Non-Cooperative and Repetitive Games for Urban Conflicts in Tirana: A Playful Collaborative System to Lower Social Tension

Sotir Dhamo, Valerio Perna, Ledian Bregasi
Universiteti POLIS
Tiranë, Rr. Bylis 12, Autostrada Tiranë-Durrës, Km 5
valerio_perna@universitetipolis.edu.al

Abstract

Game Theory (GT) offers a critical lens to understand and analyze the capacity of different actors to make rational decisions linked to complex and emergent situations. Even though developed as a theory to tackle economic issues, GT has found a wider range of applications in heterogeneous fields such as architecture, where this new transdisciplinary tool can be used to address topics such as urban planning and public participation. The objectives of these researches aim for avoiding ghettoization, lowering social tension, and conflicts, and for proposing long-term solutions in a reality where the lack of authority has led to the development of closed informal clusters at the outskirts of the city.

In this paper, we present the city of Tirana as a case study to develop our speculative research in an operative field that blends GT, computational design, and morphological/behavioral patterns. Non-cooperative and repetitive games are useful tools to identify generative patterns in the Albanian informal settlements, with the certainty that even the most spontaneous ones carry within them positive enzymes that can be taken into account to re-organize the informal settlements either spatially, socially, and economically (Dhamo, 2017, 2021). We propose a set of operative categories, filtered through the lens of GT and playful dynamics and mechanics, to set the debate for a deeper understanding of the reality of informal areas and foster co-design processes, from the perspective that collective interest is a key to let professionals, institutions and citizens work together in a more informed process of city-making.

Keywords: Games and simulation; Informal settlements; Bottom-up strategies; Playful interactions; New city-making processes

Tirana: Management Issues in Conflictual Urban Spaces

Each city is a unique phenomenon. The specific characteristics they develop throughout history are often considered as “atypical” and tend to be sterilized because they do not meet our preconditions/taboos of how the world should be. These characteristics constitute the most crucial enzymes for cites. Our interest is the city as the nucleus in which all the forces that make it, express themselves, converge or diverge; where political power is expressed concerning urban space, and where the conflicts take place. But, can we identify design methodologies and operative categories that help to face through an alternate way conflict management in urban spaces?

Tirana is an excellent case to study these phenomena, being a place where people and authorities have been continuously on two opposing fronts related to city making/building issues. Substantial parts of Tirana are spontaneously developed and not yet fully recognized by authorities. This fact generates endless conflicts and a series of precarious equilibriums. There is evidence about this conflictual relationship: starting from the last conflict in the city-ring area where the so called informal people fighting for their recognition are blocked parts of the city or the protests that developed during the mid-90s for the same reason; not to speak about coercion on people during the communist regime for living in their houses, to name a few.

This being said, governments were never able to guide urban development and create the standard conditions for growth, contrarily, it seems they always fought the natural tendency of people to urbanize. In fact, in Tirana, people better than architects understood the sense of place and organically became protagonists. It is the creative role of people that makes Tirana what it is: a city personalized/privatized in every corner.

In our opinion, this is the reason why the deterministic and one size fits all regulations applied in Albania were discredited and rejected by people; more than any "informal" process they contributed to sterilize the idea of the city/place. This is the reason why we need to discover "the secret" enzymes that inseminate the organic processes in Tirana and try to bring them back in the design process through a conscious way.

The descriptions related to the generation of the patterning process and their specific emergent qualities that follow, has been built on previous research activity "Specific realities and new hypotheses for urban analyses and urban design-Tirana as a case study", developed in the framework of the PhD program in architecture and urban planning between POLIS and Ferrara universities. In this research, the transformation of Tirana's urban morphology is seen from a theoretical perspective to outline a new hypothesis for city design.

Rules of the Game: Principles and Patterns for the Albanian capital

1. Analytical principles

To overpass the handicap described above and understand a more holistic dimension, we need to see the reality of Tirana under a different theoretical lens. Differently from the mechanical view, according to which the reality equals the sum of its parts; quantum reality is a container of infinite potentialities, tendencies, and interactions, where "things" enter in correlations in a larger whole (Zohar and Marshal, 1994). Therefore, trying to understanding the invisible structure of associations, and their interaction as part of a larger/continuous whole is crucial. Concepts hired from quantum, fractal, and complexity theories helped to overcome mechanistic = deterministic approaches. Concepts hired from quantum theory, based on the particle-wave duality, see this relationship as a malleable energy field (Arida, 2002) created by the overlapping wave effect.

This kind of unbroken web (Zohar and Marshal, 1994) creates the society-space-time (SST) continuum (Arida, 2002); fractal city theory (Batty and Longley, 1994), sees relationships as recursive behavior (regular/irregular) of elements, that create the internal/invisible form, grouped in a hierarchic structure; and complex systems theories see the relationship as a macroscopic behavior or self-organization of a collective whole which arouses through the interaction of large numbers of entities following underlying simple rules, but without a central controller that tend to self-regulate through signaling, and information exchange (Mitchel, 2009).

The emergent qualities of specific patterns in Tirana are not a mechanic sum of its parts but involve a relationship. The quantum correlation effect across space-time happens organically in the city separated "things" are aspects of some larger whole (Zohar and Marshal, 1994). The arousal effect of the wave factor from local/non-local-temporalities affects the local-temporal environment and gives rise to new emergent qualities. This is the reason why we start with historical analyses and conclude with a critical reflection on how specific patterns can be catalyzed/embodied in parametric systems that allow us to analyze and interpret quantitatively and qualitatively.

