Introduction

Needful Structures

It is a constant of the human condition to be intricately situated amid other people, material things, and systems that are structured in myriad organizational forms—some of which are incredibly complex and others of which are simpler. Every human being is born into structures that contextualize and scaffold how humans act, and why they do so. These structures include their place and time of birth, their sex and gender, their sociocultural and economic background, the general constitution of their material environment, and so on. The interplay of these structures enables human beings to realize certain possibilities of their existence while constraining the realization of others.

It is also a constant of the human condition to be burdened with both basic and more complex material and immaterial requirements, wants, and wishes that need regular satisfaction. These requirements, wants, and wishes are due not only to the organic materiality of the human body but also to the position people adopt in the constellations of society. Humans are inherently *needful* beings. They require, among other things, water, clothing, shelter, food, the possibility to move around, and a caring community. They may also desire individual meaning, fairness, and a societal purpose. Paradoxically, these *constants* of the human condition are fundamental for understanding the *process-based*, or *processual*, character of human existence. Through these requirements, wants, and wishes, as well as through people's actions to satisfy them, humans can be understood as inherently goal-directed beings. How people may get whatever they require or wish for themselves strongly depends on the contexts and structures in which they are situated, as well as on their exact place within them. The requirements for water or mobility, for instance, can be rather easily tackled in the confines of one's own home or an urban environment. However, in a deserted area, or without the necessary means—instrumental, financial, and infrastructural—the satisfaction of physical requirements and other more complex wishes can be a somewhat intricate matter.

The relation between what humans need, on the one hand, and the structures giving rise to both possibilities and constraints to fulfill those needs, on the other

hand, is an intriguing one. This fascinating relation is particularly evident in the large-scale provision of infrastructure services in urban spaces. Enormous structures, such as drinking water and waste-water disposal, roads, traffic, and transit systems, as well as information technologies and other facilities with similar importance for individual and societal thriving, are considered by some to be the indispensable lifelines of modern societies (BMI 2009, 3).

Urban infrastructures represent structured constellations of people, material things, norms, regulations, and practices that enable societies to address some of their basic and more complex needs in the long run. Simultaneously, infrastructures seem to be inherently *needful* themselves, in the full range of the term's meanings. Infrastructures are "precarious achievements" (Graham 2010, 10), full of demands, technical requirements, and practical constraints. These structures require constant maintenance to ensure proper functionality. Furthermore, critical events such as technical malfunctions, extreme weather, natural disasters, and also health crises like the COVID-19 pandemic, may disrupt the provision of infrastructure services. Hence, operating these structures on a large scale requires the employment of various preparedness and prevention measures to avoid or at least mitigate potential harm (Crespo et al. 2018). The war in Ukraine and the concomitant energy crisis further highlight the needfulness of modern societies and their infrastructures.

Infrastructures are not only full of demands and requirements—they are also rendered necessary by the essential services they provide to society, which is another aspect of their inherent needfulness. In light of the provision of these services, one way to understand infrastructures is in terms of their functional criticality. Infrastructures can be considered critical when the disruption of their functionality affects the functional interrelations of the larger form of organization of modern societies in which these infrastructures are situated (Lukitsch et al. 2018, 16–17). The inherent connection between infrastructures and society is also the root of infrastructural vulnerability. Because the continued existence of modern societies and the provision of critical infrastructure services depend on each other, these infrastructures represent vulnerable points in the larger organizational form of societies (Eifert et al. 2018).

Urban infrastructures may be exceptional examples of inherently needful structures, but this particular form of needfulness seems to pervade all of the human sociality in its myriad organizational forms. The exact composition of larger constellations between people and things may take many forms, but they are all grounded—in one way or another—in people's material and immaterial requirements and wishes, as well as in the inability of these people to satisfy them on their own. Whether in the case of families, political parties, factories, or urban spaces, all these constellations are permeated by goal-directed human actions to satisfy these requirements and wishes.

