Insights from Complexity Thinking for Border Studies: The State Border as Emergent Property of International Relations Systems

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Abstract

This paper introduces complexity thinking as a conceptual framework for the exploration and understanding of non-linear and unpredictable dynamics in the formation and maintenance of state borders. With a complexity lens, a state border can be conceived as emergent property of dynamically nested complex adaptive systems, constituted by interconnected and interacting agents. The complexity framework offers conceptual tools for an immediate consideration of the social ontology of state borders as such and deepens understanding of temporality, fragility, and malleability of state borders.

Keywords: Complexity Theory, Institution, State Border, Germany, Poland

1. Introduction: Exploring Border Complexities

The field of border studies pays increasing attention to features of boundaries and borders described as *complex* or *complexity*. However, contributions to border studies (e.g., Johnson et al. 2011) usually introduce these terms as a semantic reference without a clear-cut definition or project-tied conceptual specification. *Complexity* is predominantly introduced as a category of practice (Brubaker/Cooper 2000) and remains an expletive applied in the colloquial sense, described in the Oxford English Dictionary as "[uncountable] the state of being formed of many parts; the state of being difficult to understand" (OLD n.d.). Scientific publications utilize the term in a merely semantic way as a signal to show that results are difficult to get (Leendertz 2018).

Currently, we see the novel idea that complexity should be translated from a category of practice to a category of analysis, that complexity matters and that it should be further investigated as a category of analysis (Brubaker/Cooper 2000). However, it remains an open question whether the occasionally proclaimed "complexity shift" (Wille 2021) will unfold in coherent research efforts. One important theoretical caveat emphasized in recent contributions to border studies indicates that complexity can be conceptualized as a property of borders as well as a feature of observations of borders (2021, 113, 115).

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Among the few efforts to address complexity (Herrmann 2018; Wille 2021), the contributions by a research group at Viadrina Center B/ORDERS IN MOTION stand out. The research group suggests considering borders in a broad sense as "a demarcation tool, which divides both different spatial, temporal, cultural or social units on the one hand and orders on the other" (Bossong et al. 2017, 66). The research group continues:

> As such, any border deserves to be studied in its own right, but can simultaneously serve as a distinct perspective on these demarcated units and orders. The resulting methodological principle of *thinking from the border* implies a fundamental change of perspectives: borders move to the centre of attention, rather than being perceived as a peripheral phenomenon. This also means taking the complexity of borders more seriously. (2017, 66, emphasis in the original)

However, the subsequent considerations do not focus on a particular border but develop a multidisciplinary heuristic of multidimensional and polymorphic borders including spatial, social, and temporal demarcations and a reflection on the relationship of borders and orders. The research group finally concludes vaguely that "borders themselves are intrinsic complex orders" (2017, 77). In a follow-up contribution the research group discussed the idea of complexity anew. Gerst et al. (2018) argue that a complexity focus unfolds that spatial, social, and temporal demarcations should not be considered merely as clear-cut and one-dimensional breaks but rather as relational entities with a specific mode of connectedness. Following the sociologists Niklas Luhmann (1995) and John Urry (2005), the authors explain that the term complexity denotes a patterned mode of connections: Components cannot connect all equally but only a few with some (Gerst et al. 2018, 5). Obviously, the contribution rather tackles the significance of borders as a function of complexity reduction.

Altogether, addressing complexity in border studies either takes a semantic mode, remains at a rather unspecific abstract and general level, or focuses on complexity reduction. The proclaimed "complexity shift" is still a desideratum. Notwithstanding, the proclaimed turn towards complexity is an overdue wake-up call to devote more attention to the reflection of border complexities. For this reason, it seems obvious to consult an academic strand that trades under the name of *complexity thinking* (resp. *complexity theory*).

Complexity thinking emerged initially as an approach to improve understanding of non-linear dynamics in the exploration of abstract deductions

in mathematics or inanimate processes in natural sciences. Complexity thinking eventually gained relevance in social sciences and humanities with the exploration of emergent properties of animated collectives in life sciences (Ansell/Geyer 2017; Cairney/Geyer 2017; Sturmberg 2018; Turner/Baker 2019). The idea of emergent property means in very general terms that a whole is more than the sum of its parts and thus displays properties which do not directly derive from the parts' properties but emerge from the parts' interaction. Consequently, the emergent property shapes the parts' capacity to act and interact within the system (feedback mechanism). The formation of a fish swarm, a flock of birds or an ant colony are prominent and intensively explored examples.

