Original Research Article

Boolean Reading of Social Movements Using Space-Time Theories*

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Abstract

Problem statement: The spatiality and temporality of social movements are of great importance. A limited number of studies have investigated the spatio-temporality of social movements. This article deals with the combination of spaces used by activists, all of which have been effective in the success of social movements.

Research objective: The study aimed to investigate the factors affecting the formation of spatio-temporal patterns in social movements based on space-time theories. It also considered the impact of these patterns in shaping social behaviors and actions.

Research method: The research methodology is a combination of quantitative and qualitative methods. Thirty-four contemporary movements were studied historically, and their information was coded and categorized. Causal conditions were identified and categorized based on research criteria by using quantitative content analysis. By converting the qualitative data into quantitative and using the Boolean method, an equation was obtained in which the relationship between space-time variables and the success of movements was determined.

Conclusion: The results showed that the movement experiences success if it uses relative space-time structure spaces (i.e., institutions, universities, and unions) "and" does not use relational space-time structure spaces (i.e., virtual networks, protest arts, and communities) "or" uses absolute space-and-time structure spaces (i.e., squares, streets, and symbolic buildings) "and" also uses relational spacetime structure spaces. The findings showed that if networking based on close and extensive multidimensional relationships is not possible for the movement, then organizational networking is necessary to achieve success. It was also proved that, in the absence of institutions, the coexistence of urban physical spaces and networking-based spaces is essential for the success of the movement. Together, they form a public sphere in which they continue protesting and resisting, and challenging the domination of established power.

Keywords: *Social movements, Spatiotemporal patterns, Public sphere, Boolean approach, Space.*

Introduction

Movements are formed as a result of the simultaneous presence and coexistence of activists in the public space (Madanipour, 2003). They are a kind of infrastructure that "coordinates the activities of the actors in time and space" (Haug, 2013). The above simultaneity and coexistence show the importance of spatiality and temporality in any

analysis (Tang, 2019; Beauregard, 2011; Frouzandeh & Mansouri, 2019). These two aspects have been to some extent, disregarded in the study of social movements (McAdam & Sewell, 2001; Sewell, 2001 cited in Haug, 2013). The space used by activists sometimes has a material basis that is used to organize against institutional power (Castells, 1983), sometimes is a social space that provides the necessary connections for the movement against the government (Lefebvre, 1991), and sometimes is the repository of collective memories (Deaton, 2015), and the movements challenge the established government by evoking these memories. Time is also an effective factor in conceiving concepts such as experience, movement, human action, awareness, and space. Paying attention to the concept of time is of great importance in analyzing social processes that are effective in the production of space and place (Kaçar, 2005). Frers and Meier (2017) investigated resistance actions, their duration, and spatial expansion. Tang (2019) showed that the time indicator is important for activists. He argued that the longer the space is occupied by the activists, the more ongoing activities are disrupted, and therefore the pressure on the established government increases. So, although the spatial dimension shows itself more prominently in the research field, the time dimension is not only equally significant but is essentially inseparable from the spatial dimension. Thus, noticing the time dimensions and spatial practices will help to understand the formation of the social movement's process (Beauregard, 2011; Harvey, 2008). Although the issue of space and time has been of interest to various thinkers such as Lefebvre (1991), Massey (2005), Castells (2012), and Soja (1980), those studies that examined social movements based on the above literature, have identified certain aspects of them. Some researchers have investigated the physical properties of space (Taylor & Spicer, 2007), and others have studied its multidimensional features, such as the effect of space-time (Sewell, 2001 cited in Wang, Ye & Chan, 2019). Some scholars have considered the space of demonstrations and mobilization (Wang, Yi, & Chan, 2019; Noorbakhsh, 2007).

Therefore, this article has attempted to identify different types of spatiality and temporality that are used by activists in movements. The question raised here is how to use the internal logic of space-time theories to understand socio-spatial orders produced in social movements. And how to use this logic to read the influential spaces in the formation and expansion of social movements, as well as their relationships.

Research Hypothesis
In this research, it is assumed that the internal logic of space-time theories can be used to read patterns of organized active structures in public spaces.

Literature Review
Politics, like other social relations, is revealed in space, and thinking about it is almost always associated with naming a set of spatial relations (Tonkiss, 2006). Also, social relations are inseparable from spatial relations, and there is an internal relationship between the nature of these two phenomena. Considering each of them separately would lead to the loss of an essential part of the image (Elden, 2009). Social movements are based on the multi-layered relationships of human interactions with each other (Diani, 2000) and the relationships of these people with space. Therefore, identifying the multifaceted practices of people and space over time will help to understand its hidden layers. Many thinkers have addressed this issue. Tang (2019) and Beauregard (2011) pointed out the role of time and spatial practices in the durability and resistance of the movement. Massey (2005) and Degen (2017) emphasized the entanglement of space and time and **considered** them as dynamic entities that are formed through mutual actions. Mann refers to the physical part of the city as **having** *hard* characteristics and features such as time or experiences in space as *soft* ones (Mann, 1986 cited in Degen, 2017). In their studies, Harvey (2008) and Lefebvre (1991) discussed the spatiotemporal dialectical relationship in their studies. Meanwhile, the advantage of Lefebvre's approach is that it provides a unified theory of space that creates a kind of reconciliation and connection