This work seeks to explore the close relationship between human needs and desires, their material and immaterial requirements, wants, and wishes, the demands and requirements of the built world, and the forms of organization that hold both humans and the built world together. The central claim is that the complexity of societal constellations must be understood through the requirements, wants, and wishes of individuals, as well as through the actions that these individuals perform to satisfy them. Such an understanding allows one to understand the practical constraints that pervade these constellations as a result of human action itself. Eventually, this understanding will also allow for the reassessment of the inseparable relation between human existence, technology, and forms of organization throughout human history. To achieve its aims, this work reconstructs the foundations and inner workings of social organization that Jean-Paul Sartre explores and outlines in his philosophical writings, and, in particular, his theories on practical ensembles.

Research Problem

In his later work *Critique of Dialectical Reason*,[1] Sartre concerns himself with the situation of historically situated individuals and the claim that these individuals are both products and (re-)producers of their sociocultural and material situation (Sartre 1978, 97). Sartre's later works, especially *Critique*, represent a fusion of his existentialist philosophy with Marxist thought. Although the later Sartre advocates a material monism, he objects to the dominant Marxist beliefs of his time, especially those that claim the world to be subject to materially dialectical laws of nature. Opposed as he is to the belief that matter is dialectical in itself, Sartre claims that free, individual human action, in confrontation with the physicochemical world, to be that which manifests a dialectical progression of history in the first place. Consequently, to understand history, it must be examined based on human action and experience (Sartre 1978, 40–43). To analyze this entanglement, Sartre undertakes a complex argument about the dialectical character of human existence and the products and structures that arise owing to humanity's engagement with their material surroundings. He applies a specific mode of dialectical thinking, which, at its core, seeks to depict processes in which initially contradicting, incompatible, or categorically different aspects of a certain thing in question are brought together toward a more holistic and actionable understanding of the said thing. He

1 The current work relies mostly on Volume I of *Critique of Dialectical Reason*, because it is there that Sartre outlines his theories on practical ensembles. For this reason, Volume I will simply be referred to as *Critique*. *Critique II*—subtitled *The Intelligibility of History*—remains unfinished but has been edited by Elkaïm-Sartre (1991). Although it contains other insights into practical ensembles, its unfinished status means that quotations and passages from the second volume are used sparingly throughout this work.

advocates a processual understanding of human existence, reality, and history as driven by the dialectical character of human experience and action. Both must be understood as inherently dialectical and synthetic interrelations between humans and their surroundings.

Throughout his philosophical oeuvre, Sartre conceives human action as ontologically free and intentional. At the same time, human action is fundamentally driven by how basic and more complex requirements, wants, and wishes project toward certain intended ends; these ends somewhat abstractly outline how courses of action are to be realized. Sartre's understanding of these requirements, wants, and wishes changes across his works. In *Being and Nothingness,* Sartre conceives of them as *desires*, whereas in *Critique* he conceives of them as *needs*. However, the distinction between *desire* and *need* must be understood in terms of neither a difference between immaterial wishes and material requirements nor a more conscious or more affective relation to a certain object. Rather, in Sartre's case, the difference between needs and desires is one between the level of abstractness or concreteness in how human beings relate to their material surroundings based on what and how they require, want, or wish for something. In this understanding, *desires*, translated from Sartre's French term *désir*, represent concrete and socially structured modes in which human beings relate to their surroundings based on their material and immaterial requirements, wants, and wishes. Needs, based on Sartre's French term *besoin*, represent abstract and initially unstructured ways in which human beings make these relations. Through peoples' active and practical membership in societal constellations, their abstract needs (as *besoins*) are transformed and concretized into desires (as *désirs*). This means that human beings are fundamentally adapted to the societal constellations they are situated in, and the adaptation occurs by how these constellations enable them to relate to and satisfy their requirements, wants, and wishes through actions. Performing such actions is a synthetic act that unites materially physical aspects—requirements, wants, bodily activity, instrumental means—and mental aspects—wishes, intentions, ends—by causing effects in the material surroundings to transform them following some intended result.