The French sociologist Edgar Morin (2007) distinguished between restrictive and generalized complexity. He argued that the restricted complexity strand recognizes complexity merely in its endeavor to decomplexify and thus remains in the epistemology of classic sciences: The leading paradigm still impose a principle of reduction and disjunction to any knowledge. In contrast, Morin (2007) postulates "generalized complexity" as an epistemological rethinking that bears on the organization of knowledge itself. The paradigm of complexity imposes a principle of distinction and a principle of conjunction:

> In opposition to reduction, complexity requires that one tries to comprehend the relations between the whole and the parts. The knowledge of the parts is not enough, the knowledge of the whole as a whole is not enough, if one ignores its parts; one is thus brought to make a come and go in loop to gather the knowledge of the whole and its parts. Thus, the principle of reduction is substituted by a principle that conceives the relation of whole-part mutual implication. (2007, 6)

This paper undertakes the venture to apply (generalized) complexity thinking's way of seeing the world in the domain of border studies. As I will demonstrate in the following, border scholars affiliated with humanities and social sciences have the chance to benefit from a consultation of complexity thinking affiliated with these disciplines. However, I premise that a fertile utilization of complexity thinking must avoid abstract explications but deal with specific manifestations of borders conceived as the effect of bordering practices in their own right. To this end, I choose the state border as my subject of exploration, with the Polish-German border as a particular empirical case of reference.

The following Chapter 2 opens with a brief and topically focused account of the genesis and content of complexity theory and concludes with an introduction of five operative concepts developed in complexity theory. The subsequent Chapter 3 takes up and interprets an ongoing dispute in border studies on an agentic power of state border as an implicit reference to complexity thinking and showcases the genesis and history of Polish-German state border(s) with its dynamic and turbulent historical, spatial, and social changes displaying features of complexity. Eventually, the case is discussed in terms of complexity thinking. The final Chapter 4 summarizes the main insights and offers tentative conclusions for further research.

2. Brief Approximation to Complexity Thinking

This chapter provides a brief and highly selective outline of complexity thinking and its basic ideas. After a short sketch of the origins and key ideas, I turn to an exploration of the nature of complexity as epistemological and ontological feature. Finally, I introduce operational tools I consider to be relevant for the study of borders.

2.1 Strands of Complexity Thinking

The origins of contemporary complexity thinking can be traced back to the emerging of systems science, cybernetics, artificial intelligence and dynamical systems theory, computing, and chaos theory (Sturmberg 2018, 37). The invention of computers spurred the career of complexity thinking that finally diffused from mathematical and natural science to social sciences (Leendertz 2018).

Acknowledging the broad variety of disciplines, Manson/O'Sullivan (2006, 678) attach the word complexity to research in three major streams and identify three understandings. *Algorithmic complexity,* which is associated with mathematical complexity theory and information theory, contends that the complexity of a system resides in the difficulty of describing characteristics. *Deterministic complexity* attempts to simplify some classes of dynamic systems with the aid of chaos theory and catastrophe theory. Lastly, *aggregate complexity* emerges from the study of how individual elements working in concert create complex systems which have internal

structure relative to a surrounding environment and exhibit learning and emergence (Manson 2001).

Today the conceptual framework is applied to a broad variety of research contexts that include among others engineering, organization science, economics and management studies, migration studies, and social sciences (Cairney 2012a). The complexity paradigm encourages a vivid research landscape concisely described by the anthropologist and computational social scientist John Murphy (2017):

> Complexity theory addresses highly nonlinear systems and systems that exhibit emergent, self-organised, and adaptive behavior. Domains include virtually every field of study, from economics to cosmology, to genetic evolution, to cognition and artificial intelligence. Its appeal is that it proposes that common principles guide the dynamics and evolution of systems across all of these domains and that these principles reflect a deeper order that profoundly structures the physical and social world in which we live. (2017)

Due to the variety of contexts to which complexity theory is applied, Murray et al. (2019, 5) point out that complexity theorists conceive of the approach as a set of tools, or more accurately as a conceptual framework—a way of thinking and seeing the world. In this view, complexity is conceived as an epistemological property.