between physical space, mental space, and social space (Merrifield, 1993a,b). Lefebvre views space and time as an integral identity and a social product. He introduced his triad as a spatial practice, representation of space, and representational space (Zieleniec, 2007). From his point of view, it is not the case that the space is just placed in one of these three categories, but it can be placed in a dialectic and simultaneously in all three parts, and the measurement criteria in this regard are human action (Torkameh, 2016). Spatial practice refers to the physical environment and tangible world that can be realized. It is the space of physical and perceptible experience of the surrounding world (ibid.). In spatial practice, urban spaces and buildings act as a mere platform for people's presence and have a neutral role in the formation of a movement. People challenge the dominant order of the city and strengthen and mobilize their symbolic and social power by being in urban space and occupying it (Miller & Nicholls, 2013). Representation of space is a space produced by planners and politicians; the space of official and imagined knowledge determines how ordinary people use the space (Torkameh, 2016). Political power increases dominance and exploitation by separating, homogenizing, and hierarchizing social spaces (Lefebvre, 2009). On the other hand, by being in a place where they are not allowed and at a time or duration of time that they shouldn't, with their spatial tactics, activists violate the order of plans and thwart the established programs induced by the dominant power (Thrift, 2000 cited in Tonkiss, 2006; Tukhan, 2019). In this confrontation, each group seeks to expand the room for maneuver and articulation by shifting the boundaries between dominant and recessed spaces (Prigge, 2008). Representational spaces are lived spaces of senses, imagination, emotions, and meanings that are integrated with everyday life (Lefebvre, 1991; Harvey, 2008). These spaces are produced and changed over time due to their use. They rely more on the emotional aspect of humans. They are vivid spaces and include places of passion. There, the space of flows replaces the space

of places (Castells, 2015). People's presence in such places makes them a shared experience of the world (BanderAbad, Moradi, Kavoshnia & Aali, 2015). The political role of collective memories in the urban processes can be understood only through such an experienced space (Harvey, 2009).

Although the role of time in the use and production of space can be seen in Lefebvre's trialectic, the socio-spatial part of social practices is more prominent. In other words, in Lefebvrian reading, the focus is more on the current relationship between social relations and space. Or, more precisely, it is the space itself, which is simultaneously social and spatial (Halvorsen, 2017). But another important aspect that should be considered here is the simultaneous examination of temporal dimension and spatial practices that will help to understand the formation of the process of the social movement (Beauregard, 2011; Harvey, 2008). Many thinkers agree on considering the relationship between space and time (Harvey, 2008; Torkameh, 2016; Akbari, 2019). Physicists have been pioneers in theorizing conceptions of space and time. Due to rising global questions of meaning, they have inevitably faced philosophy (Philipsen, 2019) and have played a significant role in changing the viewpoint and mindset of humans (Alexander, 2004). Space and time-related concepts, which are rooted in the theories of physics, are generally divided into three categories: Absolute space and time1, Relative space-time2, and Relational spacetime3. In each of the abovementioned categories, space and time are simultaneously perceived together. The differences in the relationship between space and time distinguish these three categories. Absolute space-and-time is based on Newtonian physics. According to that, space is distinct from time and all things and activities happen in it. Time, in this case, is absolute and constant and is usually displayed in a linear form (Harvey, 2008). Space is independent of objects, and time passes regardless of what is happening (Tofigh & Khorasani, 2014). In this approach, space has a structure based on which phenomena can be placed and determined (Harvey, 2006). In this case, space is

considered a container of struggle (Wang, Ye & Chan, 2019) where people gather together. Buildings and urban spaces act as hubs of the population during civil actions. Actors have autonomous and placed-based relationships. These places, which are identified as sites of resistance (Friedmann, 2007 cited in Ashrafi et al., 2014), provide the possibility of people's presence to protest. These places are unique, separated from each other, and with bounded territories (Harvey, 2006). As an example, we can mention squares or political buildings, where usually during political actions, activists appear in those sites and the space is occupied by them. Relative space-time is related to Einstein's theory of relativity. In this view that believes "nothing is absolute, fixed and eternal" (Ashrafi et al., 2014), space and time are in a relative relationship. The theory of general relativity, or curved space-time, **transforms** space and time from a detached context in which events take place into active actors. Time and space are inseparably connected in this approach (Hawking, 2019). In Einstein's model, time is constant, but space has the possibility of curvature and bending due to the objects placed in it (Harvey, 2006; 2008). In other words, space is understood as a connection between objects (Harvey, 2006). In relative space-time, the distances between places are discussed and compared according to their cost, time, and physical distance. For example, the importance of the distance between two absolute space-and-time, for instance, the distance between a university and a student accommodation camp, is measured in the advancement of the movement. In this approach, space is a social construct that is produced according to the current relationships between and by people. Therefore, any type of space that welcomes a certain class of people and is based on a structured network relationship, generally organizational and official, is included in this category. Polletta (1999) mentions the institutions of the church in the southern black communities and the French peasant communities, which were able to unleash themselves from the control and surveillance of the dominant power and formed spaces based on hierarchical relationships.

Wide organizations and networks are important for mobilizing resources in political struggles (Miller & Nicholls, 2013).