Due to its synthetic character, Sartre claims human action to be an instantiation of a rather abstract dialectical principle which he refers to as dialectical *totalization*. A totalization represents a synthetic activity in which individual (physical or mental) aspects of a thing or moments of a process are actively brought together as parts of a whole—a so-called *totality*—thus giving rise to this totality in the first place. Totalization proceeds in a dialectical three-step of *position*, *negation*, and *negation of the negation*, also known as *sublation*. Sartre derives this principle by questioning the process of how human experience and action come to their respective results. These results are totalities comprising different aspects. In the case of experience, it is sensory input, expectations, practical aspects, etc. In the case of action, these aspects are an agent's intentions, bodily requirements or wants, attitudes, etc. Owing to its

totalizing nature, action must be understood as situated in socioculturally and materially structured constellations that co-constitute the frame in which this action takes place. These situated actions can be understood as structural moments in the overall processing of human existence and history. Although human beings might thus not be practically free to do as they please, they are nevertheless ontologically free. This freedom cannot be taken from them, as it is the abstract foundation they use to realize themselves by conducting concrete, totalizing actions for themselves as ends in themselves in the first place.

Sartre claims that to understand the full extent of human existence and reality, the larger constellations and historical transformations in which human action and existence are situated must themselves be understood to mirror this totalizing process. Through this understanding, human reality in its entirety becomes intelligible as a dialectical totalization that is fundamentally driven by the ontologically free and goal-directed actions of human beings to satisfy their requirements, wants, and wishes; they do so by concretizing their abstract needs into desires. In the course of *Critique*, Sartre further outlines this understanding.

In this later work, Sartre analyzes societal constellations of human and non-human elements in dialectical interrelation with each other—such as societal classes, revolutionary groups, national economies, or people at a bus stop—and scrutinizes the dynamics of their formation and transformation from what is now known as a *praxeological* perspective. Despite the subtitle of *Critique* (Sartre 1978)—*Theory of Practical Ensembles* (French *Théorie des ensembles pratiques*)—, Sartre does not use the pair of terms *practical ensemble* very often to describe such constellations. He frequently uses pairs of terms such as *social ensemble* or *serial ensemble* (e.g. 55), *human ensemble* (e.g. 65), society as *complex ensemble* (e.g. 121), the world as *ensemble* (e.g. 128), *material ensemble* (e.g. 185), and *technical ensemble* (e.g. 193). He does so depending on the elements and interrelations he intends to foreground. Since this work explores the conditions of possibility for the formation of such constellations, it uses the general term *practical ensemble*. Understanding societal constellations as practical ensembles reveals two facts: first, these constellations are permeated by human actions and, therefore, by needful individuals; second, these constellations consist of at least two elements in practical interrelation to each other. In this regard, any ensemble in the Sartrean sense, whether social, serial, communal, technical, natural and so on, must be understood as a practical ensemble.

This praxeological and dialectical perspective can be applied to the central claim of this current work. Understanding the dialectical interrelation between human existence and practical ensembles reveals both the conditions, possibilities, and constraints of goal-directed human action, and the inner workings, demands, and requirements of the forms of organization in which this action is situated. However, three factors complicate the understanding of Sartre's theories on practical ensembles. The three factors must be discussed in detail.

First, despite the subtitle of *Critique*, Sartre himself does not provide a systematic theory of practical ensembles. The main reason for Sartre's analyses of practical ensembles is to uncover the very conditions of possibility by which a dialectical progression of human history becomes intelligible in the first place. Sartre claims that this basis must be sought in the dialectical processes that pervade human action and experience. Consequently, he is much more concerned with the significance of human action and freedom than he is with the actual composition of practical ensembles. Despite his broad perspective on societal constellations and his nuanced descriptions of formation and transformation processes, individual action represents Sartre's methodological lens and his principal subject of inquiry. For this reason, Sartre's *Critique* can only with reservations be called a social ontology. Rather, it can be more properly understood as a dialectical and praxeological philosophy that examines the conditions of individual human existence in larger constellations by accentuating the social aspects of the practical relations between the elements of these constellations. Thus, the dynamics of social constellations such as social groups, societal classes, institutions, and society as a whole, as well as their role in historical processes, are at the heart of *Critique*.