2.2 Epistemological Complexity

From an epistemological view, complexity is firmly associated with uncertainty and unpredictability. Consequently, epistemological complexity is addressed in sciences striving to understand and predict the outcomes of non-linear dynamics observable for example in weather phenomena, stock-market developments, or economic processes. In a seminal paper dealing with the capacity of leaders to cope with a situation characterized by uncertainty and unpredictability, Snowden/Boone (2007, 7) conceived of complexity as one "way of thinking about the world" in addition to other approaches such as simple, complicated, chaotic or disordered. These five states are not naturally given but emerge from the epistemological characterizations of the predictability and orderliness of a context (Illustration 1).
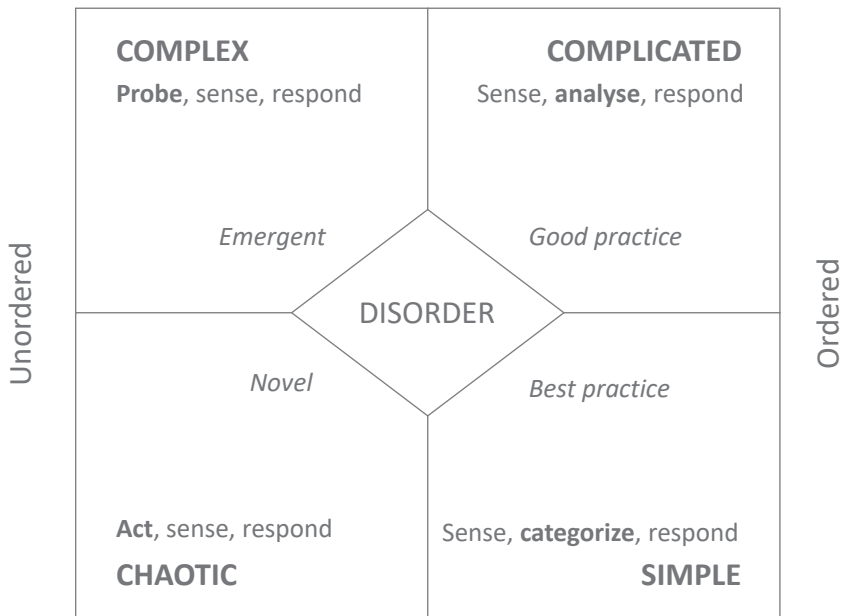
*Illustration 1: The Cynefin-Matrix. Source: own work based on Snowden/
Boone (2007, 4).*

According to Snowden/Boone (2007, 7), a *simple context* belongs to the
realm of the known knowns, characterized by recurring patterns and
consistent events. Clear cause-and-effect relationships are evident to every-
one and right answers regarding future outcomes are at hand. Decision
making follows the formula of routine: sense, categorize and respond. A
complicated context belongs to the realm of the known unknowns. It is
characterized by a cause-and-effect relationship that is discoverable but not
immediately apparent to everyone. More than one right answer is possible,
and expert diagnosis is required and available. Decision making follows the
formula of expertise: sense, analyze, respond. A *complex context* belongs
to the realm of the unknown unknowns. It is in flux and unpredictable,
cause-and-effect relationships are not identifiable, no right answers are
available, and emergent instructive patterns prevent linear predictability. In
order to master a complex situation, creative and innovative approaches
are required, and the many competing ideas should be tentatively tested
in a reversible manner. Decision making follows the formula of anticipa-
tion: probe, sense, response. A *chaotic context* belongs to the realm of the

unknowable. It is characterized by high turbulences without clear cause-and-effect relationships and offers no point to look for right answers. In a chaotic situation, leaders have many decisions to make and no time to think. Decisions must be made without appropriate knowledge in the hope that they will deliver a first anchor that provides the ground for further decisions. Decision making follows the formula of anchoring: Act, sense, respond. Finally, Snowden/Boone (2007) mention *disorder* as a state in which it is unclear which of the other four contexts is predominant in a situation. The decision making follows the formula of mapping: assigning a state to the situation.

As an epistemological feature, complexity is a matter of subjective appraisal: A system is thus only complex regarding its particulars and their corresponding context (Lange et al. 2015). In this view, the epistemological contextualization depends on the perception of those assessing a state—and the contextualization modifies according to (the belief in) the knowledge available and its ascribed certainty. Thus, scholars committed to enhance rational coordination strive to transform complex into complicated contexts (Snowden/Boone 2007). The modern scientific approaches committed to linearity and predictability are appropriate to explain simple and complicated issues but fail to explain non-linear dynamics and unexpected outcomes (Saurin 2021, 2).

One illustration of this constellation is the image of an airplane. Complexity thinkers use to argue that an airplane is complex for lay persons but complicated for engineers (Cilliers 1998; Snowden/Boone 2007). However, as airplane crashes remind us, an airplane—or more precisely, dispersibility as its emergent property—may be subject to unpredictable accidents that lead to a chaotic final state: a crash. Consequently, Saurin (2021) noted that a technical artifact such as an airplane "is a complicated system when seen in isolation […] when these artefacts are put in the real world interacting with other technological and social artefacts they are an separable part of a larger complex system" (2021, 2). Thus, sudden and unwanted transformation of epistemological states is related to an insufficient realization and recognition of complexity as a pervasive ontological feature of the material world, as famously expressed by Leonardo da Vinci: "Realise that everything connects to everything else" (quoted in Kumar et al. 2005).

