The Relationship between Physics and Sociology: An Epistemological and Methodological Perspective

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Abstract

Modern science is a methodical way to learn, unlike common knowledge. This study examines the deeper relationship between physics and sociology from an epistemic and methodological standpoint. Physics has evolved from early efforts to understand the environment to mathematical representations and complex physical interpretations. The Newtonian physics concept, which stressed the universe's intrinsic order revealed by observation and evidence, drove this transformation. Modern sociology seeks a methodical, empirical understanding of reality, like classical science. Its quantitative study of society is called "social physics," based on physics. The study compares physics and sociology's epistemologies, exploring empiricism, realism, and constructionist viewpoints in physics and positivism and interpretative methods in sociology. The paper compares rational choice theory to social science physics rules to show how physics is an archetype for science. Actor-network theory connects physics and social processes. Historical examples show how early sociologists, motivated by physics, established social statics and dynamics, making sociology a scientific subject. In sociology, Emile Durkheim's structural-functionalism and Talcott Parsons and Niklas Luhmann's social equilibrium theories use physics concepts. In conclusion, this work reveals the complex relationship between physics and sociology, increasing our comprehension of both sciences and their contributions to knowledge.

Keywords: Sociology, Physics, Epistemology, Social physics

Introduction

In the modern day, science embodies a method of knowledge acquisition that is significantly more disciplined and methodical than the layperson. Science has gone through numerous painfully slow phases of development (Sjoberg & Nett, 1968). Physics has developed from an early endeavor by scientists to comprehend the operation of their immediate environment to a collection of mathematical descriptions and contradictory physical interpretations (Bill, 2014). A work of the modern era is social science. Its origins can be traced back to the ongoing, since the sixteenth century, effort to create systematic, secular knowledge about reality that is somehow supported by empirical evidence. For several decades now, the so-called classical view of science has been the prevailing one. It was founded on two tenets. One was the Newtonian physics model and Cartesian Dualism. The Newtonian physics model holds that the past and future are symmetrical. This was a quasi-theological vision in which everything coexists in an eternal present and we, like God, can achieve certainty. As a result, we need not distinguish between the past and the future (Wallerstein, 1996). Newton was interested in "facts" in the data of experience; the aim of

his investigations, and his principles were mainly based on experience and observation: Newton's research was predicated on the idea that there is a universal order and law in the physical universe. Facts are not a disorganized, random collection of disparate components; on the contrary, they seem to fall into patterns and have distinct forms, regularities, and linkages. According to Newton, order is inherent in the cosmos and can only be found via observation and the gathering of evidence rather than by applying the abstract concept. According to Newton's law, the rate at which planets are drawn to the sun is inversely proportional to the square of the distance between them and directly inversely proportional to their mass. So the collaboration of the natural phenomena is reduced to a single universal formula. The same force that kept the planets in orbit caused everything to fall to the ground. All space and time were subject to the law. The limited universe has evolved into an unstoppable machine powered by its processes (Zeitlin, 1968).