Second, Sartre's early works have received much more attention than his later philosophy. Discussions on the implications of Sartre's later social thought can be found in Hartmann (1966), Young (1994), Boyle (2005), Rae (2011), and Richter (2011). The role of things in the constitution of social groups has been analyzed by Blättler (2012) and Kleinherenbrink and Gusman (2018). Sartre's general approach in *Critique* is analyzed by Flynn (1997; 2005), and by Simont and Trezise (1985). Approaches toward more specific aspects of Sartre's later philosophy, such as action, value, totalization, and counter-finality, can be found in Catalano (2007), Tomlinson (2014), Turner (2014), and Boria (2015). A broader conception of the practico-inert is provided by K. S. Engels (2018). More general approaches to Sartre's thoughts on technology can be found in Bonnemann (2009) and Weismüller (1999), to name but a few. Cannon (1991; 1992) provides an extensive psychological reading of Sartre's later philosophy. This work draws on Cannon's previous work on Sartre's conception of needs and desires. Ally (2012; 2017) applies Sartre's theses to ecological processes and understandings.

This list of authors is in no way complete; it is merely intended to illustrate the wide variety of topics covered by Sartre and his exegetes. Although some literature deals with various aspects of Sartre's later works, nothing specifically highlights Sartre's theoretical considerations about the fundamental structures of practical ensembles. This may be a result of the inconsistency of his examples. The underlying principles of Sartre's structural considerations about practical constellations are obscured by the social focus and by the general use of the term *ensemble*. The fact that a systematic theory of practical ensembles remains largely unexplored by Sartre

and his scholars presents both a major challenge and a great opportunity for the current work.

Third, Sartre's often multilayered philosophical ideas and concepts can be hard to grasp, which complicates an understanding of their interplay within practical ensembles. Practical ensembles must be understood as historically transformational processes, as permeated and fundamentally driven by the free actions of individuals, and as inherently mediated by technology in the form of material objects and structures. Therefore, a full understanding of the inner workings of practical ensembles requires insight into their historical, action-theoretical, and technico-philosophical foundations. These foundations, however, have to be built up first, especially in the case of Sartre's different conceptions of action and his dialectical conception of technology.

Research Approach

This work aims to explore and systematize the theoretical foundations, principles, and dynamics of practical ensembles in Sartre's philosophy, to outline a theoretical framework about them, and to apply that framework for an understanding of societal constellations—in this case, urban mobility—as *needful structures*. To achieve this goal, this work will examine three fundamental aspects of Sartre's philosophy.

First, it is necessary to understand and reconstruct Sartre's general philosophical outlook, as well as the development of his ideas throughout his works. This work advocates for a complementary reading of Sartre's philosophical oeuvre and for the fact that a more complete understanding of his philosophical concepts requires a reconstruction of how certain concepts change and other concepts mutually complement each other. Borrowing Sartre's words, this means that the totality of his philosophy must be understood by reconstructing its totalization. This complementary reading and reconstruction is of central importance. In *Being and Nothingness*, Sartre lays down the existentialist foundations of his philosophy. Here, he introduces his idea of ontological freedom and develops a general conception of human action. Although the early Sartre already uses the concept of *totalization* to refer to the synthetic character of human existence as a unity of being and nothingness, he is much more concerned with the question of why this unity can never become a completed *totality.* In *Critique*, he builds on these thoughts and elevates the concept of *totalization* to the materially dialectical basic principle of human existence, experience, and action. According to Sartre, human existence is a constant mediation of internal and external dialectics. He claims that understanding this constant mediation makes it possible to understand history. History, in this regard, is ultimately understood to progress through material transformations of socioculturally and materially structured constellations that consist of practical relations between humans and non-

human elements in a certain environment. It is here one finds Sartre's thoughts on practical ensembles.