2. Historical Brief and Patterns in Tirana

We present first a brief description of the historical conditions that produced the SST continuum (Arida, 2002). The evolution of the first organic nuclei of Tirana started at the beginning of the 17th century (Frashëri, 2004) in the intertwining of important regional commerce routes when this territory was under the domination of the Ottoman Empire. Their evolution was nourished by a combination of local preconditions, such as physical determinants and land divisions (Kostov, 2003), social factors (patriarchal enlarged family, etc.), with a premeditated strategy of the Imaret system (called later kulliye) (Ingersoll and Kostov, 2013) used by the Ottoman Empire during the 14th century as charitable institutions and city foundation devise.

As these authors argue, gradually Imarets became centers of well-defined neighborhoods grouping around the mosque other buildings, including economic activities. Generations and traces inherited under this condition have been analyzed under PATTERN 1: Historic Organic. This pattern is a direct descendant of the imaret/kulliye system of the city foundation, but it is a new emergent reality created by overlapping of the associated wave factor generated from a non-local-temporal environment (but within the SST continuum) with the local-temporal conditions. This pattern is a process during which clusters of houses based on group affiliation/family ties, driven by an introvert behavior motivated by the (Islamic) principle of the right on visual privacy, generate a recursive process legible in the modality of refracting the straight-line and isolating between interstitial buffers. This process results in a self-similar/self-affine visceral quality of space through scales. The pragmatic in-fill that happened during the last two decades in these areas is a simulacrum of the historic organic: it is similar in shape but incoherent in its meaning.

The phase from 1920-1944 represents the first efforts to move from organic to a designed city or from the Ottoman system of Imarets to the Europeanization of Tirana. These attempts were represented first in King Zog's interventions for the ceremonial complex of the ministry square, and the central axis of the boulevard; and almost a decade later during the Italian fascist occupation for the construction of "Piazza Littorio". These interventions that carried a completely different philosophy and mentality from the Ottoman Tirana introduced a new dimension in public life and a new dialectic between organic and geometrically designed parts of the city.

The phase from 1945-1991 under the communist dictatorship represents a social experiment that attempted to create a new physical and social reality. Architecture and city design followed ideological principles supposed to support the so-called revolutionizing of the entire life. They needed to create an egalitarian environment and "kill" any differences created during history: a city designed by demolition and building a new one in morphological opposition with the historical traces became the norm. What mostly transformed Tirana during this period were the 4-5 stories of poor/low-cost standardized a-stylistic housing blocks: a city between empty frames deprived of the human spirit and historical specificities: a city people wanted to abandon.

This condition of emptiness served as the main base for PATTERN 2: Recording Over. This pattern is a re-engraving process that transforms not only the pre-designed frames defining the space but also the space itself. This is a gradual process where a mass of so-called agents, driven by an inward behavior, coordinated in small but motivated by an act of re-appropriative revenge against the public space (because of the denied property rights during the communist regime) generated a recursive process legible in the modality of wrapping the space and the buildings/frames from within or from without. Such process results in a self-similar/self-affine involute quality of space through scales.

The phase that started from the beginning of the '90s with the collapse of the communist regime was characterized by rapid uncontrolled urbanization and the emergence of informal suburbs in the periphery. In parallel, the public space in the center was reduced through progressive infill. It was a kind of return to the organic city. Tirana lost the compact form and entered into a phase of dissolution. In the vision of the Berlage Institute (2004), Tirana was a metropolis still under formation. Despite efforts to stabilize limits of urbanization, Tirana continues to grow in a shapeless organism with endless ramifications swallowing preexisting settlements, resulting in a more significant and unstable organism. However, from 2010 until this date, the trend in the construction industry and urbanization calmed down. This recessive trend is still in progress.

Generations and traces formed under this condition have been analyzed under PATTERN 3: New Organic. This pattern is a process during which individual houses grouped in the urban/rural space acquire a certain masse through densification or dispersion. This condition of isolating (to hide from authorities) results in a self-similar/self-affine collapse in the quality of space itself (no anthropological principles) through the modality of compression, or in the inflated quality of space through the modality of floating the nucleus or sparse houses in the rural space. There are some similar formal characteristics to the Historic Organic pattern. There are differences in the reasons that motivated this pattern and in the anthropological factors that triggered the motive.

As pointed out, the city of Tirana is in need to solve its management issues in a more conflictual urban fabric growth. In the next paragraph, we will explore the possibility of a game-based strategy to propose a divergent lens to address these issues. Games are a speculative tool that can be helpful to trigger new reflection and to give architects and designers-new methodologies at hand. Our approach for this work is 'non-solutionist', we believe that the informal development of the city since always being a part of its generative DNA, is not an issue to solve in any way, but a widespread point to be taken into account by the design community, which deserves a much better understanding and needs a new approach towards problem-solving.

Games and Architecture: Playful Systems to Confront anti-Participative Systems

The use of games in architecture and urban planning is not new. Their implementation has a long history since the 1960s (Abt, 1969; Duke, 1975), and has remained a favorite tool for spatial modeling and simulation, and public participation (Mayer, 2009; Poplin, 2012). In the last decade, we have seen the rise of urban play as a tool for community building and city making (Tan and Portugali, 2012; Tan, 2017), and western society is actively focusing on play/playfulness as a way to approach complex challenges and emergent situations. Even though games and play have entered the mainstream in a wide range of different contexts, and the combined study of games and cities (Nijholt, 2017) is gaining more and more attention from academic researchers, we still lack a specific definition of what a game is.