2.3 Ontological Complexity

Complexity thinking opposes so-called reductionist thinking which aims to produce knowledge by distinguishing a whole in its parts and explaining each part separately—a paradigm perceived to be an over-simplification (Cilliers 1998). Complexity thinkers agree that not all systems are necessarily or always complex and concede that the orientation on reductionist principles has led to extremely brilliant, important, and positive scientific developments (Cilliers 1998; Morin 2007). However, reductionist thinking fails to sufficiently take into account and accept that some processes are inherently unpredictable due to complex non-linear interaction of components. In this vein, Turner/Baker (2019) summarize that

> complexity science expands on the reductionistic framework by not only understanding the parts that contribute to the whole but by understanding how each part interacts with all the other parts and emerges into a new entity, thus having a more comprehensive and complete understanding of the whole. Individual causal research in complex systems is near futile; a comprehensive approach is required to account for the unpredictability found in complex systems. (2019, 2)

Complexity is conceptualized as property of systems or organizations. A system is a set of inter-related elements and a complex system is one in which "the whole is greater than the sum of its parts" (Byrne/Callaghan 2014, 4). Complexity thinking shifts the focus from analysis of the individual parts of a system to the system as a whole, with a focus on the interactions of both the components and systems, and the exploration of non-linear and disruptive dynamics (Cairney 2012a).

The relevance of complexity thinking for social sciences was soon identified. More than 50 years ago, Brewer (1973) observed that social systems "exhibit properties of organised complexity. Their structure contains overlapping interaction among elements, positive and negative feedback control loops, and nonlinear relationships, and they are of high temporal order." Further, Brewer states that "these characteristics largely account for the observable diversity of social behavior" (1973, 73, quoted in Leendertz 2015, 8).

A special case of complex systems is known as the *complex adaptive system* (CAS), which demonstrates the ability to learn from, adapt to and co-evolve with its environment over time, especially when this environment also consists of other such systems (Holland 1995). The involvement of

human beings with their peculiar abilities of intentionality and reflexivity (Dittmer 2014, 389) add further complexity, "making the operation of human systems more complex and unpredictable rather than less so" (Stacey 1996, 187). Complexity thinking thus implies a readiness and willingness to open a horizon of a space of possibilities (Dittmer 2014). Bousquet/Curtis (2011) argue that

> one of the core features of complexity is its ability to refocus attention onto processes and social relations, offering a very different social ontology to those which see social entities, such as states for example, as having pre-theoretical characteristics or dispositional interests. (2011, 48)

2.4 Five Operative Concepts

The previous section outlined circumstances and reasons for the occurrence of complexity thinking and described how it related to and dissociated from an enlightened scientific épistéme referred to as reductionist. This section turns to the operational aspects. In orientation to explanations provided in the introduction of the seminal *Handbook Complexity in Political Sciences* (Cairney/Geyer 2015, 2), the main features of complexity theory encompass the five concepts of emergent properties, interconnections and interactions, non-linear dynamics and feed-back loops, stabilizing attractors, and dynamic equilibrium.

Emergent properties: As already noted, complex systems display "emergence". This concept is used in different ways by different authors. For Newsome (2009), emergence means that "capacities of a complex system are greater than the sum of its constituent parts [...] a system can have emergent qualities that are not analytically tractable from the attributes of internal components" (2009, 55). He further explicates that

> complex assemblies of simpler components can generate behaviors that are not predictable from knowledge of the components alone and are governed by logic and rules that are independent of (although constrained by) those that govern the components. Furthermore, the intrinsic logic that emerges at higher levels of the systems exert 'downward control' over the low-level components. (2009, 55)

Emergent order emerges from the interaction of many entities. The patterns that form are not controlled by a directing intelligence but through self-organizing (Kurtz/Snowden 2003, 464).

Interconnections and interactions: Cairney/Geyer (2015) further emphasize that emergent properties derive not from the nature of the components, but from the frequency and quality of the interconnections and interactions of these components. Moreover, these components are interconnecting and interacting with each other at a local level, sharing information and combining to produce systemic behavior. In contrast to systems theory, complexity thinking does not postulate that the capacity to connect underlies narrow restrictions, but is rather related to a system of components with the potential to establish new connections or change existing ones.

Nonlinear dynamics: A particular feature of complexity is a non-linear cause-effect relationship. Most systems do not work in a simple linear fashion. In much of the reality, causation is complex.

> Outcomes are determined not by singly causes but by multiple causes and these causes may, and usually do *interact* in non-additive fashion. In other words the combined effect is not necessarily the sum of the separate effects. It may be greater or less because factors can reinforce or cancel out each other in non-linear ways. It should be noted that *interactions* are not confined to the second order. We can have higher order interactions and interactions among interactions. (Byrne 1998, 20)

These considerations lead to the idea that complexity is not about properties but capacities. "While properties of a material are relatively finite, its capacities are infinite because they are the result of interaction with an infinite set of other components" (Dittmer 2014, 387). Some actions (or inputs of energy) in complex systems are dampened (negative feedback) while others are amplified (positive feedback). Consequently, small actions can have large effects and large actions can have small effects (Cairney/Geyer 2017).