However, before addressing Sartre's thoughts on practical ensembles, the second fundamental aspect of his philosophy, namely his view on the structures of human action and existence as a *praxis*-process, must be explored and further developed from an action-theoretical point of view. The reason for this perspective is the importance Sartre gives to human action in general, and to instrumental means in the formation of practical ensembles in particular. Despite the fundamental role of human action throughout Sartre's philosophy, and his general remarks about human action and history, there is no unified action-theoretical conception in his philosophy or in that of his exegetes that provides a structural understanding of action as both a mediation of internal and external dialectics and a goal-directed and totalizing endeavor driven by the dialectic of need and desire. The reason for this conceptual lack may be attributed to the fact that Sartre proposes two seemingly irreconcilable action concepts in his philosophy—the free action as self-projection in *Being and Nothingness* and the materially constrained, historically situated *praxis* in *Critique.* Only an action-theoretical understanding that unifies these action concepts based on the dialectical principle of totalization can provide the foundation for outlining the inner workings and overall structure of practical ensembles. Furthermore, Sartre provides many examples of how instrumental means mediate human actions and how this mediation, in turn, affects the larger structure of societal constellations. Thus, to understand the intricacies of human-technology relations in Sartre's philosophy, this action-theoretical approach is also needed.

Practical ensembles are societal constellations in the constant process of totalization. This process is driven by the structured relations between individual historical agents, other agents, and instrumental means. These agents engage in constellations to satisfy their requirements, wants, and wishes. How agents are motivated to take up goal-directed behavior stems from how these agents totalize themselves and their world through their needful interrelation with their environment and how their abstract needs are concretized as desires. This again returns to the overall form of organization of practical ensembles as needful structures. To develop an understanding of practical ensembles, it is not enough to state that human beings have certain physical or mental necessities and urges, or that they act in specific ways to satisfy them. Rather, the exact role of these needs and desires in the motivational structure of action, as well as the concrete course of these actions, must be demonstrated. Although this exposition eventually has some thematic overlaps with Sartre's broader historical account of action, it approaches the structure of action from a different angle. This does not just render the very course of action intelligible as a mediation of internal and external dialectics; it also lays the foundation for the third fundamental aspect of Sartre's philosophy.

That third fundamental aspect is his dialectical conception of technology. Throughout his works, Sartre concerns himself with the relationship, similarities, and fundamental differences between human beings and things. Here, Sartre has a dialectical understanding of instrumentality: he claims that a thing only becomes an instrumental object in the totalizing relation between agent and end. Furthermore, he says that human existence is technologically mediated. However, this form of mediation only becomes intelligible through an action-theoretical understanding of human existence.

Despite the social emphasis of Sartre's later work, reflections on the relationship between human action and technology, such as tools, machines, and consumer goods, provide the theoretical background for his philosophy. Insofar as material entities are manufactured, they must be considered *practico-inert*. As such, they must be understood as results of former actions. Practico-inert objects have specific material properties by virtue of which these objects not only signify possible options for action but also mediate and manifest human interrelations—and thus mediate and manifest the structure of societal constellations as well. According to Sartre, "these heavy, inert objects lie at the basis of a community whose bonds are, *in part*, bonds of interiority. It is through this interiority that one material element can act on another from a distance […] social facts are things in so far as *all things* are, directly or indirectly, social facts" (Sartre 1978, 179).[2]

Foregrounding and further developing Sartre's reflections on human-technology relations from a philosophical perspective on technology helps to better capture some of his fundamental insights and to apply them to understanding practical ensembles. This is especially true for the multifarious ways in which human agency and technology interrelate and influence each other in these systems. Rather than accentuating social dynamics and understanding practical ensembles primarily as social ensembles, this work highlights the interrelations of humans and technology in these ensembles and demonstrates that technological artifacts must be given equal significance for the totalizing processing of practical ensembles.