Spacetime is a relationship based on quantum theory, which defines time as not fixed but dynamic. The relational concept of space is most closely associated with Leibniz. It leads to the idea of internal relations. Although relationships play an important role in relative space-time too, there they have external essence and act as an organizer and coordinator. While in relational spacetime, relationships penetrate deeply into the phenomenon, include emotions and feelings, and play an important role in the temporal and spatial expansion of the movement. An event or an object at a point in space is not merely understood by just referring to what exists at that point but depends on everything that happens around it. Past, present, and future all together define the nature of that point (Elden, 2009; Harvey, 2008). For example, we can mention symbolic places that are remained in people's historical memory due to the past political memories occurring at that point. They usually will have more potential to attract people to future movements. Therefore, space and time are considered in a mutual relationship. In this structure, the world is accepted as a set of "mutual connections between different networks and flows" (Tuan, 1977; Buttimer & Seamon, 1980 cited in Ashrafi et al., 2014). In this case, the space itself is a product of relationships and a construct of relationships. It is a multiplicity and heterogeneity, not homogeneity. It is plural, not singular. It is plural and not singular. Therefore, space is always being produced and is never finished (Elden, 2009). With this definition, social space is no longer a geographical space. Rather, it transcends time and space and includes all groups who pursue common interests (Fisher & King, 1994 cited in Ghaffari & Athari, 2004). In this regard, digital technology has greatly contributed to the expansion of communication society, and its role in the formation of new public spaces (Zukin, 1995 cited in Ashrafi et al., 2014) and contemporary social movements (Haug, 2013; Bourne, 2017; Lim,

2014; Arampatzi, 2017) is undeniable. To form and maintain solidarity between movements over long distances, virtual communication is essential. In the contemporary era, many movements have been formed in different geographical places in parallel. For example, occupation movements all over the world are of this category. At the same time, all spaces based on social relations, spaces of poetry and creativity, art and emotion, and dreams and aspirations are all included in this category. For example, spaces based on empathy create a network of relationships and interdependencies between different under-discrimination groups and classes. According to Castells, communication networks here cross the barriers of space and time and challenge the power relations in space and time (Lim, 2014). The fact that events of one movement affect the events of another one indicates that both are directly related to each other (Mallgrave, 2016). Bearing common goals and having an influence on each other, these movements, all of which proceed in parallel at different geographical points, are reminiscent of parallel worlds in the relational spacetime world.

Spatio-Temporal Reading of Protest Spaces in Social Movements

David Harvey believed that limiting oneself to a single aspect of spatial or spatio-temporal thought is impossible (Harvey, 2006). For reading social phenomena, he suggested that the triad of space-time structure, including absolute space and time, relative space-time, and relational spacetime be considered in conjunction with Lefebvre's trialectic division of imagined, perceived, and lived space. Using this matrix as a basis, this study sought to investigate social movement reading (Fig. 1).

The distinctive feature of the first column (absolute space and time) is that space already exists regardless of any event. Fixed points of geographical places whose main characteristic is to provide a location for social movements. Stage 1, the intersection of absolute space-and-time and spatial practice, is the starting point of any movement. Strangers and independent individuals locate in certain points of urban spaces, such as public squares or campuses, to protest against the established government. The presence of people in the space is only physical, and they are generally strangers to each other. In the intersection of absolute space-and-time and the representation of space in stage 2, although communication is still place-based, a degree of connection is established between people due to the time they have spent in space. The relationships here are somehow formed but are still in a limited and fixed network of every individual's friends. Like the relationship that students form between their circle of friends in the dormitory or on campus. In this state, the order established in space is disturbed by the actors, and they interact with their environment. For example, in the Hong Kong movement, students occupied the space of campus, and by reorganizing it, such as installing posters, etc., they redesigned it according to their will (Wang, Ye & Chan, 2019). In stage 3, people's presence duration in space and its quality has reached a point where interdependencies are formed. By the music played in space or any other activity affecting people's experiences and emotions, the space is lived by people. Space, in this state, acts as an important source for the movement. Physical properties of space, such as accessibility, visibility, and density, increase the possibility of people's attendance. Therefore, the relationships formed between people in this column are all location-based commonalities. At this stage, the movement demonstrates itself at the front stage of the public sphere. The more the urban spaces are occupied by the activists over a longer time, the more they reorganize the space according to their will and against the ruling government, and the more successful they are in creating complex networks and interdependencies, as they acquire wider visibility in society and, the result will be a local movement with higher potential for expansion.