A man could easily be viewed as no more than a molecule by a gigantic spectator who was himself the size of the earth. A viewer from such a vantage point would find that, like gas molecules, groupings of men follow some basic physical rules if equipped with the right tools for gauging population densities and motions. The viewpoint would be advantageous for developing a precise social science, or "social physics." Numerous researchers have approached the study of societies by using the analogies and precision of physics. At least since the French philosopher Auguste Comte in the nineteenth century, the phrase "social physics" has been used. Social physics examines how people interact regarding space, time, and number. It is the quantitative study of society, to put it briefly. Its starting point is data from statistical analyses of people. It draws on mathematical physics whenever appropriate for ideas and analogies that appear helpful as guides for identifying and arranging social notions (Stewart, 1948). Auguste Comte held that every scientific research passes through a series of stages before arriving at the final, or positive, step and that the sciences are sequentially and logically related. He advocated for the study of society to develop into the science of society, believing that it was time for investigations into social issues and social phenomena to reach this final level. The name "sociology" that Comte gave to his new study was problematic from several perspectives. The word "sociology" is made up of the Latin words ‘socius’, which means companion or colleague, and ‘logos’, which means word. The phrase was created as a result of these two. Using components involves discussing society. Another nineteenth-century philosopher and social thinker, John Stuart Mill, offered the term "etiology" for a portion of the new discipline. Although this phrase has the advantage of being entirely Greek, other writers seem to have never found it to their taste. When Herbert Spencer developed his systematic study of society in the second half of the 20th century and openly used the word "sociology" in the title of his work because "the convenience and suggestiveness of our symbols are of more importance than the legitimacy of their derivation - it became the official name of the new science and sociology (Wallerstein, 1996). From physics, sociology is built up. As a result, it broadens the definition of "science" without losing the distinctions between the many disciplines. Conversely, if one continues the reverse process of reductionism from sociology to physics, one loses, at every reduction, the unique characteristics of the separate sciences.

Epistemological Foundations of Physics and Sociology

Notwithstanding certain instances of overlap, the epistemic underpinnings of sociology and physics are very different. Empiricism emphasizes empirical evidence's relevance in advancing knowledge. According to empiricists, only sensory experience and observation may lead to knowledge acquisition. This method is sometimes compared to positivism in sociology, which aims to create scientific knowledge of social phenomena through empirical facts. Empiricism is a crucial foundational principle in physics as well because the scientific method relies on the observation of natural phenomena to generate hypotheses and theories (Comte, 1830). (Wallerstein, 1996) Outlines the realist and constructionist views of epistemology, which are both essential to contemporary physics. According to the realist interpretation of physics, the physical universe can only be understood by observations and experiments. The constructionist theory of physics accepts the value of observation, experiment, and description while contending that the physical laws themselves are a result of the interaction between observation, experiment, and the way that people perceive reality. According to this theory, scientists used their creativity to describe and understand the physical world, which led to the development of physical laws. The positivists held that the social sciences were still in their infancy and that they could advance by emulating the models employed by the most sophisticated sciences, such as mathematical physics. This implied that the social sciences need general rules, nomological models of explanation and prediction, and axiomatic theories. The issues that severely strained the positivist theory and fueled criticism of it were specifically caused by the transfer of the hypothetical-deductive approach from the natural sciences to the social sciences. This method is sometimes compared to interpretive in sociology, which aims to comprehend social phenomena from the viewpoint of the individuals and groups concerned. Some academics contend that social and cultural variables shape scientific knowledge, which has been the subject of social constructionism applied to the study of scientific knowledge itself in the field of physics (Berger, Luckmann, Latour, & Woolgar, 1966,1986). According to realism, there is an objective reality that does not depend on human interpretation or perception. Realists place a strong emphasis on comprehending the fundamental principles and structures that give reality its shape. This method is frequently compared to critical realism in sociology, which looks at both the structural and agential components of reality to establish a thorough understanding of social processes. Realism is a key tenet of physics since it serves as the foundation for the creation of scientific ideas that attempt to describe the natural world (Bhaskar, 2008). According to postmodernism, knowledge is always subject to context and contingency. There is also no such thing as objective reality or truth. Understanding how language and power shape knowledge and understanding is crucial, according to postmodernism. This method of sociology is frequently compared to post-structuralism, which aims to dismantle established ideologies and hierarchies. Postmodernism has been used to explore the social and cultural influences that shape scientific knowledge in the field of physics. The study of the social and cultural influences that shape scientific knowledge has been incorporated into postmodernist physics (Lyotard & Pickering, 1979. 1995). In sociology, the theoretical process starts with isolating some fundamental features of the social world. Differentiation among societies is one such feature. If we can all agree that this is something that happens among people everywhere

and always then we can go on to the next step, which is to relate this attribute to other aspects of the social universe (Turner, 1979).

