (EuskoBarómetro, 2009).

In this way, over the years, there was a stark contrast between society’s hope for peace (and repulsion against violence) and the violent methods used by ETA.

Despite ongoing acts of terror and forced silence, Basque society challenged and ultimately de-legitimized political violence. Civil action was one of the engines for political

transformation, helping to precipitate an end to the violence by undermining the support for ETA in Basque society (Argomaniz, 2019). One key example is Gesto por la Paz, a peaceful platform, which played an important role from its beginnings in the mid-1990s.¹³

Additionally, the Basque nation had been intentionally transforming the environment through cultural, social, and economic development over the previous decade. The Basques achieved rapid economic growth (Markuartu, 2012; Porter et al., 2004; Uranga, 2002) through their specialty: A cooperative-based economic approach. In fact, in the Basque Country, workers owned and managed the world's largest successful cooperative, Mondragón (Herrera, 2004; Hollender, 2011; Whyte, 1991). Moreover, a significant line of innovation resulted (Arancegui et al., 2011; Espiau, 2011; Heras, 2014), while research has revealed a meaningful role of real-life networks in developing indirect pressure for peace (Praszkie & Bartoli, 2014). As a result, the violence became an impediment to the growing social, economic, and interconnected environment.

Terrorism suddenly and unexpectedly (singularity) stopped on 5 September 2011, when ETA announced the definitive cessation of its armed activity.¹⁴ There were no particular actions or incidents that could have predicted this ceasefire. The black swan effect seemed to be a cumulative result of the multiple ways in which civil society was striving for peace.

Polish Underground Peaceful Solidarity Movement, Poland, in the 1980s¹⁵

The nationwide strikes put pressure on the communist government to legalize “Solidarity” in 1980—the first independent Trade Union in the Soviet zone. During the hardliner Brezhnev rule, while Soviet tanks were being prepared on the Polish border, this was an extraordinary, unexpected singularity-type event. Operating legally for over a year, it was de-legalized during Martial Law imposed in December 1981. From then on, it operated for a decade illegally as a peaceful civic resistant movement, carrying out multiple clandestine and bottom-up activities (Kenney, 2001, 2002).

¹³ See: <http://www.gesto.org/es/que-fue-gesto-por-la-paz/mensaje/principios-fundamentales.html> (Accessed 22 April 2023).

¹⁴ Basque ceasefire statement: Full text. *The Guardian*, October 2010. Retrieved from: <http://www.theguardian.com/world/2011/oct/20/basque-ceasefire-statement-full-text> (Accessed 23 March 2023).

¹⁵ Polish citizens under the Soviet regime were, since the end of the Second World War, renewing their uprisings for liberation. In August 1980, multiple strikes covered most of Poland, forcing the communist regime to acknowledge the free and independent Trade Union “Solidarity.” Afraid of the power of the new movement, a regime was enforced in December 1981, called Martial Law, which de-legalized “Solidarity.” However, “Solidarity” continued clandestine pro-freedom initiatives, involving most Poles. After a decade, “Solidarity” won and, through roundtable talks, led to free elections in 1989, subsequently resulting in freedom and independence.

Examples include supporting illegal education (classes or lectures at home); publishing and distributing illegal books, brochures, and newsletters; running self-help groups; supporting the families of arrested activists; boycotting governmental TV (the only one available). The TV boycott was carried out by both celebrities and viewers, with actors performing sub-rosa at homes and supporting themselves as taxi drivers (Kenney, 2001).

One of the unpredictable and seemingly impossible black swan events was the horizontal peer-to-peer nationwide communication, during a time when government authorities had cut telephone and telex lines, jammed radio broadcasts, and shut down post offices (Osa, 2003), with multiple checkpoints on the roads and train travel available only with special permission.

One example is the evening when candles in windows were lit in unison, throughout all of Poland, in small and big cities alike to commemorate special events. Another example is that of people effectively boycotting government-sponsored TV news. Each evening, at exactly 7:30 p.m., when the propaganda broadcast began, people left their homes to take walks around their neighborhoods, socializing with other families along the way, until 8:00 p.m. sharp, when the nightly news ended, and everybody returned home for dinner. The police were helpless to stop the “protest,” given that no one was verbally or physically confronting the regime. However, the collective action taking place at a specific time made a powerful impact and sent a strong message.

Tanks on the streets, house raids, and arrests necessitated innovative clandestine methods—instead of direct confrontation with the regime. Many initiatives appeared ad hoc, using personal and professional networks (Friszke, 2006). One example of this comes from Gdańsk: An activist was asked to organize an illegal broadcast, called Radio Solidarity, without any detailed instructions on how to do it. He developed his own plan and assembled a team; he authored the news and asked a friend who was uninvolved in the movement to read and record the news. He recorded this on several separate tapes, keeping them in his pocket when boarding a crowded train. Here, another person (whom he barely knew) took the tapes out of his pocket and placed them in three portable tape recorders, each of which was stored in a different suitcase, together with homemade broadcasting equipment. Finally, these suitcases were placed on three roofs in different cities and set to play sharply at the time of the official TV news, in effect replacing said news with their own broadcast over the audio track of the regime’s propaganda. After the broadcast, a different team observed whether the police detected the suitcases. If not, then they collected the equipment for further use (Praszkie, 2018a).