In stage 4, people's bodily interactions reach a point that leads to the formation of intra-group bonds. Factors such as spatial proximity, mobility, homogeneity, and isolation of space (ibid.) help to
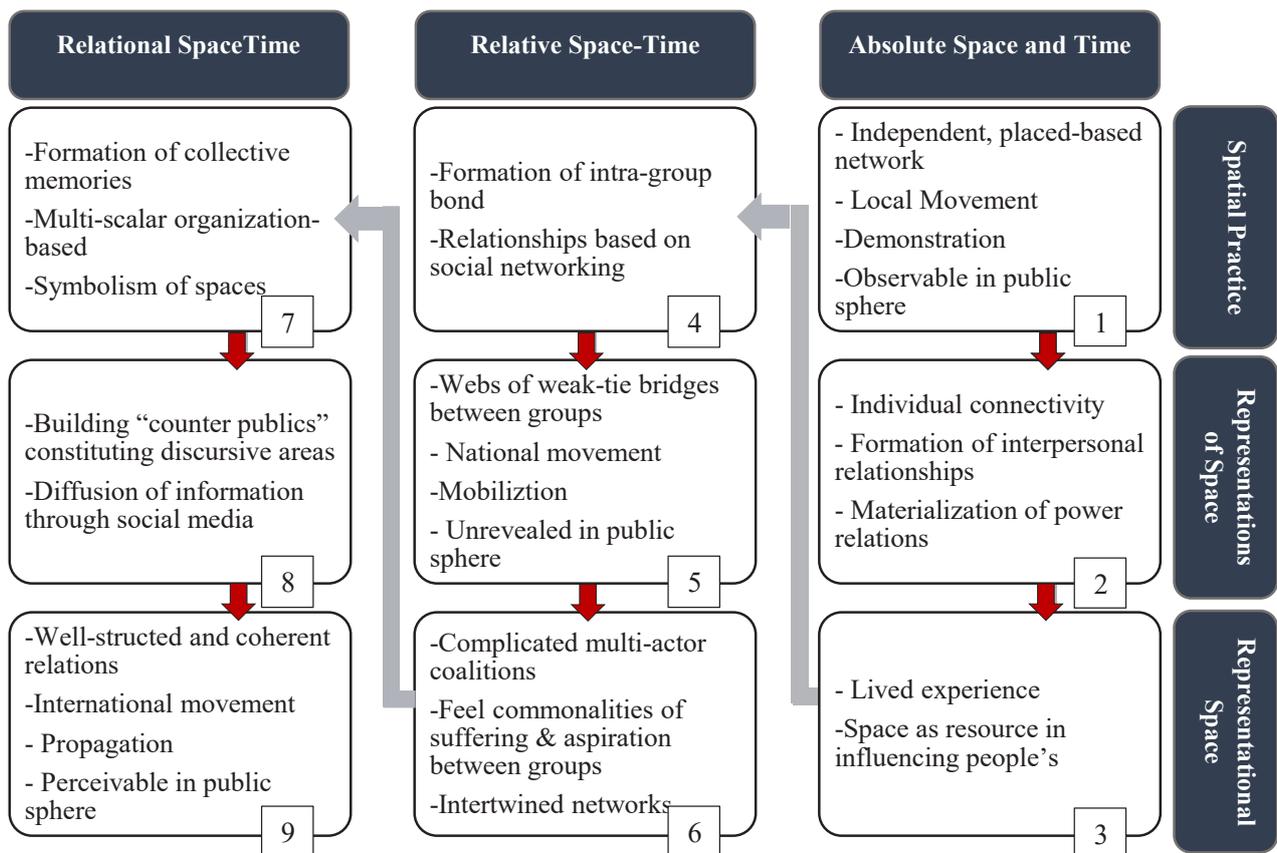
Fig. 1. Spatio-temporal matrix of social movements. Source: Authors.

strengthen the formation of group-based relationships. In stage 5, weak communication bridges are formed between independent groups of the previous step. And in stage 6, which is located in the row of the representational space, the shared intra-groups actions lead to the formation of complicated multi-actor coalitions. At this stage, groups share their common sufferings, pains, and desires. For example, women and LGBT people sympathize with each other as oppressed groups. Due to the nature of relative space-time, interpersonal relations and then intergroup and inter-organizational relationships are formed backstage of the movement and remain unrevealed to public view. Unlike absolute space-and-time that made possible the emergence of the movement in places and sites on a local scale, here organizational relations provide the mobilization and expansion of it on a national scale. If in stage 3 limited sites such as university campuses were occupied and redesigned by individuals, here this is the city that is occupied and reorganized by people. People transform the public spaces of the city into private spaces by attending and staying in space. For example, in Tahrir Square in Egypt during the Arab Spring movement or the Wall Street movement, it seemed that people created a new city with all the required facilities for themselves in the occupied areas. Here, the criteria of urban design, such as the wideness of urban spaces, the width of sidewalks and streets for gathering, and accessibility and openness of the space, are influential in the formation of aggregations. In stage 7, identities and collective memories, and common feelings are formed, which itself is the result of the presence of people in the place (stage 1) and the formation of intra-group bonds (stage 4), and finally, inter-group ties (stage 7). The symbolic nature of the place and its position in history play an important role in influencing people's emotions and attraction to the place (Bandarabad et al., 2015; Deaton, 2015; Harvey, 2006; Sedighi & Farzbod, 2020). Stage 7 allows an individual to belong to several groups simultaneously. In step 8, by establishing coalitions between different

groups, multi-scalar organization-based structures can be formed. At this stage, mass media and the Internet allow for dialogue and interaction between counter publics (Fraser, 1990 cited in Miller, & Nicholls, 2013), and by taking the public sphere out of the phenomenon of place-monopoly, it has made it possible to propagate the spaces of dialogue to a global level. Finally, in stage 9, well-structured and coherent relations can make a scale shift from a national level to an international level. The distinctive feature of relational spacetime is providing the relationships needed for the expansion of the movement; the space, which is based on emotions and feelings and, although physically invisible, is tangible and perceivable, and highly influential.