We agree that a game is a "form of structured play" (Salen and Zimmerman, 2004) and that four conditions are required to call an event a game (Suits, 1978): 1. A clear goal, 2. The need for performing explicit acts (rules) to reach this goal, 3. A collective agreement among players to embrace the rules and work towards the goal, 4. Players need an assessment loop for continuous motivation. If a recent statement invites people to "play anything" (Bogost, 2016), we see no side effects in attempting to bring game dynamics and mechanics in a complicated and risky field like the architectural one. Since participation and civic engagement have increasingly formed a significant part of urban planning and governance (Gordon and Mihailidis, 2016), we identify the need of using games as new tools to trigger participation and to address a variety of aspects in urban planning such as design issues, stakeholders negotiation, deliberation, and self-organization practices (Glick, 2012; Grahan & Marvin, 2001; Krasny, 2013). The current situation of the city of Tirana represents for us a privileged field of study, because after the fall of the dictatorship, the evolution of the urban fabric has always been based on anti-participative systems where the social tension has always been exploited for personal claims rather than been solved.

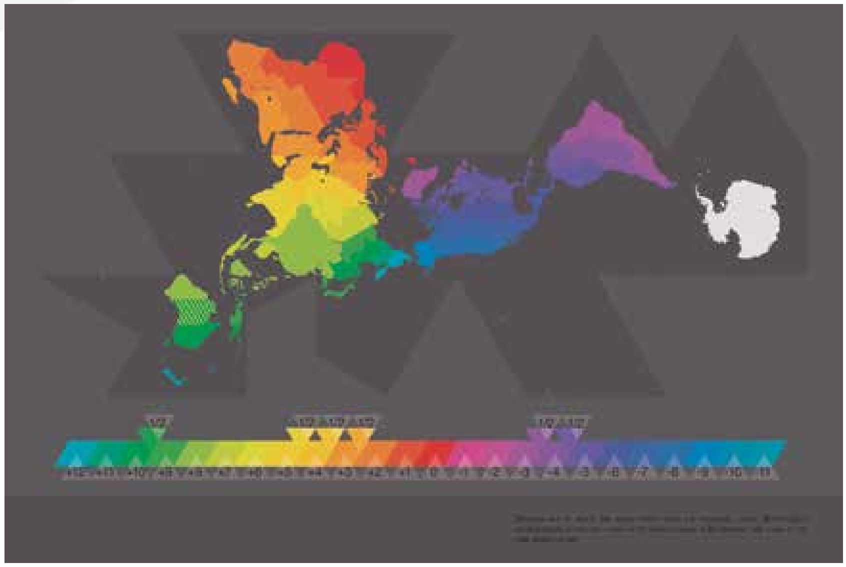

Figure 1: Buckminster Fuller, World Game, 1961-Reconstruction of the game board for the game's anniversary. The game is described by the Buckminster Fuller institute as a "great logistics game" and "world peace game" (later shortened to simply, the "World Game") that was intended to be a tool that would facilitate a comprehensive, anticipatory, design science approach to the problems of the world.

Notions of Game Theory: Solution Games between Balance and Conflict

> "*A game can be described in terms of strategies that players have to follow within their moves: we have a balance when no one can improve its behavior unilaterally. To change, it is needed to act together"*[1].

To understand the deep relation between architecture and games, and how the latter can be used to tackle complex urban challenges, it is necessary to deal with some notions of Game Theory (GT). This excerpt is systemic to our research for two reasons: on the one hand, to show how playful systems can be implemented in multiple areas with useful-and not only hypothetical results; on the other hand, to create the bond within games, city, and urban planning, that will set the base for our operative experimentation. Game Theory was in gestation for most of the early nineteenth century, but then it developed between the Sixties and Seventies and found a more substantial diffusion in the last quarter of the previous century (Bilancini, Boncinelli in Bertolo, Mariani, 2014). Its birth corresponds with the publication of the book *The Theory of Games and Economic Behaviour*[2] (Von Neumann and Morgenstern, 1944) that provides its cultural framework and essential formalization. Nevertheless, the first theorem ascribable to Game Theory was developed in 1913 by the mathematician Zermeno who stated that in every game in which (1) there is the presence of at least two players (2) who can observe reciprocal moves, and (3) alternately play their turns without (4) influencing the decisional system, represents a game in which at least one of the players owns a strategy to reach victory or draw. The following step occurs with John Nash who, during the 1950s, introduced his solution system that would be recognized worldwide as *Nash Equilibrium*[3] (Nash,

1 Nash, J. (2008) Interview with Piergiorgio Odifreddi, John Nash tra genio e follia, in *Repubblica, Espresso, Cultura*, March 11th.

2 Some important pioneers are Cournot (1938), Edgeworth (1981) for what concerns economic-agent behaviors and Darwin (1881) for applications regarding evolution theory. It is important to remember also a previous text by Von Neumann (1928).

3 A Nash Equilibrium for a game is a set of strategy (marked with the superscript *e*) that is: Ui (se1, se2,…, sei,…, seN) ≥ Ui (s1, s2,…, si,…, sN) for every *i,* and every strategy *s* chosen by the single player *i.*

1950b, 1951). The American mathematician prompted a research program called *Nash Programme*-that aimed for creating a link between *cooperative* and *non-cooperative games*[4], and for tracing back the last to the first.

From this starting point, in the last thirty years, GT further developed and enriched with a theoretical *corpus* that takes into account multiple disciplines (Aumann, 1987). Indeed, even if its origin is related to war and financial applications, we can currently find interesting implementations in fields such as political and social sciences, IT, biology, and not the least architecture.

In 2006, Winy Maas- professor at the Berlage Institute/TU Delft, and founder of the architectural firm MVRDV-published the book *Space Fighter*, which triggered reflections upon the *Evolutionary City*: a city that is constantly taking shape and is the result of processual changes in urban planning that tend to the progressive enhancement, adaptation, and optimization, of human/economical/resources management systems. After tracing the origins of Game Theory, if we want to create a deep connection between games and architecture, we have to deal with one of its most useful features-that if analyzed and understood can be turned into design and research components. We are talking about: strategic interactions.