In the face of the prevalent lack of goods on the market, the movement developed covert groups to experiment with whatever was available. For example, the technical section found a

way to make printing ink by mixing cleaning agents with boot polish; another group developed a method for DIY portable printing equipment that could fit into a backpack. Manuals on how to fabricate the equipment were disseminated, and, consequently, thousands of small publishing units became engaged in printing and disseminating illegal newsletters, magazines, and banned books.

Important to mention is that this civic engagement was not treated as a burden; on the contrary, it was a source of joy for the participants, particularly because of its use as a tool to ridicule (instead of confronting) the regime. One example is the Orange Alternative, a loosely organized group of anti-government individuals who arranged street theater and happenings, mocking the communist system. For example, before Christmas, someone dressed as Santa Claus was giving out free toilet paper in one of Wrocław's main squares. This was a reaction to the proverbial lack of toilet paper in Poland during the Martial Law. People laughed and waved around toilet paper publicly. The police were disabled: Should they publicly arrest Santa Claus? If so, what for, as nothing was said against the regime? Finally, they publicly arrested Santa Claus. People laughed and chanted "free Santa Claus." Later, the city's walls were covered with symbolic drawings of Santa's hat for months (Kenney, 2002).

In the essentially leaderless underground movement (leaderless in the sense that the original leaders were either in prison or in hiding), 10 million of the total population (40 million, including children and senior citizens) participated (Brown, 2003). By initiating multiple decentralized, flourishing, bottom-up, covert initiatives, Poles prepared to take over and adapt easily to a democratic civil society (Brown, 2003; Misztal, 1992; Tyszka, 2009).

This movement created a constant though non-confrontational pressure on the government through a self-organizing civil society. In 1989, the regime was forced to agree to roundtable transition talks, leading to "phase transition," i.e., to the first free elections in the communist zone.

In this way, the Solidarity movement contributed to the transformation of Central and Eastern Europe and to the fall of the Berlin Wall (Ash, 2002; Kenney, 2001, 2002; Kubik, 1994).

Arab Spring¹⁶

The Arab Spring started abruptly in 2010 with demonstrations in Tunisia (after a young street merchant set himself on fire). The movement, called the "Jasmine Revolution," spread

¹⁶ The Arab Spring was a series of unexpected anti-government protests (black swan events) that spread across much of the Arab world in the 2010s. It began in Tunisia in response to corruption and economic stagnation and

throughout the country. The government tried to deter demonstrations through violence and enticements such as economic concessions. However, protests soon spread and forced the authoritarian President to flee the country and change the system, allowing Tunisians to participate in a free election. Tunisia became the first country of the Arab Spring in which protests caused a peaceful transformation to truly democratic elections (black swan event).¹⁷

In Egypt, the revolution began in 2011 and spread across the country. It consisted of demonstrations, marches, occupations of plazas, non-violent civil resistance, acts of civil disobedience, and strikes. Millions of protesters from various socioeconomic and religious backgrounds demanded the overthrow of the authoritarian President.¹⁸

One of the essential communalities of the Arab Spring in many countries was the centrality of dignity and respect, understood as being associated with the idea of citizenship. Additionally, there was a feeling of cross-religious and cross-social strata solidarity in pursuing common civic ideas (Khosrokhavar, 2015).

This solidarity was manifested, for example, through the mutual protection of prayers between Christians and Muslims: Christian protesters stood together to protect Muslims as they prayed by joining hands and facing outwards, surrounding hundreds of Muslim protesters that would have otherwise been left vulnerable as they knelt in prayer.¹⁹ Meanwhile, Muslims formed human shields to protect praying Copts from the police (Saleh, 2011). One of the important days (Martyrs' Sunday) was celebrated by Egyptians of both religions as an affirmation of national unity in struggle.

There was also music, singing, and dancing involved, e.g., a group formed a circle and sang, accompanied by a guitar, the song "Arise O Egypt, arise. Arise Egyptians: Muslims, Christians, and Jews" (Alexander, 2011). Dancing occurred in diverse Arab Spring locations, e.g., in improvised site-specific dance moments, or sardonic joking, in Tahrir Square in Cairo (Abaza, 2011; Martin, 2016). Musicians, especially rappers, performed in the protesting areas (Kimball, 2014). To sum up, old and young found and discovered themselves, and enjoyed being both patriotic and rebellious (Allagui & Kuebler, 2011).

spread to other countries, e.g., Libya and Egypt. The protests in Tunisia and Egypt were peaceful, organized ad hoc through social media. Protesters demonstrated solidarity and mutual support, e.g., Christians protecting Muslim prayers at Tahrir Square in Cairo and vice versa. Authoritarian rulers were ousted.

¹⁷ See: <https://www.britannica.com/event/Jasmine-Revolution> (Accessed 2 March 2023).

¹⁸ See: <https://www.aljazeera.com/features/2021/1/25/remembering-tahrir-square-10-years-on> (Accessed 2 March 2023).

¹⁹ See: <https://www.dailymail.co.uk/news/article-1353330/Egypt-protests-Christians-join-hands-protect-Muslims-pray-Cairo-protests.html> (Accessed 2 March 2023).

The Arab Spring also revealed the significance of ICT and digital connectivity, which was embedded in its organization by networks that played an important informational and organizational role. Communication technologies in the Arab Spring empowered citizens and brought them together (Allagui & Kuebler, 2011; Wilson & Corey, 2012), creating a cumulative transformational singularity effect that was previously unexpected.