Based on a general notion of these fundamental aspects, one can engage Sartre's understanding of societal constellations as practical ensembles. Such an understanding has deconstructive and reconstructive aspects. First of all, it reveals societal constellations to be in the constant process of totalization based on human actions. Therefore, this understanding allows one either to examine the function

2 Sartre comes to this conclusion by accepting both Durkheim's maxim to *treat social facts as things* and Weber's response according to which *social facts are not things*. In recognizing that social relations represent material interactions that are always mediated by matter, either in the form of the human body or material objects, he takes a middle position between Durkheim and Weber. However, a comparative analysis of these views cannot be provided in this work.

of the organizational form of societal constellations and scrutinize the structural elements—i.e. *partial totalities*—, which this organizational form consists of; or to reconstruct the nature of interrelations between these partial totalities as structural moments in the overall totalization. In this regard, a practical ensemble resembles a system (Ropohl 2009, 75). Furthermore, conceiving such constellations as practical ensembles allows one to understand how the partial totalities in these constellations become mutually adapted to the overall form of organization the constellations take over time. According to Sartre, such adaptations take place through material change, technological development, habit formation, and habituation. Eventually, the formation of habits and concomitant attitudes towards actions entails an association of instrumental means with the continued existence of human beings within these constellations. Therefore, when analyzing them, it is paramount to not lose track of the fundamental significance of human requirements, wants, and wishes, the way abstract needs are concretized into desires, and the way human action is technologically mediated.

Eventually, the general framework of practical ensembles can be applied to societal constellations of human and non-human elements to reveal their structural interrelations. A factory, for instance, when conceived as a practical ensemble, presents itself as a constellation of laborers, directors, machines, and work routines, among other things. The overall function of this constellation is to produce goods. Scrutinizing the partial totalities as structural elements of this overall totalizing process, it becomes obvious that human requirements, wants, and wishes, as well as the dialectic of need and desire, pervade this organizational form. Laborers work for wages to reproduce themselves as laborers. Directors employ laborers for profit when selling goods for a higher price than their production required owing to the surplus value of the laborers' work. These goods themselves are needed or desired by others who are willing to pay for them. Machines and work routines support, manifest, and stabilize these labor processes by material inertia, both in the features and characteristics of machines and in the habituated and thus incorporated institutional rules and labor processes within the laborer's bodies. In this regard, a practical ensemble resembles a system in which the interaction of subsystems (laborer, director, machine) define the mode of operation of the system (factory) in relation to the system's environment (a societal system in demand for goods).

The fundamental tenet of this research approach is comparable to the one mentioned by Ally (2017). He writes that the task of his book *Ecology and Existence*—a fusion of Sartrean thought and ecology—is not so much to think *about* Sartre but "*to think with and beyond him*, and even to stretch and bend his thought here and there, without breaking it" (5, emphasis in original). The same also applies to this work, insofar as it advocates for a novel reading of Sartre as a praxeologist, an action theorist, a philosopher of technology, and a quasi-system theorist.

Motivation and Research Context

The personal motivation for this work is a long-standing interest in the conditions of human existence, the bonds and boundaries of human freedom, the potential for self-realization, and the possibilities and constraints of a technologically mediated life. Against this motivational background, it stands the question why Sartre's thoughts still have relevance for the contemporary challenges of the human condition. Current global, social, and technological developments—global warming, increasing social conflicts and disparities, and the rise of digital technologies and AI—make it necessary to take a particular look at the mechanisms by which the social systems in which one is situated come into being, the role that technology plays in them, and whether the ways in which these systems are organized actually meet one's underlying needs. Sartre's decidedly existentialist perspective on technology, society, and history allows one to understand and reassess one's position and role within social dynamics and systems and to reorient how one may engage with the world to make a change.

Academically, the work itself is situated within the research training group KRITIS at TU Darmstadt and represents an extended version of the author's PhD thesis that was titled *Needful Structures: The Dialectics of Practical Ensembles and their Significance for Understanding Urban Mobility.* KRITIS is concerned with a general understanding of networked urban infrastructures, the critical significance of these structures for modern societies, and the potential challenges and risks resulting from their composition. Concerning the research program of KRITIS, this work emphasizes the *construction* and *transformation* of the conditions of possibility for critical infrastructures. However, this must not be understood in a purely technical way. Within the research program of KRITIS, urban infrastructures are considered sociotechnical systems, or *systems of systems*, that comprise a functional interplay of people, things, large built structures, rules, regulations, and so on (Engels et al. 2021).