Strategic Interactions: Tools for Emergent Processes in Informal Situations

Game Theory studies the so-called *strategic interactions*: situations in which distinct *players/decision-makers* (individuals, organizations, NGOs, IT systems, etc.) interact with each other to obtain a maximum *profit* through their actions, and to have a positive behavior in the results of the interaction itself. The primary field of application and study of this discipline are those games where the players act in a *strategic* way; to mention that their and the other players' actions directly affect the outcomes of the game. The target of GT is dual: on one side, it aims for organizing our knowledge around a specific class of phenomena (it works, indeed, concerning typing); on the other hand, it tends to raise our awareness to make these phenomena communicable and foreseeable. Therefore, it makes use of a *reductionist*[5] approach where the details of an event are not considered in order to focus only on its fundamental features through operations of abstraction and systematization. Within this research, it is possible to identify two macro-areas: the *non-cooperative Game Theory* - which suits best a strategic decisional approach-and the *cooperative* one, primarily used for splitting up of values and resources inside groups of people. Our interest is pointed towards the use of GT to simulate emergent decisional processes that can structure, and shape, the governance of cities where citizens experienced the lack of centralized governance, like, Tirana and the subsequent social/conflictual dynamics triggered by this situation.

4 Cooperative games are the one in which there is a chance for the players to establish binding agreements. On the contrary, in non-cooperative (or competitive) ones the players cannot have any pact (even normatively), regardless of their objectives.

5 In epistemology the term *reductionism*-refers to any kind of sciences, which states that every being, methodology and the concepts related to this have to be reduced to the lowest, which is sufficient to explain the facts of the theory in question.

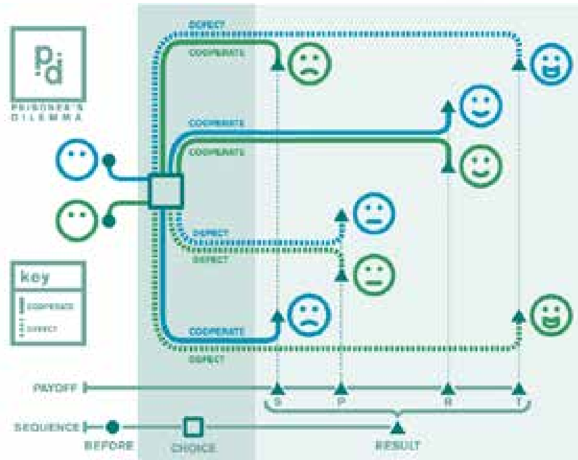

Figure 2: Jon Jensen, C. X., Riestenberg, G. (2012) Infographic that shows all the possible combinations to reach a 'Nash Equilibrium' in the Prisoner's Dilemma (1950), a typical example of non-cooperative game.

Moreover, through the use of Game Theory, we can shape models (Saggio, 2007, 2013) that simulate self-organized biological groups where the analogies between complex urban systems, the biological ones, and the simulations themselves, allow the use of non-standard research methods. These through the appropriate abstraction level, can structure useful invariable systems to operate results' movements in heterogeneous disciplines. In architecture and urban planning as well, we can find a useful implementation of this theory to generate new thoughts regarding the management of participative methods and dynamics, that shape bottom-up processes where the decisional phase is not subordinate to unilateral top-down influences, but also has to take into account the infighting and unpredictability of the many players/agents involved.

Following Michael Batty[6], we are far from the idea of a city as a machine, submitted to a mechanical logic where there is a unilateral correspondence between past and future events, and we are approaching one that is more and more similar to an organism. This is a complex system, neither abstract nor isolated, that acts in relation with the external agents, which hit it, and modifies and shapes itself in different time intervals activating moments of adaptation and innovation. For these reasons, and the unique situation, of the city of Tirana in the following path we will start with the definition of a Game Theory-based strategy to solve the multiple issues of the city's informal settlements development. This paper aims for starting the identification of a positive genome in the urban fabric DNA and for using computational tools to shape a model able to foresee and offer a concrete solution to steer-holistically and systemically-the future growth of the Albanian Capital.

Simulating Emergent Processes in the Urban Environment: Netlogo and the Prisoner's Dilemma

It is possible at this point to simulate processes able to allow the emergence of an urban form of organization, where the centralized control is missing. These simulations can be considered an ideal representation of self-organized biological processes where the rules that control the biological behavior can be used as a set of rules for governing the simulation. A research direction of applying the simulation of emergent processes to the city can be represented by the previously mentioned approach of Winy Maas of MVRDV and the Delft School of Design in the already mentioned book *Space Fighter, The Evolutionary City (Game)*. Their city, mimicking the biological evolution, is opened towards the process and to continuous improvement, optimization, and adapting to ever-changing conditions. This city is governed by a software-controlled extensive database and the democratic participation would

6 English urban planner and geographer, founder of the *Centre for Advanced Spatial Analysis*, founded in 1995.

allow the emergence of a hierarchical structure not administered by planning specialists but by every inhabitant becoming a “city maker”.

The role of the architects and city planners would be in this case the interaction with economic, demographic, and informatics fluxes. SpaceFighter creates in this way a platform able to simulate complex behaviors of contemporary settlements thanks to the interactivity and competition of different stakeholders or players. A more radical research direction can be undertaken if the mediating role of the platform that manages the large database of fluxes and conflicting players is not foreseen in the system. If the simulation is based on the competition of rational agents on a territory, the Game Theory can be one of the most useful frameworks for developing the simulation. Not by chance, but the origins of Game Theory can be related to the 1944 work of John von Neumann and Oscan Morgenstern, Theory of Games and Economic Behavior. Even though von Neumann was mainly interested in unravelling how to create winning strategies for competing games like Poker, he manages to create a method for measuring the fitness of complex systems. By introducing the concept of fitness of a system, it is then possible to look for ways of improving the fitness and so making the whole system evolve.