*Euromaidan*²⁰

Euromaidan was perceived as a “critical case of mass protests” (Onuch, 2015a), spreading across the country and uniting various previously conflicted groups, e.g., the deep regional split manifested linguistically, culturally, and economically (predominately the Russian-speaking east and the Ukrainian-speaking west). The Euromaidan rebellion was also beyond divisions of the political system, embodied in rivalry between the two groups of influence (Shevsky, 2022). The direct trigger factor was the pro-Russian President Yanukovich’s sudden refusal to sign an agreement for European association (passed by the Parliament). It was also against the ineffective public budget management that weakened the state and the destructive influence of oligarchs (Onuch, 2015; Shevsky, 2022).

The singularity black swan event was, first of all, the unity of the previously divided nation: Euromaidan protests took place not only in the western part of the country (naturally leaning toward the EU and Western culture), but also in the eastern part, e.g., in Donetsk and Kharkiv, previously prevailing under Russian influence (Zubar & Ovcharenko, 2017).

The emergence of unexpected and unpredicted singularity-type protests in Ukraine in 2013/2014 is also attributed to the “social” component of social networks and media, both on and offline (Onuch, 214). Social media and the Internet played an important role in diffusing information and framing protest claims, also engendering and facilitating pre-existing social network ties, which were especially influential in the mobilization process (Onuch, 2015b).

The Euromaidan participants shared values of love, friendship, mutual help, freedom, and dignity (Trach, 2016). There was also the feeling of joy, e.g., BBC News featured protesters playing piano and singing in front of armed police, under the falling snow, and Euromaidan

²⁰ Euromaidan (also known as the Revolution of Dignity) comprised a wave of demonstrations and civil unrest in Ukraine, which began on 21 November 2013 with large protests in Maidan Independence Square in Kyiv and spread across the country. In a bottom-up, citizen-driven movement, people opposed the pro-Russian orientation of the President and supported Parliament’s decision to sign a cooperation treaty with the European Union. The protesters also opposed governmental corruption, abuse of power, and human rights violations. The determination and scope of the resistance caused an unexpected phase transition, forcing the President to flee and escape to Russia, thus sparking democratic changes.

guitar playing; one of the songs was “Your land is waiting: do we go East or West?”²¹ Funny banners of young Ukrainians were mushrooming, e.g., “Ukraine, WTF?!” “No Putin No Cry,” “Europe, dear, we are coming back home,” “Putin, if you love us – let us go!,” or some graphics such as a drawing of the police beating someone up, signed “Welcome to Ukraine.”²²

Recap: Characteristics of Social Movements

Singularities

The above five examples of peaceful and successful social movements indicate that their indispensable attribute was reaching one or more singularity turning points, which were unpredictable in advance (i.e., black swan events). The Civil Rights Movement’s decisive moment was Rosa Parks’ refusal to give up her seat on the bus to a White passenger. Through a *butterfly effect*, this triggered further processes, i.e., the bus boycott and the resulting carpooling system to provide transportation to boycotters (initially illegal). This broad societal self-organization unleashed more bottom-up initiatives, e.g., the Club from Nowhere, spreading in a cusp catastrophe-like manner. Such further development led to eradicating segregation and discrimination (the Civil and Voting Rights Acts), a total *phase transition* in American history.

In the Basque Country, the black swan event was ETA’s totally unexpected permanent renouncement of violence. The decade-long Polish underground Solidarity civic peaceful movement of the 1980s (as a response to Martial Law) was an unpredicted *rare event* in the Soviet bloc; as a result, the 1989 peaceful transformation to freedom and democracy was a definite *phase transition*. The appearance of the self-organizing Arab Spring in Tunisia was an unpredicted *black swan event*, so was the cross-segment solidarity and support of the protesters (e.g., mutual prayer protection by Muslims and Christians). The Ukrainian Euromaidan, a successful pan-national civic protest (against pro-Russian policy), was a totally unexpected *black swan event* in the post-Soviet zone, especially that it was self-organized, occurred in many cities and, at the end, led to a pro-Western Ukrainian orientation.

The Big Idea

In all five cases, the attracting and mobilizing factor was a compelling, far-reaching, big idea, sounding at first like utopia. Equal rights and desegregation in the USA were the dream

²¹ See: Ukraine protests: Singing in the cold, BBC News, December 20 2013. Retrieved from: <https://www.bbc.com/news/world-europe-25468055> (Accessed 4 April 2023).

²² See: Smart and funny EuroMaidan posters, Kyiv Post, 25 December 2013. Retrieved from: <https://archive.kyivpost.com/article/content/euromaidan/smart-and-funny-euromaidan-posters-334231.html> (Accessed 4 April 2023).

of many generations, though they seemed impossible to achieve against millennia-long traditions. Similarly, peace in the Basque Country, freedom and democracy in Poland, liberal laws and eliminating corruption in Arab countries, and Ukrainian pro-Western-orientated democracy sounded, at the onset, unrealizable. However, addressing people's dreams became, in all of these cases, a compelling magnet.

The Properties of Networks

In all cases, connections between participants developed; for example, during the Civil Rights Movement, people organized themselves around the bus boycott and carpooling, as well as in clubs such as the Club from Nowhere. They weaved new connections that involved both Black and White people. The Polish underground Solidarity was predominately based on people-to-people horizontal communication. Despite the threat of secret police, there was an increase in trust, cooperation, and solidarity even between unknown underground activists. During the Arab Spring, unfamiliar to one another, people cooperated with one another, as well as protected other believers' prayers. Most of the Euromaidan activists were people of diverse walks of life, meeting for the first time at a demonstration, supporting and relying on one another.