Methodology

Since in social movements, social, spatial, and temporal relations are intermingled, a model was required that considered these three simultaneously in reading the social phenomenon. Harvey had properly recognized that neither Lefebvre's trialectics regarding socio-spatial relations nor space-time relations solely could be sufficient for the explanation of social facts. Also, since these two models have lots of commonalities, if they are placed in an intersection matrix, they will be complementary. Harvey did a reading of the World Trade Center using one row of this matrix (Harvey, 2008) and left the entire table to be completed by other researchers. In this article, an attempt was made to explain the social-spatial-temporal nature of this model4. In the process of reading social movements based on Harvey's model and by searching the literature, new layers gradually appeared. This led the matrix to transform from a two-dimensional state to a three-dimensional cube (Fig. 2). This model was considered the theoretical basis of the research in the theoretical framework. Then, 34 social movements were historically studied, and their data were identified in the form of tables containing 30 main factors, all of which had subcategories. This information was separately coded and categorized. Since the research sought to discover the relationship

between spaces affecting social movements, the quantitative content analysis method was used to reveal them. Therefore, the emergence of any type of space that activists in the movements used was considered duplicate criteria (Kalantari, Abaszade, Sadati, PourMohammad, & Mohammadpour 2009; Ghaedi & Golshani, 2016) and was counted and categorized in texts. The list reached theoretical saturation with 22 spaces (Abbaszadeh, Bodagi & Karimi, 2012). Then, the 22 spaces were divided into three spatial-temporal structures according to how they were used in the process of social movements and their spatial and relational features (Fig. 3). They had internal homogeneity and external heterogeneity (Patton, 2002 cited in Ghaedi & Golshani, 2016) and were comprehensive and restrictive (Ghaedi & Golshani, 2016). So none of the 22 spaces were excluded, and none were included in more than one categorization.

Although counting the spaces that were used during the movements through quantitative content analysis was beneficial for descriptive and statistical analysis, the quantitative method in a linear path could not capture the diversity of this social phenomenon.
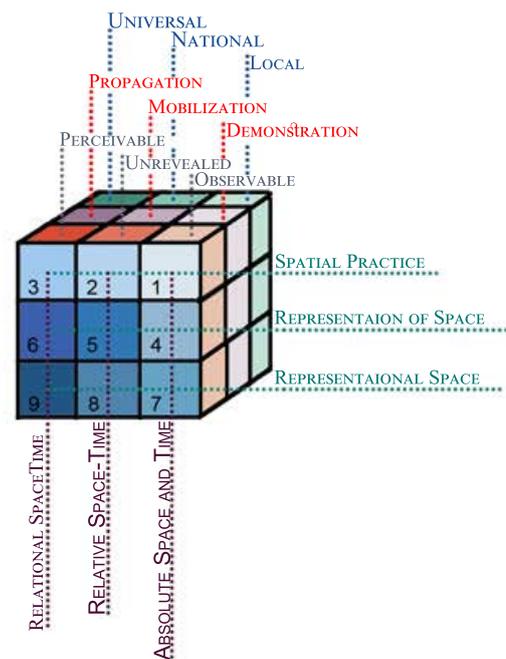

Fig. 2. Three-dimensional cube of space-time relationships in social movements.Source: Authors

Reducing text to numbers would lead to the loss of combinational data and meaning (Weber, 1990 cited in Ghaedi & Golshani, 2016; Iman & Nooshadi, 2011). Therefore, it was necessary to use quantitative and qualitative methods to complement each other at the same time (Holsti, 1380 cited in Ghaedi & Golshani, 2016). So, the Boolean approach was used. This approach is one of the effective techniques in comparative methodology in social sciences and was first proposed by Charles Ragin, one of the experts in the field, in his book named The Comparative Method: Moving Beyond Qualitative and Quantitative Strategies. The logic of this approach is essentially hybrid (Ragin, 2017). This approach considers the causal conditions affecting the occurrence of the event not as individual causalities but as a combination of causal conditions. This feature of Boolean qualitative comparison makes it a desirable tool for identifying multiple hybrid causality patterns (Ragin, 2017; Sedighi & Farzbod, 2020; Taleban, 2009).

Therefore, through quantitative content analysis in the study of 34 social movements, 22 spaces were identified, each of which was placed in one of the three spatiotemporal structures according to their relational, spatial, and temporal characteristics (Fig. 4). Every social movement benefits different spaces

and methods to further its goal based on its condition. Therefore, the research sought to find out what combination of these spaces, if used together, can lead to the success of the movement. The equation obtained from the Boolean approach provided this goal. The equation answered the question: under what circumstances of space-time structures, success in social movements is possible? The equation specified the combinations of spaces that can together lead to the success of the movement. This whole process is shown in Fig. 5.

Discussion

Three causal conditions for the occurrence of the event were defined to form a Boolean value table (Table 1). As the basis for determining effective causal combinations, these conditions should have been determined based on the theoretical framework (Ragin, 2017).

- Causal condition A: Absolute space-and-time is essential for the success of the movement.
- Causal condition B: Relative space-time is essential
- for the success of the movement.
- Causal condition C: Relational spacetime is essential for the success of the movement.
- Event R: The success of the movement. And that

Spatial-Temporal Structures		
Relational SpaceTime **Type 3**	**Relative Space-Time** **Type 2**	**Absolute Space and Time** **Type 1**
-Formation of strong relationships based on collective identity and memories -Virtual space as the formation context of relationships -Relationships based on the weak and strong friendship -People can join or exit gatherings freely -Formal and informal structures -Virtual and non-physical relationships	-Formation of commonalities based on weak relationships -Cite is regarded as the context of relationship formation -Intra-group relationships between people -People with organizational and group dependencies -People can join or exit the gatherings based on their membership -Unity in decision-making -Formal structure -Face-to-face communication	-Formation of commonalities based on the place -Places as the attraction pole of population -Strange and independent relationships among people -Individualism is based on unlimited and various networking -People can freely join or exit the gatherings -Lack of unity in decision-making -Informal structure -Face-to-face communication

Fig. 3. Space-time characteristics of absolute space and time, relative space-time, and relational spacetime structures. Source: Authors.