John Nash who was granted the Nobel Prize for Economy, in the definition of his famous equilibrium, states that in the case of the Prisoners’ Dilemma, the equilibrium is reached if none of the prisoners collaborates. If the two players collaborated, the gaining would be highest for both, but the risk of the collaboration is to lose everything if the opponent defects. For this reason, economy wise the most rational behavior would be not to collaborate. This situation is commonly imagined in conflict situations where the authority is missing.

In a more realistic situation, the complexity of the system would be higher. It is rare to have real-life events in one-time interactions. When we consider a physical territory, it is common to have repeated interactions and negotiations among the same people. The iterated games would represent a more advanced model of real-life conflict situations. In repeated sets of Prisoners’ Dilemma, it is possible to build up strategies based on the moves of the opponent.

Robert Axelrod, known for his work on the evolution of collaboration using Agent-Based Modeling, organized during the ’80s a series of Prisoners’ Dilemma tournaments where different gaming strategies competed for 200 times among them. The winning strategy was proclaimed TIT FOR TAT, which starts by collaborating and then copying the last move of the opponent. In few words, in this strategy the competitor starts by being good and continues to play fair if the opponent does the same. It defects when the opponent defects. By being kind with who is kind and by opposing who opposes you, Axelrod claims that the system can have the highest gain (Axelrod, 1984).

Chris Adami uses evolutionary principles for selecting ever better competing strategies. After each generation of competition, only the best strategies are selected for the next match, allowing a progressive improvement of the fitness of the system. One of the most interesting emerged strategies is “Win-Stay-Lose-Shift” (WSLS) which makes the same move for as long as it is winning and changes it when it losses (Adami & Hitze, 2013). The 2005 winner of the Nobel Prize for Economy, Robert J. Aumann gave an essential contribution to the better understanding of the conflicts and collaborations through the repetitive games. Aumann states that genetic and memetic evolution brings to a strategic equilibrium and behaviors like altruism, cooperation, trust, and revenge emerged thanks to the repetition of games during the centuries (Aumann 2005).

It is essential to understand at this point that collaboration is not associated with any ethical attributes. The partnership is not to be imposed in this case by any higher authority but it would be rational and profitable for the individual agent and the whole system to collaborate. Some of the features of the iterating game system can be observed through the PD Basic Evolutionary in NetLogo[7]. The simulation

7 NetLogo is a multi-agent modeling environment based on the Logo programming language (Wilensky, 1999).

creates a complex system where each agent that occupies a pixel of the lattice representing an abstract territory plays the prisoners' dilemma with all its neighbors and learns from its surroundings.

The agents change their behavior after each generation based on their own and the neighbors' experiences. There are only three simple rules of the game: 1. the agent chooses to collaborate or defect (blue for collaborating, red for defecting, green and yellow for changing behavior during the last generation), 2. During each generation each agent plays a prisoners' dilemma with its eight neighbors having as turn out the average of the turnouts of each game, 3. Each agent adapts in the next generation, the best strategy used by its neighbors. The unique controlling parameter of the system is the ratio between the prize gained by collaborating and the prize acquired by defecting. It is noticeable in images 3 and 4 that the gaining by defecting should be at least 1.6 times bigger than the gaining by collaboration for the system to have a defecting majority; otherwise, the collaboration emerges. It is this ratio that acting as an incentive takes the role of any moral or state authority in allowing the emergence of cooperation and managing a complex and otherwise unpredictable complex system.