Sartre's approach lends itself to such an understanding. It too conceives of societal constellations as structured interrelations between partial totalities, which can again be scrutinized for their composition. Furthermore, it emphasizes the fundamental role of material and immaterial requirements, wants, and wishes in the dialectic of need and desire for understanding the inner workings of these constellations. Lastly, Sartre's conception of the practico-inert allows one to conceive of urban infrastructures as materially inert residuals of former actions, which manifest certain strategies of tackling supraindividual needfulness by concretizing abstract needs into desires.

This work intends to make a theoretical contribution to the study of Sartre's philosophy by providing new perspectives on various aspects of Sartre's works and pro-

moting interest in Sartre's historical and theoretical ideas on action, his philosophical thoughts on technology, and his understanding of societal constellations.

Beyond that, this work is also located in the larger field of approaches toward the study of science, technology, and society (STS). It is especially applicable to approaches that assume a dependence between practice and materiality (Schatzki 2010) or a sociomaterial interweaving of practice, materiality, and forms of organization (Pickering 1995; Orlikowski & Scott 2008), or that deal with the research of infrastructures (Shove 2016; Shove & Trentmann 2019). In terms of the philosophy of technology, the work is situated in debates about a dialectical philosophy of technology (Hubig 2006) and the supposed power of and through technology (Hubig 2015), as well as postphenomenological approaches toward technological mediation (Ihde 1990; Rosenberger & Verbeek 2015). In addition, problems of habit formation are taken up as well (Sparrow & Hutchinson 2013). This work intends to make a practical contribution to infrastructure research, as it seeks to develop a sociomaterial understanding of larger forms of societal constellation from a philosophical and anthropological perspective. It is also meant to sharpen views on usually obscured modes of structuring that affect human existence and action.

How Sartre conceives of structured compositions of human and non-human elements, which practically interrelate to perform actions, has thematic overlaps with other approaches, such as Foucault's analyses of *dispositifs* and Latour's conception of hybrid action in actor-network constellations (Richter 2011; Hubig 2015) and other approaches that investigate the relation between *agents*, *action*, and *structure* (Giddens 1986). However, this work does not engage in comparative discussions about these approaches. Another related line of research that will not be examined here is assemblage theory (Deleuze & Guattari 2005; DeLanda 2006). However, the current work aims to be a foundation for future research in this regard.

Structure of this Work

This work is divided into two parts. Part I, containing the first three chapters, deals with the dialectical foundations of practical ensembles. Part II, in Chapters 4 and 5, then deals with the theory and *praxis* of practical ensembles.

Chapter 1 approaches the first fundamental aspect of Sartre's philosophy. It explores the core themes of Sartre's works *Being and Nothingness*, *Search for a Method*, and *Critique of Dialectical Reason* to reconstruct Sartre's philosophical development. The chapter leads chronologically through Sartre's works and demonstrates that Sartre consistently concerned himself with the dialectic of human existence. Whereas Sartre's early works lean more toward internal dialectics (section 1.2), his later works represent approaches to examine (section 1.3) and even unify the internal and external dialectics of human existence (section 1.4). The last section of the chapter examines some of Sartre's thoughts on the dialectical progression of history

to illustrate the fundamental significance of human action in that process. The first chapter as a whole, therefore, aims to clarify the fundamental role of human action in Sartre's philosophy by reconstructing the complementary nature of his works. However, merely a historical account of the significance of action is provided at this point. This account lays the foundation for Chapter 2.