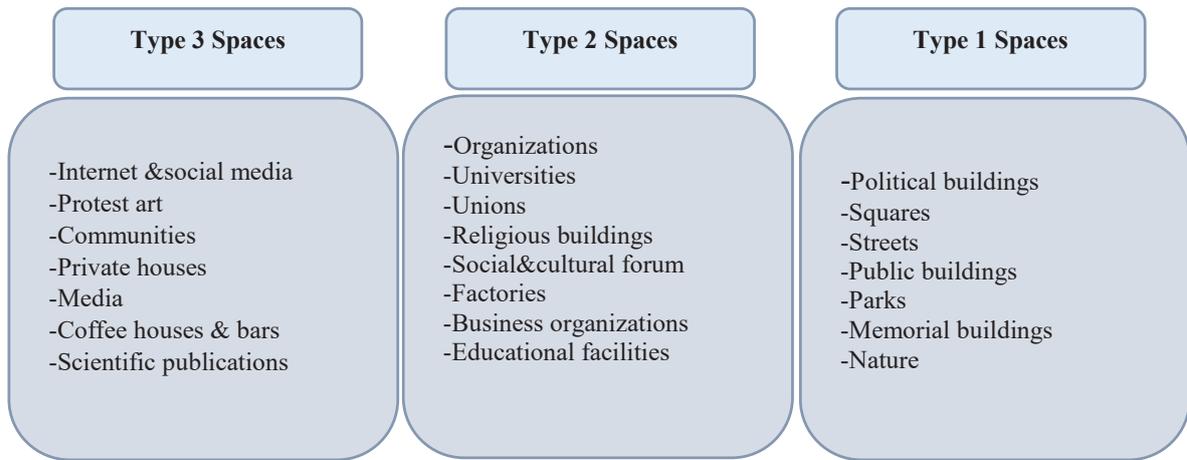| Type 3 Spaces	Type 2 Spaces	Type 1 Spaces
-Internet &social media -Protest art -Communities -Private houses -Media -Coffee houses & bars -Scientific publications	-Organizations -Universities -Unions -Religious buildings -Social&cultural forum -Factories -Business organizations -Educational facilities	-Political buildings -Squares -Streets -Public buildings -Parks -Memorial buildings -Nature

Fig. 4. The division of 22 spaces resulted from quantitative content analysis according to how they were used, and their spatial and relational features in three spatiotemporal structures. Source: Authors.
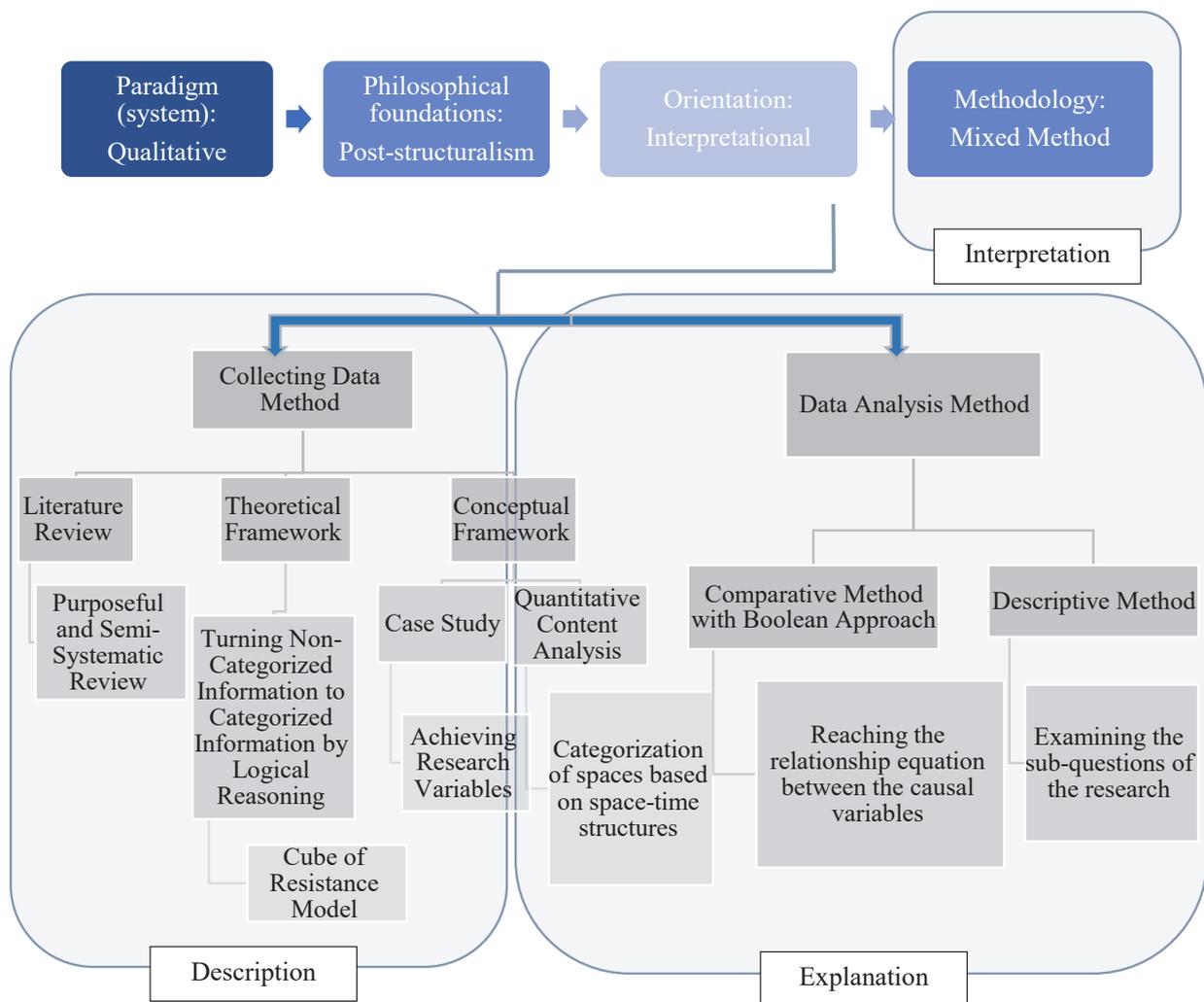