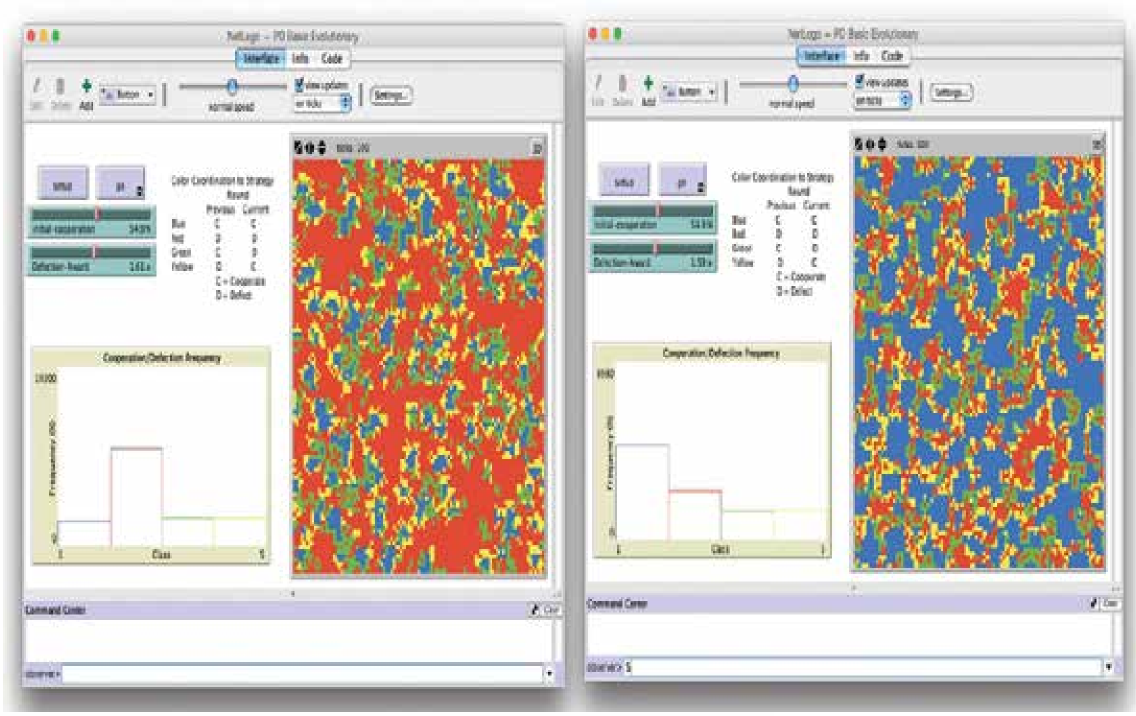

Figure 3-4: Netlogo simulation of the prisoner's dilemma. The agents change their behavior after each generation based on their own and the neighbors' experiences. In this first simulation we can see that the gaining by defecting should be at least 1.6 times bigger than the gaining by collaboration for the system to have a defecting majority Author-Ledian Bregasi.

The second simulation in NetLogo introduces the memory in the system. The agents do not behave following the best possible strategy of their neighbors but remember some past generations and choose the best among them. It can be noticed in images 5 and 6 that systems where the agents remind themselves of more than 50 previous generations, tend to collaborate more. This system managed to evolve not only by mimicking the behavior of the neighbors but learning from its past. It is important to state that collaboration is not necessarily a value per se, but in all cases, the net worth of the system was higher where collaboration emerged.

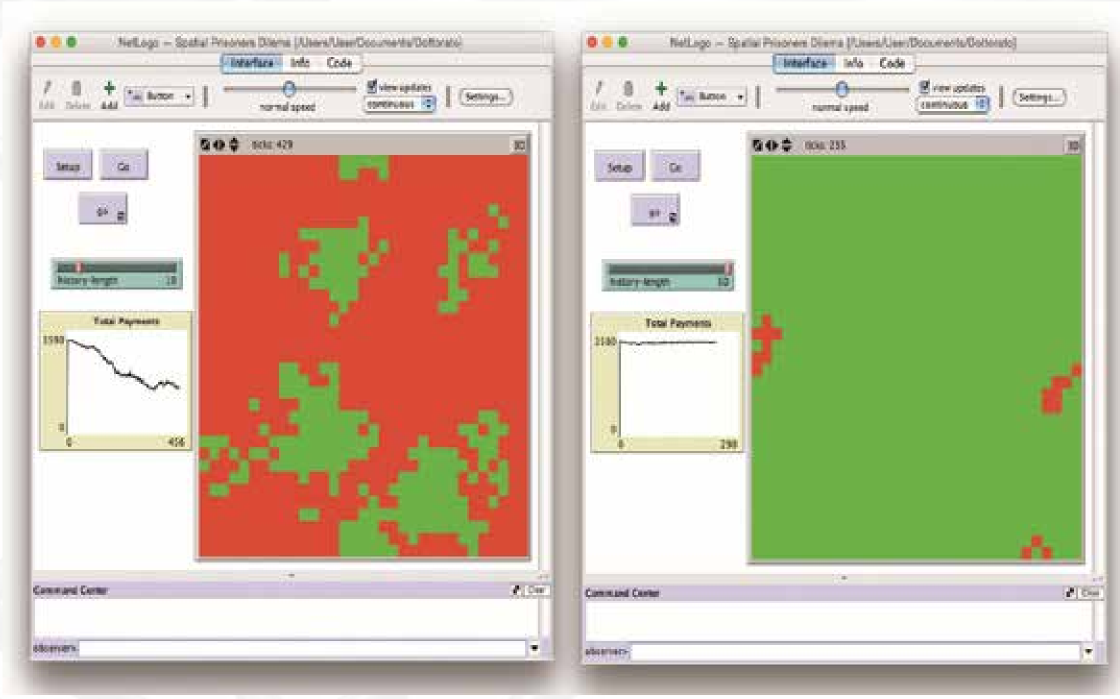

Figure 5-6: In this second simulation memory is introduced within the system. The agents can remember some past generations and choose the best among them. In the pictures above we can see that, introducing this new parameter, agents tend to cooperate more. Author-Ledian Bregasi.

It can be stated at this point that when dealing with complex and interacting systems, such as contemporary cities where it is impossible for a central authority to control every aspect of the urban development, incentives and continuous interactions between the inhabitants can enhance the emergence of collaboration and self-organization. Most importantly, systems that can remember and learn from their past can better organize and adapt to ever-changing environments.

Computational Design to Inform Qualitative Urban Development: Further Steps of a Research

As a starting point to explain our design proposal, we firmly want to detach ourselves from some previous computational design researches that took into account only quantitative parameters in the algorithmic process. We must highlight this difference because we believe that to positively inform the future urban development for the informal areas of Tirana-and to abandon the old-fashioned mentality lying behind urban planning approaches-also qualitative features of the urban fabric must be understood and inserted as variables within a digital process. For this reason, our data analysis is rooted in a thematic analysis (TA) framework (Braun, Clarke, 2014).

According to the authors, with this methodology, we refer to a way for systematically identifying, organizing, and offering new research insight into patterns of meaning (themes) ranging across a set of data. Furthermore, TA allows the researcher to identify and critically organize collective or shared meanings and experiences. The primary aim of TA is not to identify unilateral and unique meanings within a single data item but make sense of the commonalities found in heterogeneous data sets and to isolate the ones that can be interrelated to answer a specific design and research question. The main strategy for our experimentation would be then to start by identifying the gene of its 'cell' referring to the studied patterns of Tirana.