This exceptional trust, cooperation, and solidarity between unknown individuals during these movements indicates the formation of social capital—an important lever for growth (Praszkier, 2013; Putnam, 1993; Zabłocka et al., 2016). Moreover, two kinds of social capital were manifested: Bonding (connectivity within homogenous groups) and bridging (linking across diverse social groups) (Putnam, 2000). Connecting with people from outside one's close-knit circle means establishing weak ties, which provides connectivity with the outer world, as opposed to strong ties, which link inside "small worlds." The significance of weak ties is that they are far more likely than strong ones to bridge the gap between groups—even between distant network participants or groups (Granovetter, 1973, 1983).

Social Movements' Culture, Identity, and Joy

The Civil Rights Movement's bottom-up culture was constitutive, producing and solidifying trust, contacts, solidarity, rituals, and meaningful systems (Andrews, 2004). Moreover, this culture spread through networks, mobilizing and bringing "structural proximity" to the movement (McAdam, 1999).

In general, in contemporary social movements, communication and social media play an eminent role, becoming part of their culture (Bennett & Segerberg, 2012). This was especially

visible during the Arab Spring (Comunello & Anzera, 2012; Wolsfeld et al., 2013), Euromaidan (Bohdanova, 2014; Onuch, 2015b), and the recent Occupy movements, blurring the internal and external boundaries of the movement, bridging and opening space for inclusiveness and direct participation (Kavada, 2015); for example, women played an exceptional role in building connectivity and networking (Boler et al., 2014).

Interestingly, high-level horizontal communication was also a societal fulcrum during the pre-Internet era. For example, the underground Solidarity movement operated in an environment where telephone connections were initially cut, and when restored, they were heavily bugged, so the information could only be spread by word of mouth. This proved efficient, e.g., when the idea of lighting candles in windows at a certain time, as a symbolic protest, spread instantly throughout all of Poland.²³ Another example is the well-orchestrated national demonstrations of civil disobedience spread through word of mouth, effectively boycotting the government-sponsored TV news, by people leaving their homes when the broadcast began to take walks around their neighborhoods, socializing with other families along the way (Praszkie, 2018b).

Singing, dancing, cultural interests, and joy have accompanied, as mentioned before, several movements. Associated with NSMs is a specific culture, which is also supportive of the project identity and subsequent social transformation (Kendall, 2005; Langman, 2013). The specific emotions involved, e.g., loyalty to the movement, pride, and calmed fears, support the NSM identity (Goodwyn et al., 2004). Recently, this was clearly visible during the Occupy protests in the USA and Great Britain (Kavada, 2015; Langman, 2013).

During the Polish underground Solidarity movement, artists and actors boycotted official institutions, though the interest in art did not fade away, so art exhibitions and theater performances were carried on and rotated at homes. Dancing also accompanied the Occupy movement (Steinhelfer, 2011). Important to mention is that joy is seen as an inevitable component of social movements, accompanying the feeling of participating in the fight for serious goals (Hynes & Sharpe, 2009; Shepherd, 2005).

The Kind of Leadership Enabling Bottom-up Initiatives

Some of the movements were basically leaderless: In the case of the Polish underground Solidarity movement, the leaders were either arrested or stayed in hide-outs, so people took initiative into their own hands. However, there was still an inspirational influence of the leaders,

²³ See: <https://polskiemiesiace.ipn.gov.pl/mon/all-events/december-1981/history/5300,quotSolidarityquot-goes-underground.html> (Accessed 18 April 2023).

even if they had been arrested, e.g., of the iconic Lech Walesa or the Pope of Polish origin (JPII). Similarly, Martin Luther King and other civil rights leaders were frequently arrested, though people self-generated bottom-up initiatives, aggregating over time into a powerful, common opus. In the Basque Country, the pro-peace trend was leaderless, with responsibility instead distributed among many individuals; similarly, during the Arab Spring and at Euromaidan, people were self-motivated to assemble, thus generating the power of civic movement.

The inspirational role of social movement leaders seems important (see: Gusfield, 1966), as does a distributed kind of leadership (Brown & Hosking, 1986). This distributed leadership is characterized as an emergent property of a group or network of interacting individuals open to shifting the boundaries of leadership and possessing varieties of expertise distributed across many individuals, instead of the few (Bennett et al., 2003; Bolden, 2011).

An example of distributed leadership is the position of one of the Solidarity leaders, who said that he saw his role as limited to making sure that the movement remained peaceful and that potential violent actions were knocked down (Praszkier, 2018b).

The conjecture is that a distributed kind of leadership is the best fit for NSMs, where initiatives are usually dispersed over multiple individuals and groups.

Early Indicators of Possible Singularities: The Lessons Drawn from NSMs
The above analysis indicates a “gluing” role of the big idea, seen as a source of durable energy and a driving force for social change (Sztompka, 1993). The specific kind of networks, supporting trust, cooperation, and solidarity, are the scaffolding that fosters identity and becomes a reference point that empowers participants. Distributed leadership leaves space for participants’ initiatives, leading to a bottom-up process of coordination (see Figure 7).