Fig. 5. Research method model. Source: Authors.

Table 1. Boolean value table. Source: Authors.

No	Causal conditions			Frequency of observed cases of causal combination	Attendance/absence output code P	Number of occurrences S	Event code R
	A	B	C				
1	0	0	0	0	0	0	?
2	1	0	0	9	1	4	0
3	0	1	0	5	1	4	1
4	0	0	1	2	1	1	0
5	1	1	0	5	1	3	1
6	1	0	1	5	1	3	1
7	0	1	1	6	1	3	0
8	1	1	1	1	1	1	1

is when the movement leads to permanent changes in the society and/or the government, and there is no need for the actors to continue the demonstrations.

- After the required processes, the equation of the relationship between causal conditions needed for the success of social movements was obtained[5]:

$$R= AC + Bc$$

In this equation, the capital letters indicate the existence of the causal condition, and small letters indicate the absence of it. Addition in Boolean algebra is known as an OR, and multiplication indicates an AND. Therefore, such a conclusion can be drawn from the equation: the movement succeeds if it uses the spaces of absolute space-and-time structure (the first type) "AND" also uses the spaces of relational spacetime structure (the third type) "OR" the movement succeeds if it uses the spaces of relative space-time structure (the second type) "AND" does not use the spaces of relational spacetime structure (the third type).

In reading the Boolean equation, the presence and absence of the causal conditions are considered together and simultaneously. In other words, their presence or absence are combined and interact with each other and are not evaluated individually. Considering the causal conditions in a combinational form is the advantage of this approach. The equation considers the causal conditions of the occurrence of the event (= the success of the movement) and not contrariwise. It is possible to check the combination of causal conditions (=combination of used spaces) that will lead to the failure of the movement through

the Boolean DeMorgan equation. The first part of the equation, i.e., AC, implies the simultaneous existence of absolute space-and-time (A) and relational spacetime (C) for the success of social movements. It can also be interpreted in this way: In the absence of relative space-time, the existence of both absolute space-and-time and relational spacetime is required simultaneously. It was explained earlier that the characteristic of absolute space-and-time is their dependency on location. According to Fig. 4, the spaces placed in this category were urban spaces and public buildings of the city, all of which provided sites of aggregation for activists during the movements. Relative space-time refers to spaces that mostly provided the organizing and mobilizing role of the movement and were based on formal and organizational relationships. These spaces included all institutions and organizations. And finally, relational spacetime was based on emotional-sensual influence, provided relationships, and played an important role in the expansion of the movement. Internet and social media, and protest arts were of great importance in this category. Therefore, the first sentence, i.e., AC, showed that: If the movement simultaneously uses urban spaces for its demonstration and uses tools such as protest arts for emotional impact and virtual spaces for its expansion, then the movement will be successful. Previously, other thinkers had emphasized the coexistence of these two categories. Harvey (2008) stressed the simultaneous use of absolute space-and-time and relational spacetime. Lim (2014), Castells (2012), and Armapatzi (2017) all three brought

up digital media and urban spaces as dependent dimensions of movements. On the other hand, Rafail (2018) and Halvorsen (2017) highlighted the role of urban spaces in creating emotional solidarity. Deaton (2015) and Lefebvre (1991) also pointed out the role of urban spaces as ones that are intertwined with prominent political memories and underscored their significant role in mobilizing the movement. It is clear that institutions and organizational spaces (B) play a major role in shaping organizational collective actions such as sit-ins and strikes. The first sentence (AC) states that if it is not available for the movement to take advantage of these spaces (b), both the public and physical spaces of the city (absolute space and time) and network-based spaces (relational spacetime), such as protest are which affect people's feelings or virtual networks which expand the movement, must be conquered simultaneously. The relational spacetime affects people's feelings and virtual networks help the movement to be expanded. Neither possessing the absolute space of the city nor possessing virtual and relational networks separately will bring the movement to its destination. The above sentence shows that activists should use these two categories of space at the same time.