Stabilizing attractors: Complex systems display a tendency towards a dynamic state of equilibrium. Several mechanisms contribute to this tendency. Complex systems are stabilized by the emergent properties' capacity to exert some degree of downward control which aligns the arrangements of components—a feature called *strange attractor* (Partanen 2015). In social systems, strange attractors are institutions which represent sets of rules to which people adhere, causing regular patterns of behavior (Cairney/Geyer 2017, 3). Through the persistence of internal structure, a system remembers and path dependency occurs. The causal mechanisms should be better understood not as impositions but as *constraints* (Juarrero 2000, 26).

Dynamic equilibrium: Complex systems are constituted and maintained by the interaction of components which dynamically adapt behavior in mutual response to the behavior of other components. This feedback pattern facilitates a dynamic equilibrium that is at rare intervals punctuated by radical transformations (Holland 2006). Complexity theory observed the interplay of longer lasting dynamic equilibrium and occasional radical change in a wide range of dynamic processes of abstract and natural complex systems among natural processes like evolution, the experimental piling of sand, occurrence of avalanches, or development of politics (Bak 1996; True et al. 2007; Cairney 2012b). Complexity thinkers observed that complex systems are robust in two senses: Much of the time they basically stay the same, with changes being neither trivial nor transformative. But occasionally, complex systems can change radically in terms of form while retaining systemic integration. Complexity thinking emphasizes that a system's concurrence of stability and radical change does not derive from the characteristics of the components, but from the frequency and quality of the interconnections between the components which generate emergent properties that retract to the individual components (Bak 1996; Gloy 2014).

In its political science version, the punctuated equilibrium theory (PET) states that this general feature of dynamic stability with smaller imperceptible or unnoticed adaptations and rare radical transformation also characterizes political processes. According to True et al. (2007), this pattern emerges from the effects of limited capacities to process information. The capacity of attentiveness suffices only for a limited scope of issues. Thus, a particular occurrence may draw attention towards a hitherto neglected issue—and the more actors turn attention to this occurrence, the more the pressure to attend to the issue increases, and so too the probability of radical and disruptive change (True et al. 2007; Ansell/Geyer 2017; Masse 2018; Amri/Drummond 2021). Joly/Richter (2019) highlight that public policy theories prior to PET had been relatively successful at explaining either policy stability or large policy changes. "The main originality of PET was that it proposed a single theoretical model of policymaking that explains how the same governmental processes cause both stability and major policy shifts" (2019, 41).

3. Applying a Complexity Lens in the Analysis of State Border

This chapter aims to consider the implication of the selected concepts for the study of state borders. For that purpose, it is helpful to start with a general consideration of the epistemological and ontological nature of this very kind of border.

3.1 Epistemology and Ontology of State Borders

As a principal rule, as with other social boundaries, the state border—as Georg Simmel (1997) has famously stated—is "not a spatial fact with sociological consequences but a sociological fact that forms itself spatially" (1997, 142). By sociological fact, Simmel means that borders are not natural entities but mental abstracts that emerge from, and gain social reality from, the interaction of human beings or groups. These explications suggest that borders are primarily mental abstract objects (Rosen 2020) that become a concrete component of the social world only through the interactions of interconnected actors. While social boundaries—including state borders—emerge from the agency of human beings they reify as a structure independent from the agency and intentionality of individuals and subsequently constrain and enable as institutionalized structure human action (Berger/Luckmann 1967; Giddens 1984; Bousquet/Curtis 2011, 52), thus displaying properties of emergence.

The idea that borders can be conceived as emergent property of complex adaptive social systems with a capacity to downward control is echoed in strands of academic literature, media, national, politics and policies that—as Paasi (2021, 20) deplores—uncritically perceive bounded spaces and borders "to have 'agentic capacities'". Paasi (2021) argues that an anthropomorphic language and related terminologies accentuate abstract "spatial entities such as regions/territories or borders as actors that can do things" (2021, 20–21). Paasi considers such imaginaries as a socio-spatial fetishism that comes into play when meaning is created and attributed to bounded spaces. As Paasi claims, spatial fetishism displays itself in many ways—from simple core-periphery-related political rhetoric to views on spatial entities as fixed, stable, bounded and unchanging—a feature frequently associated with the territory and borders in geography and International Relations studies. Paasi (2021) believes that human beings "seemingly do fetishize relentlessly to be simply able to attain some convenient grasps on the complex world

of open or semi-bounded social systems" (2021, 21). However, he deals with perceptions and related languages that anthropomorphize borders without asking what makes people believe and behave as if borders display agentic force.