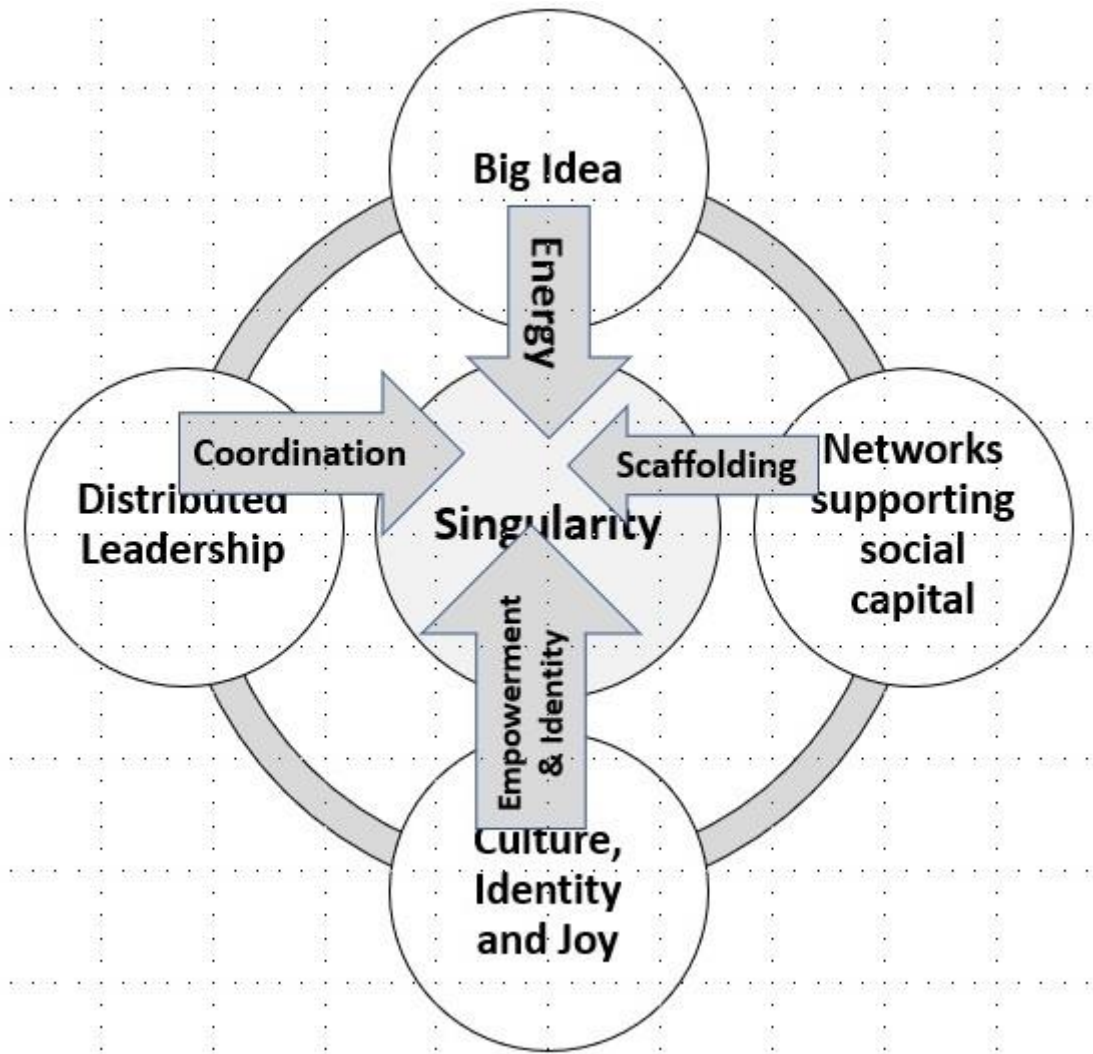


Figure 7. Predictive indications drawn from analysis of New Social Movement (NSM) cases.

The conjecture is that over time the cumulative effect of these four factors increases the likelihood of a singularity occurrence—similar to the processes outlined above. This would lead to the conclusion that identifying the four factors within possible future movements could pave the way for predicting forthcoming singularities.

Along these lines, one may discuss other NSMs, e.g., considering why the Occupy movement did not reach a singularity point. The conjecture may be that although there were strong networking and cultural/identification components, a positive big idea was missing, as participants united around negative ideas (i.e., opposition to social and economic inequality and against large corporations and the global financial system). Moreover, there was no specific leadership, especially of the indicated distributed kind.

However, for additional confirmation, it would be beneficial to complement these conclusions with other predictive methods.

Alternative Methods of Predicting Singularities in Social Dynamics

Limitations

Predicting black swan events may sound like an oxymoron, as the definition indicates unpredictability. However, even if problematic, attempts at predicting rare events may be beneficial for teams and organizations, so as to develop a deeper knowledge of the dynamical approach to (possible) changes, as well as to evolve the predictive way of thinking. Rare events modeling (REM) encompasses efforts to forecast the occurrence of similar events over a future time horizon, which may be of interest for both scholarly and applied purposes (Goodwin & Wright, 2010).

Computer Simulations and Modeling

In business and in life, one small and seemingly meaningless individual decision or action can cause significant consequences for large groups. This was compellingly illustrated by Thomas C. Schelling through computer modeling (Schelling, 2006).²⁴ One of his well-known examples deals with segregation/integration. Schelling showed that slight (though far from malicious) preferences for neighbors of the same race eventually leads to a completely segregated population. This discovery prompted the introduction of formal prediction methods in the social sciences and the design of the well-known Schelling simulation. This computerized simulation program adjusts pixels on a grid using pre-set rules. In Schelling's example, each pixel (red or green) represents the race of a community member and was programmed to have, for example, a relatively small desire to have neighbors of a similar race (e.g., 30% on a scale of 0% (race makes no difference) to 100% (absolutely no neighbors of another race). To each pixel was then assigned a rule that, in each step of the computing, would attract (with 30% strength) pixels of similar colors and repel pixels of different colors (see below simulations designed by Wilensky (1997, 1999).