Now the second sentence is examined. The sentence Bc states that in the absence of relational spacetime (c), the existence of relative space-time (B) is necessary. The common feature of these two types is their auxiliary role in shaping network communications. While the term relative space-time (B) is based on organizational networking, relational space-time (C) is based on friendly and mostly virtual and non-physical networking. Now, if the movement cannot use any kind of relational space, including virtual networks or protest arts, etc. to expand or communicate between activists, then the existence of organizing institutions is necessary for the advancement and guidance of the movement to achieve success. Deaton (2015) stated in his studies that although presence in urban spaces such as squares and streets may be useful in the short term, for the sustainable mobilization of the movement, secondary

spaces are essential to continuously challenge the established government. He attributed the failure of the Green Movement in Iran and the Student movement of May 1968 in Paris to the inability to communicate with secondary spaces. In contrast, the Velvet Revolution in Prague and the 1979 Iranian Revolution succeeded because of the appropriate use of theaters and mosques, respectively, as secondary spaces.

According to the equation $R = AC + Bc$, the existence of one of the two structures that include physical spaces, i.e., absolute space-and-time (A) or relative space-time (B), is essential. A is required in the combination AC, and B is required in the combination Bc. As the presence of causal conditions A and B is necessary for the event to happen, they are necessary conditions (Ragin, 2017). In other words, causal conditions A and B are necessary conditions. Because their presence is necessary for the event to happen (ibid.). Therefore, if A and B are considered essential in the same category, it can be argued that the objective experience of space is vital in social movements. Now, if the movement is manifested in absolute space-and-time (A) and applies relational spacetime for its expansion (C), it will definitely succeed by the combination of these two structures. But if it does not use the capacity of relational spacetime (c), in this case, the existence of coordinating organizations and institutions (B) is necessary backstage for structuring the movement. These spaces equip and mobilize the movement in line with its goals and policy for victory. Therefore, the abovementioned equation shows that the use of urban physical space or architecture is necessary for the formation and success of the movement. It also reveals that if the movement utilizes only relational spacetime, specifically virtual networks, it may emerge and expand in society, but it does not achieve success. Also, these two sentences convey the meaning that among the two structures that are both physical, i.e., A and B, the power of organizations and institutions is more than mere urban spaces. Because B is sufficient enough for the success of the movement in the absence of c, A must occur simultaneously with C for the movement to succeed.

Although what was obtained from the equation may seem evident and obvious at first glance, in this research, by applying the Boolean method, what was previously theorized in the literature by researchers in an interpretive way was confirmed quantitatively.

Conclusion

Spatiality and temporality are two essential factors in dealing with any social movement. At the beginning of the study, following Harvey's suggestion, the spatial features of movements were categorized in a matrix whose rows and columns were Lefebvre trialectic and triple structures of space-time, respectively. In this reading, movements were interpreted as the process made of interdependencies of its components. In this research, the Boolean approach was used, which is one of the noteworthy techniques in the field of social research. This combinational strategy reveals the maximum causal conditions that are logically possible and is not limited to simple reduction. Therefore, the qualitative data collected concerning social movements were converted into quantitative data in the analysis stage. By using the Boolean approach, the internal logic of space and time theories was used to understand the relationships between effective spaces in the success of social movements. The success of the movement was determined by the occurrence of the event in the equation. Therefore, the equation revealed the combinations of spaces that together can lead to the success of the movement. The equation indicated that the coexistence of urban physical spaces and relational spacetime (including social media, networking, and protest arts) is essential for a movement to succeed. If the movement wants to achieve victory, both the public and physical space of the city (absolute space and time), as well as network-based spaces affecting people's feelings, and virtual networks which expand the movement (relational spacetime), must be conquered simultaneously. Neither possessing the absolute space of the city nor possessing virtual and relational networks separately will bring the movement to its destination. It also revealed that organizational and institutional

networking is essential if the movement does not have the possibility of using a variety of free media and extensive networking. Also, the equation made it clear that in both existing causal combinations that caused the occurrence of the event (=the success of the movement), the existence of one of the two structures that included physical spaces (A or B) is necessary. A is required in the combination AC, and B is required in the combination Bc. As the presence of causal conditions A and B is necessary for the event to happen, they are necessary conditions (Ragin, 2017). Therefore, if A and B are considered essential in the same category, it can be argued that the objective experience of space is vital in social movements. Also, these two sentences convey the meaning that among the two structures that are both physical, i.e., A and B, the power of organizations and institutions is more than mere urban spaces. Because B is sufficient enough for the success of the movement in the absence of c, A must occur simultaneously with C for the movement to succeed.

Although what was obtained from the equation may seem evident and obvious at first glance, in this research, by the application of the Boolean method, what was previously theorized in the literature by researchers in an interpretive way was confirmed quantitatively. One of the objections that some thinkers bring to qualitative research is the possibility of the researcher's intervention in the research, as well as ambiguity in measuring the quality of the research. The strength of this study was the quantification of qualitative parameters. The quantitative analysis of the research made it possible for the researchers to distance themselves from the research.

Endnotes

1. In the text, wherever absolute space and time are used, the words space and time are separated by an "and" due to the nature of the relationship between them.
2. In the text, wherever relative space-time is used, the words space and time are connected by a "-" due to the nature of the relationship between them.
3. In the text, wherever relational spacetime is used, the words space and time are considered as one word and are written continuously due to the nature of the relationship between them.
4. Although it is not hidden that the description of these steps using samples will greatly help to understand the subject, it is beyond the capacity of this article. Here only the model and the spatiotemporal theories as a basis for

using the Boolean approach are described.

5. For further information on the Boolean value table and the equation resulting from the causal conditions, refer to the book The Comparative Method: Moving Beyond Qualitative and Quantitative Strategies written by Charles Ragin.

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