On the other hand, Green (2012, 579) argues that most border studies focus on the subjects and objects of bordering practices and not on borders as such. She goes on to say that borders do not independently exist as self-evident entities in the landscape but are fashioned out of particular epistemologies that vary across time and space. Green (2012) premises that borders are more of a verb, a practice, a relation and, importantly, a part of imagination and desire (2012, 579–580). Green's amalgamation of the epistemological and ontological dimension combines the social constructivist premise that a state border is the result of both human mental operations and social practices, while observing that borders are not just epistemological entities. Rather, Green (2012) states that borders are also ontological entities: "epistemologies made real, in a sense" that once constructed "can take on thing-like qualities both in practice and people's imaginations" (2012, 580). Such a conceptualization of borders—one that rests on insights from social constructivist and institutionalist approaches (Berger/Luckmann 1967; North 1991; Searle 2010)—connects very well with the idea that complex social systems display emergent properties that consequently may exert downward control.

Referring to the theory of institutional facts (Searle 1995), Cooper/Perkins (2011) stress that a particular place works as a border not because of its physicality, but because people accept the place as having the *status* of a border.

> The interesting thing about the border is that it is a place that has a function imposed upon it, but the nature of that function is to impose further status-functions to create institutional realities i.e. to situate things people and ideas within networks of legitimate meaning. (2011, 61)

In other words, as an institution, a border displays agentic-like capacities to both constrain and enable behavior and interactions. Seen with a complexity lens, the word 'border' denotes an emergent property of a complex system of interrelated and interacting social actors. Enacted in practices, a state border may work among many other functions as sorting machine (Mau 2021), value-filter (Kearney 2004), facilitator of collective identity (Newman 2006; Brown 2010), interrupter of movements (Bauman 2002),

or creator of incentives to develop cross-border links within a border region (Trippl 2019).

3.2 Making the Case: The Polish-German State Border(s)

As already indicated, it is reasonable to focus analysis on a particular kind of border. To this end, I choose to explore the Polish-German border. In this section I will briefly recall with a combined place-sensitive and phenomenological approach the historical shifts and morphological changes of this particular state border(s). The account's focus of attention is shaped by the operative concepts borrowed from complexity thinking and pinpoint the aspects of the Polish-German borders as emergent properties of the system of interconnected and interacting states, the nonlinear development with interplays of disruptive change and dynamic stability.

Today, the Polish-German border runs in line with the rivers Oder and Neisse and demarcates the territories of the Republic of Poland (RP) and the Federal Republic of Germany (FRG).

The border history goes back to the Polish-Lithuanian Commonwealth, which existed as a sovereign state for more than two centuries until disappearing from the map in 1795 when Russia, Prussia, and Austria usurped the areas. For 123 years, Polish-speaking populations were not organized in a sovereign and independent state (Grosfeld/Zhuravskaya 2013). A Polish-German border reappeared in 1918 with the re-establishing of a Polish state. However, at this time, the border was located east of the Oder and separated the two states of the first Polish Republic and the German "Weimar" Republic (Marks 2013).

In 1939, the fascist Nazi-regime invaded Poland and, in complicity with Stalinist Soviet Union, erased the Polish state. In anticipation of the end of World War II, the Allies negotiated the outline of a new world order, and agreed on a spatial re-ordering of territories and border pathways that included the westward shift of Polish territories (Allen 2003). The rivers Oder and Neisse were determined to be the site of the new border line that would demarcate the future German and Polish territories (Jajeśniak-Quast/Stokłosa 2000; Hong 2008; Eberhardt 2015).

Between 1945 and 1989, this state border separated the territories of two states both belonging to the same Cold-War camp (e.g. Warsaw Pact): The Polish People's Republic (PPR) and the German Democratic Republic (GDR). While the GDR accepted the Oder-Neisse line, the other German

state belonging to the Western camp—the Federal Republic of Germany (FRG)—refused to accept the loss of former territories and to recognize this border. However, due to other states' recognition, the Oder-Neisse line achieved the status of an internationally accepted border (Kamusella 2010).

At the local level, the shifting of the state border along the course of the two rivers displayed disruptive effects on formerly integrated areas. Until 1945, the settlements on both shores had belonged to the same state. Now, localities like Frankfurt (Oder), with a municipal area stretching across the river and connected through bridges, were suddenly separated. After 1945, the international border cut off the city of Frankfurt (Oder) from its former district Dammvorstadt on the other side of the river (Jajeśniak-Quast/ Stokłosa 2000; Knefelkamp 2003). The German-speaking inhabitants had to leave, and Polish-speaking people settled down. The former district *turned into* the Polish town Słubice. Although the neighboring states both belonged to the same political camp, governments impeded cross-border connections and exchange at the local level for political reasons. Historical experiences and political concerns severely impaired mutual sympathy: German powers had assaulted and erased the Polish state while characterizing and treating Polish citizens as subhuman beings. A sharp linguistic boundary, different prevalent religious traditions (Catholic vs. Protestant), and distinct political and legal cultures divided people.