Figure 8 illustrates the initial state (the board on the right) where the green and red pixels are randomly scattered. The interface (on the left) provides two scroll bars. One is for choosing the number of inhabitants in the community preset—in this case, 1650. The other is the “similar desire” scroll bar, preset to 30%.

²⁴ Also see: Avetisov et al. (2018).

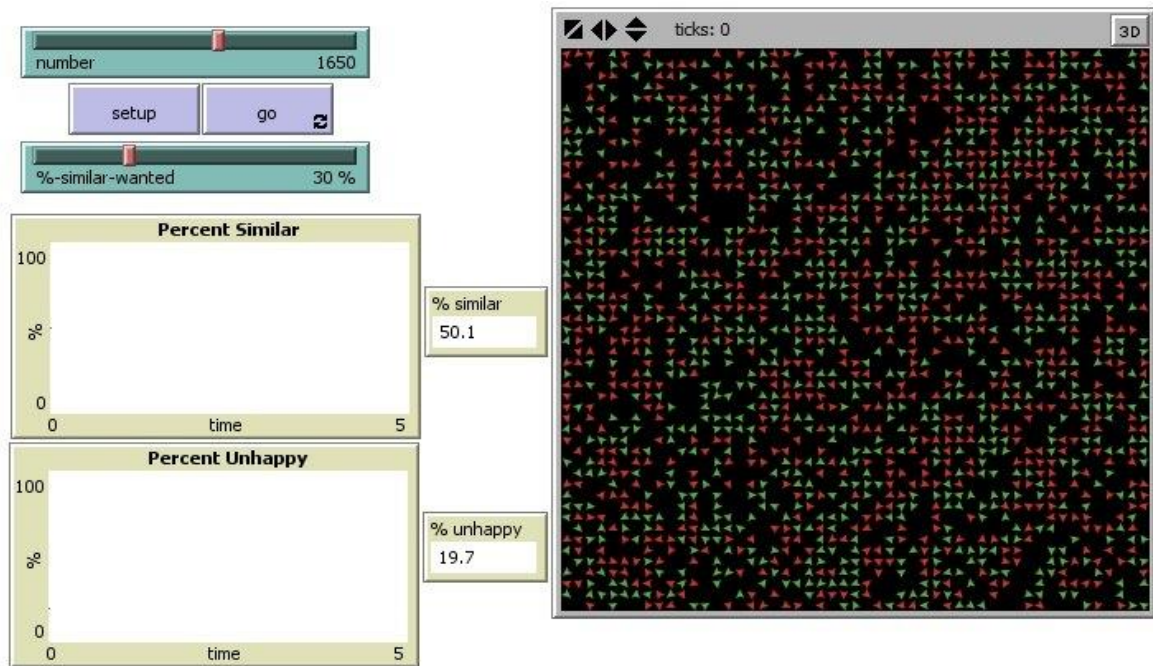


Figure 8. Initial setup (indicated by the “ticks-0” message above the board). Preference for similarity is set here to 30%, while number of inhabitants is set to 1650.

The “go” button starts the program. Each computer tick is a move toward 30% similarity around each pixel. Figure 9 reflects the results after 13 computer ticks. Note that similar colors are more closely grouped. At the same time, the charts on the left display the percentage of similar colors coming together (70.8%) and the percentage of unhappy dwellers, i.e., those that want to be surrounded by a similar race but are not (already 0%). Visible islands of segregation are starting to form.

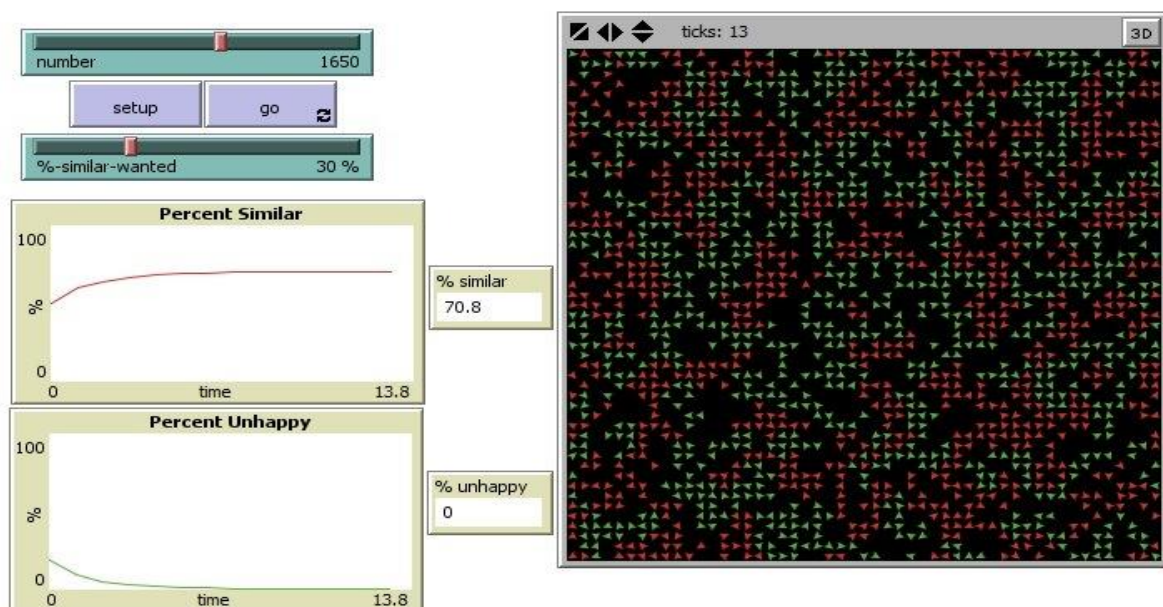


Figure 9. Islands of segregation after 13 computer ticks.