Chapter 2 turns the focus from the significance of human action for the progression and intelligibility of history to the structural characteristics of the action itself. The different foci of Sartre's works mean that a unified conception of action can hardly be identified on the surface of his philosophy. In *Being and Nothingness*, Sartre provides a relatively technical definition of action as the realization of ends through the employment of means, both in the form of the body and in the form of instruments. In his early work, individual action represents the situated realization of individual existence. In *Critique*, the *praxis* of historical human beings is emphasized as a socioculturally situated activity that takes place within a mediating material milieu. However, in *Critique*, Sartre also points toward totalization as the underlying principle of action. Therefore, the chapter is preceded by a technical reconstruction of Sartre's concept of *totalization* as the basic principle of human-world interrelation, and *totality* as the (temporal) outcome of totalization (section 2.2). The remainder of the chapter brings together action-theoretical thoughts from *Being and Nothingness* and *Critique* to develop a conception of situated action based on the dialectic of need and desire. The analysis begins with a closer look at the existentialist roots of Sartre's action-theoretical thoughts. Here, human existence becomes comprehensible as an existential lack that seeks completion. Based on this existential foundation, a Sartrean conception of situated action is developed. According to this conception, human action is an ontologically free, intentional, yet inherently need- and desire-oriented endeavor (section 2.3). This conception will be further developed and integrated into Sartre's understanding of human existence as an ongoing, autopoietic, and totalizing *praxis*-process (section 2.4).

Chapter 3 explores Sartre's philosophical thoughts on technology. The chapter proceeds less chronologically than it does thematically. From the dialectical character of action in Sartre, it follows that the use of instrumental means must be understood as a dialectical totalization as well. In this context, Sartre's understanding of the body as the center of an individual field of possibilities and how he links his thoughts to Heidegger's concept of *equipmentality* are introduced and scrutinized (section 3.2). According to Sartre, manufactured objects and body techniques not only serve as instruments but also signify certain forms of conduct by virtue of their materiality. They also refer to larger supraindividual forms of organization and history (section 3.3). The chapter concludes with a technology-focused exploration of Sartre's understanding of the practico-inert (section 3.4). The *practico-inert* is a fundamental concept in Sartre's later philosophy. It is significant for the formation of

practical ensembles. It describes the fact that certain forms of conduct become materially inert in instrumental means.

Chapter 4 forms the thematic focus of this current work. Here, the theoretical framework of practical ensembles is developed based on the previous findings. The chapter begins with an examination of Sartre's conception of humanity's struggle against *scarcity*. This concept is rather important in Sartre's later work, as it represents the fundamental condition for humanity's needful relationship with its surroundings. According to Sartre, all forms of societal organization arise in a scarce material milieu. This means that societies emerge in an attempt to deal with the fact that there are not enough resources for everyone's survival at a given time. Therefore, resources must be gathered, rationed, and distributed in a certain socially organized way. Furthermore, access to certain resources must be secured (section 4.2). The analysis of this conception is followed by more focused analyses of processes according to which practical ensembles coalesce through serial modes of structuring (section 4.3), and of how these serial modes transform into communal modes of structuring (section 4.4) based on how individuals can satisfy their requirements, wants, and wishes. Following this, the persistence of practical ensembles is examined through Sartre's conception of *hexis*. This concept is neither well developed by Sartre himself, nor is it well researched in Sartre studies. Its significance is shown, however, for understanding how societal constellations stabilize and persist over time (section 4.5). This is followed by a more thorough examination of how the workings of practical ensembles generate external effects that act back on them in the form of *counter-finalities* (section 4.6). The chapter concludes with a discussion about the general understanding of the practical ensemble framework (section 4.7).

Chapter 5 applies Sartre's theories to urban mobility systems. It explores how urban mobility systems can be understood as practical ensembles, how the flow of urban mobility results from the structured interrelations between different users of urban infrastructure systems, how their interrelations are mediated by each other, and how urban dwellers escape the serial structuring of their practical ensembles through desire paths (section 5.2). In light of this, anthropogenic climate change is re-read as a Sartrean counter-finality (section 5.3). After this, infrastructures are scrutinized regarding their critical function for society among others (section 5.4). The chapter concludes with a more focused analysis of urban infrastructures as needful structures with the help of three key concepts in infrastructure research: resilience, criticality, and vulnerability.

I Dialectical Foundations