Notwithstanding, during this period the grade of permeability of the border fluctuated. In times of political and economic stability, the border was more permeable, and inhabitants had the chance to go to the other side to work, shop or meet friends. In times of political unrest, particularly during the imposition of martial law in response to the Solidarity movement of the early 1980s, authorities curbed cross-border movement. During this period, the state border was fortified and cross-border movement was restricted and surveilled (Jajeśniak-Quast/Stokłosa 2000; Schumacher 2005).

This situation changed radically at the end of the 1980s. Following the collapse of the Socialist state system, Poland emancipated from Soviet Union domination, and changed from a Communist Party-dominated People's Republic into a Parliamentarian Democracy known as the Polish Republic. Subsequently, the GDR became a Parliamentarian Democracy. The first freely elected Parliament voted for an accession to FRG. However, to get the confirmation of former Allies, FRG had to accept the loss of former German territories and recognize the Oder-Neisse line as its Eastern border. With reunification, the territory of FRG stretched to the rivers Oder and Neisse overnight, and the border line now separated

the states of RP and FRG. Governments abolished visa requirements in 1991, which enabled visa-free entrance for citizens. In the aftermath of Poland's accession to the Schengen agreement (2003) and the European Union (2004), border control facilities at the local level were completely dismantled. This permeable border arrangement enabled citizens from both sides to cross the bridge on an everyday basis for education, shopping or employment (Jajeśniak-Quast/Stokłosa 2000; Dębicki/Doliński 2017). Local administration also intensified cooperation: The cities of Frankfurt (Oder) and Słubice launched a joint plan for regional development and established a joint office with the leitmotif "Without Borders". However, in spring 2020, national governments stipulated border controls and installed mobile barriers in response to the covid-19 pandemic. Border crossing was almost completely curbed for 35 days. Local population from both sides protested the pandemic-caused border closure, thus displaying a default preference for an open border arrangement among the local population. In response to these protests, the policies on both sides pursue the goal of avoiding future border closures (Cyrus/Ulrich 2022).

3.3 Seeing Borders as Emergent Properties

Against the background of the case example of the Polish-German borders, in the remainder of this section I will discuss complexity thinking's potential to deepen border studies' understanding of state borders by turning attention to nonlinear dynamics of (state) borders' trajectories both from a diachronic and synchronic perspective.

The diachronic *longue durée* observation of the Polish-German borders reveals dynamics of dissolving and reemerging, location shifting, incremental changes of the organizational design, and disruptive transformations. The Polish-German borders provide a particularly clear case for the pervasive fragility and variability of a state border in time, space and design without being unique. Fragility and variability are constant and inherent features of each state border without exception—and differences are rather a matter of degree, pace and timing (Newman 2011).

Moreover, the diachronic *longue durée* observation pinpoints that the fragile and variable trajectory of the Polish-German border is embedded in an overarching institutionalized framework of the State Border (with capital letters) as an institution that constrains and enables the (self-)formation of states in the modern sense of a unity of people, territory and

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government (Jellinek 1905). Today, the ideal model of a nation-state with clear-cut territorial borderlines constitutes the hegemonic and inevitable frame of reference for collectives that have established (or strive to establish) a distinct polity with an internationally recognized status of sovereign equality, as enshrined in Article 2.1 of the Charter of the United Nations. Contestations and conflicts among states regard a particular state border or recognition of equal sovereignty of a particular state, but the State Border institution is taken for granted as the institutional frame of reference. The modern model of statehood has

> as its central geographical moment the imposition of sharp borders between one state unit (imagined as a nation-state, however implausible that usually may be) and its neighbors. Previously in world history, a wide range of types of polity co-existed without any one – empire, city-state, nomadic network, dynastic state, or religious polity – serving as the singular model of 'best political practice'. It is only with the rise of Europe to global predominance that an idealized European territorial state became the global archetype. (Agnew 2008, 181)

In addition, the variety of polity types implies a variety of understandings. For example, the ancient Roman understanding conceived of the state border as the limit and demarcation of a civilized world from a barbarian one. The Mediaeval understanding stressed the rule over persons and accepted multiple loyalties and diffuse zones of transition at the edges of territories. Eventually, it was the development of cartographic precision, infrastructural capacities, and the idea of *Volkssouveränität* that facilitated the modern understanding of State Border. Thus, the institution of State Border displays features of temporality, fragility, malleability, and variety.