If we assume that one computer tick represents one month, then the prediction is that for over one year (or 13 computer ticks; Figure 9), community inhabitants will keep moving, finally reaching the desired state of semi-isolated islands of red and similar islands of green.

The next stage is about what happens if the rate of desire for a similar race is set to 70% (Figure 10). Clear segregated bubbles maintain the homogeneousness of neighborhoods, reached in over six years (80 computer ticks).

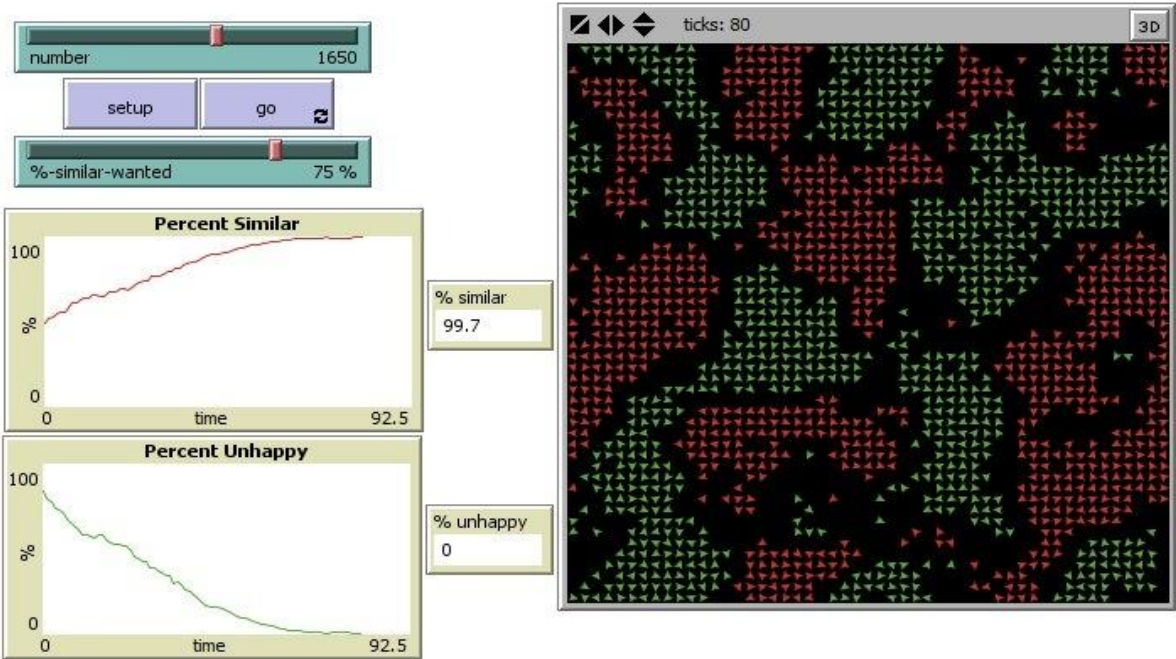


Figure 10. It took 80 ticks for the computer to reach an equilibrium, with 75% of dwellers wanting neighbors of a similar race.

A threshold can be set, assuming that after a certain degree of isolation, the singularity phenomenon appears, making both sides alien and malevolent. Similarly, beyond a certain degree of integration, a singularity point may be defined, creating unity and a harmonious community.

Schelling’s simulation allows to consider a variety of scenarios, adjusting for larger or smaller communities, or for a stronger or weaker desire to be surrounded by similar individuals.

Computer simulations can create a multitude of scenarios. They can model the transmission and perpetuation of a virus in a certain human population to show how many people may get infected and how many may remain immune. They can forecast the dynamics of social networks, the flow of traffic on a highway, and weather that is unique at its level of complexity. Especially critical are simulations of human behavior in a disaster situation (not possible to

simulate in real life). Some see sophisticated predictive computer systems as essential, outperforming both the imperfect market and the best of the experts (Chen et al., 2003).

One of the practical applications of computer modeling is predicting road catastrophes. An example is a model applied in Athens: After an increasing number of car accidents, traffic data were assembled²⁵ (on flow, occupancy, mean time speed, and percentage of trucks). For the first time, a novel approach to rare events modeling was applied in the field of safety evaluation of motorways. Computer modeling has revealed some insights into traffic dynamics, e.g., a negative relationship between accident occurrence and the natural logarithm of speed in the accident location, allowing to restructure real-life roadway communication (Theofilatos et al., 2016).

Computer modeling has become an important resource in many fields, e.g., predicting market financial bubbles and shocks (Oya et al., 2014; Smug et al., 2018) or modeling complex health dynamics in medicine (Davey, 2021). It may also be adjusted to identify future singularities.