Through these studies four main patterns have been analyzed, each referring to a moment in the growth of the city and each harboring in themselves a different set of parameters and different 'genes'. Each of those can be used to identify the oldest gene or the starting gene that has directed the growth of the other settlements. As stated by Sotir Dhamo (2017, 2021), most of those transformations and additions over time highlight a system of growth based on the self-similar and self-affine, meaning that the original cell or theory, the current condition informed by the original cell be used as the starting point of the game.

Seeing as this is research-based on both quantitative and qualitative/perceptive data, all these need to be translated into parameters that will influence the way the generative system behaves. Spatial qualities and the parameters related to the spatial attributes would play a central role in the spatial result of the generative algorithm. As actors play, their space changes according to decisions that they make and these changes need to be following minimal spatial and architectural parameters. All parameters will be deduced by comparing spatial typologies of current and historical structures. This outcome could be achieved by using metaheuristic search algorithms to discover novel and high-performing results within a given design system. Its framework is based on three main components:

- a generative geometry model that defines a 'design space' of possible design solutions;
- a series of measures or metrics that describe the objectives or goals of the design problem;
- a meta-heuristic search algorithm such as a genetic algorithm which can search through the design space to find a variety of high-performing design options based on the stated objectives.

Since the main aim of GT is to study strategic interactions, the so-called players/decision-makers that make these decisions are to play a central role in the generative process. So actors, citizens, local governance, stakeholders, etc. themselves can be the players/decision-makers of the game. Each of them would have specific rules and limitations according to their role in the game, a position that also defines the goal. Seeing as we are talking about a non-cooperative GT each of their goals is individual. More than one of each actor can be part of the game, allowing for a more complex and better-fit result by introducing more parameters and iterations.

Furthermore, Mitchel and McCullough (1991) have identified the role of generative design processes early on and stated that computational design processes are able to address a level of complexity of parameters and interactions much higher than what the average human cognitive process can handle alone. They continue however by saying that instead of promoting "automated design procedures" there should always remain a central role for the designer's intellectual capacity, using his critical judgment towards the writing or application of the algorithm, the input of data parameters, and the definition of evaluation criteria. Generative design in this context is proposed to operate on the relationships rather than on formal characteristics of the built environment.

As per the statement of Michael Batty and following the studies of Tirana and its informal areas' development, and since Tirana represents in a lot of different ways a complex organic system, it is only normal that an approach to a generative system should shy away from just the spatial approach but should instead work on all the underlying parameters that need to be discovered that give shape to this complex system. Using non-cooperative GT as a way to introduce actors into the generative system and give them the possibility to influence the system and outcome directly would be a different and innovative way of city making.

Conclusion and Future Steps

The next challenge for our research will be focusing on demonstrating how “traditional”-and quantitative-methods for planning urban processes can comfortably coexist, and thus be enhanced, by the use of interdisciplinary tools such as computational design tools, digital media, and gamified citizens engaging system to interrelate multiple sets of different data. The city making process we refer to is the one where the design phase is human-centered (Ferri, De Wall, 2017) and takes into account also needs and the desires of all the stakeholders involved in the evolution of the city. As pointed out in many recent pieces of research (Ampatzidou et al., 2018) three main perspectives can be considered as benefits for participatory processes implementing Game Theory and playful applications: 1. The possibility to illustrate complex urban issues and make the complexity more tangible, 2. The idea of evoking social learning and capacity building, and, 3. The chance to make the participatory processes ‘lighter’ and easier to attend.

Our aim with this paper was to set the base for a quantitative/qualitative analysis to understand better the peculiar generative patterns that coexist in the kaleidoscopic urban fabric of the Albanian capital of Tirana. As a next step, more on-site testing and validation are certainly needed, and we see this process as inherently iterative, incremental, and practical. We are conscious that there is much work to be done, but also that the potential of this approach is far from being exhausted. For this reason, the next step will consist in developing the design algorithm-actually scripted using Rhinoceros’ plug-in Grasshopper-and later applying it to a chosen informal area of Tirana to test, and eventually, re-shape, the categories we have been using in this paper as an analysis tool.

The upcoming algorithm will be shaped following both a quantitative set of parameters-to optimize the physical need of the dwelling such as sun enlightenment, private/public delimitation, etc., and also a qualitative one to take into account different inputs and try to develop a tool to lower the social conflicts that characterize the urban development of the informal city and set a positive research agenda to inform the future development of the city’s more problematic area. There is much work to do, and we surely need more complex data analysis and real-case experimentations, to set an ever-growing design-oriented dialogue that can lead to further implementations and follow-up studies.

Bibliography

Abt, C. (1969) *Serious games*. New York: Viking Press.

Arida, A. (2002) *Quantum City*, Publisher: Routledge.

Ampatzidou, C., Gugerell K., Constantinescu T., Devisch, O., Jauschneg M., & Berger M. (2018) All Work and No Play. Facilitating Serious Games and Gamified Applications in *Participatory Urban Planning and Governance. Urban Planning*, 3 (1), pp. 34-46.

Aumann, R. J. (1987b) Game Theory, in J. Eatwell, M. Milgate and P. Newman (eds.), *The New Palgrave, A Dictionary of Economics, Vol. 2*, Macmillan, Basingstoke, 460–482.

Aumann, R. J. (2005) War and Peace. In K. Grandin (ed.), *Les Prix Nobel* (pp. 350-358). Stockholm: Science History Publications/Watson Publishing International.

Axelrod, R. (1984) *The Evolution of Cooperation*. New York: Basic Books.