With an complexity lens, both the State Border (with capital letters) and the state borders (in plural) can be conceived as emergent property of separate but nested complex adaptive systems (CAS). Seeing State Border and state borders as emergent property of complex adaptive systems provides a clue for resolution of the dispute on the agentic-like features assigned to state borders. As an institution, the State Border and state borders are constituted by and acting on interconnected agents constituting a complex adaptive system—an effect emerging from the acceptance and cooperation of involved agents (Searle 2010).

The concept of emergent property aligns with Simmel's dictum that borders are sociological facts, and thus transforms the term from a category of practice into a category of analysis. In methodological terms, seeing borders

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as emergent property encourage to identify the agents constituting a CAS, and to analyse the rules (strange attractors) and dynamics of interactions among these agents.

As an institution, the State Border emerges from, and is maintained by, a CAS of international relations with states as agents as formally assembled in today's United Nations. The concept of attractor helps ensure that state governments accept the institutional principles of equal sovereignty and non-intervention in the internal affairs of another state and accept and cooperate in the institutionalized UN system for the sake of mutually shared self-interest in a stable and predictable order (Müller 2013). However, cooperation in the institution does not prevent governments from attempts to dominate other states and unilaterally redraw borders while still participating in UN institutions. In such a situation, acceptance of the State Border institution simply means that aggressive state governments feel obligated to invoke justifications that somehow respond to the institutional principles and values. Against this background, complexity thinking points to the possibility that the current dynamic stability of the UN system is not secured against radical transformation. To follow this thread further, border studies may gain fresh insight from a consultation of existing and ongoing research on complexity in world politics (Harrison 2006; Room 2013; Crowley et al. 2020).

Complexity thinking offers guidance for an appraisal of the dynamic formation and maintenance of a particular state border, its organizational design, assigned functions, and features such as permeability. At the local level, the composition of relevant CAS is not limited to state parties. As indicated, the protest of local commuters against the pandemic-related closure of the Polish-German border induced a change of border arrangements towards more permeability.

The case of the Polish-German borders illustrates that borderlines that first and foremost serve the purpose of equally determining and demarcating territorial ownership become and serve as contact points for borderland population, and the site of functions such as migration control, formation of collective identity, value filter, and facilitator of cross-border relations. The working and maintaining of such functions assigned to these borders depend on the acceptance and cooperation of all agents involved in the particular property-related CAS.

In a strong sense, the historical recapitulation shows that the phrase Polish-German borders refers to different entities existing at different times, geographically located at different sites, demarcating the territories of dif-

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ferent states, and displaying different functional and material arrangements. The phrase 'Polish-German border' turns out to be an empty signifier that deceivingly suggests a non-existent continuity and identity that does not comply with any entity. Behind the epistemologically created and semantically suggested impression of continuity, the Polish-German borders appear as entities displaying a dynamic equilibrium as conceptualized by PET: Long phases of dynamic stability with incremental changes are punctuated by few disruptive transformations. The concept of emergence helps to integrate the phenomenon of phantom borders in border studies, i.e. defunct state borders that have left traces and influences in the present day despite the temporal distance (Grosfeld/Zhuravskaya 2013; Hirschhausen et al. 2015).

4. Concluding Remarks: What Can We Learn and Take Away

This paper aimed to introduce and apply the conceptual framework of complexity thinking in the field of border studies. To avoid abstract explications and hollow generalizations, I focused on state borders and chose the Polish-German border as case of reference. Complexity thinking's emphasis on nonlinear and unpredictable dynamics direct attention to the temporality, malleability, and fragility of this very border, and eventually to the State Border institution. The complexity framework encourages to analyse incremental changes and disruptive transformations as outcomes of the interactions of agents interconnected in complex adaptive systems of border formation and maintaining at both the local and international level.

The form of appearance of a state border emerges from an interplay of dynamically nested complex adaptive systems at different levels (Harrison 2006; Turner/Baker 2019). This view implies not only an empirical openness to identify all CAS and agents involved in these dynamics, but also that an analysis requires a clear and consciously pursued focus on a particular property as point of reference due to the polymorphic feature of state borders (Burridge et al. 2014). Properties like durability, permeability, or liminality (Schiffauer et al. 2018) emerge from various nested and partly overlapping CAS (Cairney et al. 2019).

These short remarks aim to highlight the potential of a complexity lens to complement established border studies' agendas which hitherto do not tackle the state border as such (Green 2012). In addition to the analysis of border-related effects (such as cross-border connections in borderland

studies) or particular functions (like migration control in critical border studies), the complexity framework offers an avenue to explore the ontology and dynamics of a state border as such. While leading border scholars have good reasons to question the possibility of generating a single or general theory of borders (Newman 2011, 43; Paasi 2011), a complexity lens that views borders as emergent properties of complex adaptive systems provides fresh impulses for border thinking.

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