Red and Green Teaming

Instead of computer modeling, some processes can be roleplayed in reality. Roleplaying is an active explorational and learning method, in which employees act out situations under the guidance of a trainer. Participants enact the scenes as though they were real.

Red teaming is a kind of roleplay, providing a methodology to explore the uncertainties and challenge of situations associated with *cusp catastrophe* etiology. Some participants take on the role of the enemy or competitor. Similarly, another variety is scenario planning, which involves imagining and playing with various possible future scenarios. As such, it requires flexibility and imagination to envision and roleplay simulations of far-future developments (Fuller, 2018; Masys, 2012; Yang et al., 2006).

While red teaming represents a competitive or conflict situation, also used for analysis of military operations (Gold & Herman, 2003; Longbine, 2012), green teaming represents open situations, also encompassing cooperative and non-competitive behaviors. It is pursued through real-life roleplaying games, where participants imagine future situations. Green teaming may provide a more open space to explore, e.g., by setting a scenario to explore the future market trends related to the team's specific interests. These scenarios can be located far in the future, e.g., in the game "Us after 10 years" (Praszkie, 2019). Projecting the imagination of

²⁵ In the 2008–2011 period, pursued by Athens Attica Tollway.

participants far into the future helps to augment their creativity, as it has been documented that temporal distance increases creative thinking (Förster et al., 2004).

Green teaming may be applied to forecasting singularities. In particular, roleplaying in the far future may help to circumvent Taleb's black swan event definition's impediment, as black swan events are specified as unpredictable and generate hindsight explanations (after the event has happened), which make (back in time) singularity seemingly plausible. Setting the time of roleplay in the far future opens a justified avenue for such "hindsight," because the team analyzes hypothetical black swan events from a future perspective.

As an example of an instruction in a green teaming-based roleplaying game, focused on predicting future singularities, imagine that you are meeting as the same team, but 10 years older. During those years, you gained multiple experiences worth analyzing. Start the roleplaying game by imagining that the meeting (10 years from now) is set for analyzing the lessons learned from the past 10 years of dynamics in your market's segment. Discuss the past leverage and inflection points, as well as market growths and declines; particularly focus on any rapid, abrupt changes that happened during those 10 years, and discuss how your team reacted, etc.

The 10-year temporal distance perspective allows to look at the dynamics from outside the box and, in this way, to detach oneself from current pressing occurrences. Moreover, from a more general and distant perspective, one may discover unexpected solutions embedded somewhere in the fringes of the issue (e.g., in the back of one's mind). Finally, as said before, it augments creative thinking, opening new cognitive avenues.

Using roleplaying to explore opportunities or for training also has its disadvantages: It may make some participants feel uncomfortable or may be perceived as "not serious" (Fuller, 2018).

Discussion and Conclusions

It is trivial to simply say that analyzing societal dynamics is important for understanding the flow and its consequences. The focus of this article was on a specific manifestation, i.e., singularities, creating unpredicted, abrupt system changes. This article should be considered only as the first step in studying this phenomenon, as there are numerous related issues to explore, e.g., the educative role of NSMs for their participants, who experience the benefits of being part of a long-term cooperative and trustful environment, achieving together a system-changing transformation. Other open issues may be related to cross-movement communication

and cooperation: Do NSMs influence, directly or indirectly, external societies or groups, and if so, how successfully?

It is important to mention is that there are limits to the presented approach. First, this article challenged an oxymoron, aiming at predicting something that is, by definition, unpredictable. In this vein, there will always remain space for unanticipated occurrences. Second, the implication of choosing criteria for selecting the abovementioned five cases could be considered a limitation, as profound, peaceful, and system-changing movements fall under the definition of NSMs. It is important to mention that along these lines, the selected movements were perpetuated by endogenous dynamics, whereas there are also examples of movements that are close to reaching a singularity point, but impeded and derailed by exogenous forces (e.g., the close-to-success civil society opposition to the totalitarian regime in Venezuela, devastated by the invited Russian troops). Such movements are worth studying as well.

The conclusion indicates the creation of a three-pronged prognostic methodology, based on the here-presented predictive model, computer simulations, and real-life roleplaying games. The next step could include adjusting these predictive lines to the specifics of NSMs. For example, the computational method could be better adjusted to the specifics of big social movements, as could the instructions for roleplaying.

Finally, the concept of looking at the present from a future perspective may be elaborated in further studies. Especially given that the dependence of existing processes on present and future dynamics is a common intuition both in biology and the societal arena (Longo, 2018)—becoming a call for using imagination to construe a time machine.

Acknowledgements

Thank you to Paige Munnik for her significant editorial contribution.

This article is assigned to the Institute of Advanced Studies Kőszeg (iASK).

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ABOUT THE AUTHOR

Ryszard Praszki (Poland) is a researcher at the Institute for Social Studies, University of Warsaw and a lecturer at the Polish Academy on the Psychology of Leadership. He is interested in the properties of social networks that support profound, peaceful social transitions, e.g., the cases of the Polish underground Solidarity and the American Civil Rights Movement. He worked as an international staff training director for Ashoka, Innovators for the Public for over 16 years. During the 1980s, he participated in the peaceful Polish underground Solidarity movement and for example publicized under a false name an illegal manual for Solidarity activists “How to Survive Police Interrogation”. He was a consultant for Solidarity candidates for the first free elections in 1989; in the early 1990’s was a co-founder of several grassroots NGO’s in which he is still active.