Adami, C., & Hitze, A. (2013) The evolutionary instability of zero-determinant strategies demonstrates that winning is not everything. Nature Communications, 4.

Batty, M. and Longley, P. (1994) *Fractal City, a geometry of form and function*, Academic Press, San Diego, CA, and London.

Bertolo, M. e Mariani, I. (2014) *Game Design. Gioco e giocare tra teoria e progetto.* Milano-Torino: Pearson Italia.

Bogost, I. (2016) *Play Anything: The Pleasure of Limits, the Uses of Boredom, and the Secret of Games*. Hachette UK.

Braun V., and Clark, V. (2012) Thematic Analysis, in H. Cooper (Editor-in-Chief) *APA Handbook of Research Methods in Psychology: Vol. 2. Research Designs.*

Dhamo, S. (2017) *Specific realities and new hypothesis for urban analyses and urban design; Tirana as a case study*, PhD Thesis in the framework of the Joint PhD Programme POLIS University (AL) – University of Ferrara (IT).

Dhamo, S. (2021) *Understanding Emergent Urbanism. The Case of Tirana.* New York: Springer Cham

Duke, R. (1975) *Metropolis: The urban systems game*. New York: Gamed Simulations, Inc.

Ferri, G., de Wall, M. (2017) *A Lab of Labs: Methods and Approaches for a Human-Centered Design*, Amsterdam: Amsterdam Creative Industries Publishing.

Frashëri, K. (2004) *Historia e Tiranës, Historia e Tiranës si qytet deri më 1920*, vëll.1, Botimet Toena.

Glick, D. (2012) *Bottom-up urbanism: A survey of temporary use in Europ*e. Boston: Hart Howerton Community Fellowship.

Gordon, E., Mihailidis, P. (2016) *Civic Media: Technology, Design, Practice*. 1 edition. Cambridge, Massachusetts: MIT Press.

Grahan, S., & Marvin, S. (2001) *Splintering urbanism: Networked infrastructures, technological mobilities and the urban condition*. London: Routledge.

Ingersoll, R. and Kostov, S. (2013) *World architecture: A cross-cultural history*. Oxford University Press, New York, Oxford.

Kostov, S. (1991) *The City Shaped – Urban Patterns and Meanings Through History*. Fourth printing 2003, Bulfinch Press AOL Time Warner Book Group, Boston, New York, London.

Krasny, E. (ed.). (2013) *Hands-on urbanism 1850–2012: The right to green*. Hong Kong: MCCM creations.

Mayer, I. S. (2009). The gaming of policy and the politics of gaming: A review, in *Simulation and Gaming*, 40(6).

Mitchell W. J., and McCullough, M. (1991) *Digital Design Media*, New York: John Wiley and Sons Inc.

Mitchell, M. (2009), *Complexity a guided tour*, Oxford University Press, 825–862.

MVRDV / Delft School of Design. (2007). *Space Fighter, The Evolutionary City (Game)*. Barcelona / New York: Actar.

Nash, J. (1950b) Equilibrium point in n-person games, in *Proceedings of the national academy of science*, 36(1): 48-49; Nash, J. (1951) Non-cooperative games, in *The Annals of Mathematics,* 54(2): 286-295.

Nijholt, A. (2017) *Playable Cities: The City as a Digital Playground*, New York: Springer.

PhD Report Dhamo, S. (2018) *Specific realities and new hypotheses for urban analyses and urban design-Tirana as a case study*, developed in the framework of the PhD program in architecture and urban planning between POLIS and Ferrara Universities.

Poplin, A. (2012). Playful public participation in urban planning: A case study for online serious games, in *Computers, Environment and Urban Systems*, 36(3), 195–206.

Saggio, A. (2008) Perchè la rappresentazione nel mondo del gioco è importante per l'architettura, in Unali M., *Abitare Virtuale significa rappresentare*, Roma: Kappa.

Saggio, A. (2013) *The It Revolution in Architecture. Thoughts on a Paradigm Shift*. Raleigh USA: Lulu.com.

Salen, K., and Zimmerman, E. (2004). *Rules of play. Game design fundamentals*. Cambridge, MA: MIT Press.

Suits, B. H. (1978) *The Grasshopper: Games, Life and Utopia*. Toronto: University of Toronto Press.

Tan, E. (2017) *Play the City. Games Informing the Urban Development*. Heyningen: JAP SAM Books.

Tan, E., Portugali, J. (2012) The Responsive City Design Game. In *Complexity Theories of Cities Have Come of Age*, edited by Juval Portugali, Han Meyer, Egbert Stolk, and Ekim Tan, 369–90. Springer Berlin Heidelberg. Accessible at https://doi.org/10.1007/978-3-642-24544-2_20.

The Berlage Institute (2004) *Tirana Metropolis – Tirana: a modern European capital, research report under the guidance of Zenghelis*, E.; Aureli, P.V. and Tirana Summer Academy park projects.

von Neumann, J., and Morgenstern, O. (1944). *Theory of Games and Economic Behavior*. Princeton N.J.: Princeton University Press.

Wilensky, U. (1999). *NetLogo*. Retrieved on 2014-4-05 from NetLogo: http://ccl.northwestern.edu/netlogo/index.shtml

Zohar, D., and Marshall, I. (1994) *Quantum Society, Mind, Physics, and a New Social Vision*, Quill William Morrow, New York.

Cite this article as: Dhamo S., Perna V., Bregasi L. "Non-Cooperative and Repetitive Games for Urban Conflicts in Tirana: A Playful Collaborative System to Lower Social Tension", *International Conference on the 4th Game Set and Match (GSM4Q-2019)*, Doha, Qatar, 6-7 February 2019, https://doi.org/10.29117/gsm4q.2019.0039