Methodological Approaches to Linking Physics and Sociology

Astronomy and mechanics in physics serve as the archetype and role models for science in general. These are the core ideas in physics: observation, experimentation, theories derived from laws, mathematization, closed world, determinism, causation, and reductionism. The application of physical laws of social science can be seen as a special instance in the rational choice theory. In contrast to the central idea of physics laws of social science, which holds that all human behavior is governed by fundamental quantum mechanics equations, the central premise of the rational choice theory is that people's rational behavior can be explained using logical and mathematical reasoning. Hence, provided that mathematical and logical arguments represent the dynamics that quantum mechanical equations provide (Wayne, 2013). The study of human society is called sociology. According to Auguste Comte, sociology is a broad approach to the study of society. In a sociological study, there are two methodological problems. In both empirical and logical science, sociology is scientific information that can be approached in one of two ways. One (sometimes referred to as empiricism) is the method that emphasizes experience and the truths gleaned from experimentation and observation. The second referred to as rationalism, emphasizes reason and the theories that come from logical inference. Facts are gathered by the empiricist and coordinated and organized by the rationalist (Bierstedt, 1970). Auguste Comte used the term social physics to describe social phenomena. The concept of "social physics" is reintroduced in this work, aiming to identify universal characteristics of the social realm that are not limited to specific temporal, spatial, or contextual circumstances. The inquiry starts with a preoccupation with the fundamental aspects inherent in all forms of social organization(Turner, 1979).

Social physics uses mathematical models to study and forecast human behavior. To explain social processes, the field of research known as social physics now makes use of big data and computer techniques (Pentland, 2014). Social systems are networks of actors, both human and non-human, connected by different kinds of relationships. To comprehend the dynamics of social systems, actor-network theory uses physics principles from the fields of systems theory and network theory. It highlights how crucial it is to research how individuals interact with one another as well as how non-human factors like technology shape social occurrences (Latour, 2005). Both the positivists and their detractors disregarded biology while establishing a connection between physics and sociology. As sociology is a science like physics, the positivists' perspective on social reality is clear and precise: The elements that make up its reality have characteristics with physical elements and objectively exist apart from people. It is possible to identify social reality's laws and mathematically represent them because of this reality's objective existence. For a more complete knowledge of social phenomena, critical realism aims to combine the insights of both physics and sociology. Social systems are intricate and cannot be broken down into their parts. It also acknowledges that both social and material causes influence social phenomena (Bhaskar, 2008).

Empirical Examples of Integrating Physics and Sociology

From sociology's origins, we see little of our theoretical constraint. Post-Newtonian social philosophers like Comte and Spencer were optimistic about sociology. They were also interested in modern sociologists' empirical work. Contrary to current sociologists, they allowed methodological constraints to limit their theoretical originality (Turner, 1979). As part of his positivist approach to analyzing society, Auguste Comte established the idea of social statics and dynamics. While social dynamics is concerned with how society changes and develops, social static studies the institutions and structures that keep society intact. To formulate these ideas, Comte drew inspiration from the principles of physics. He said that just as the laws of nature govern the physical world, so too do they govern social interactions and human conduct. He argues that social statics is concerned with "the laws of order and stability that regulate society," while social dynamics "concerns the laws of progress and development that govern the historical evolution of society. The emergence of sociology as a scientific field was influenced by Comte's theories on social dynamics and static. He established the foundation for later sociologists to build upon with his positivist method of societal analysis, which placed a focus on empirical observation and the application of scientific techniques. Auguste Comte's ambition included the development of a scientific discipline aimed at exploring the inherent characteristics of social phenomena within the realm of human society(Turner, 1979).

The idea of social equilibrium was first mentioned in sociology by French sociologist Emile Durkheim. The balance that exists in a society when its constituent elements are in accord with one another was described by Durkheim using the physics notion of equilibrium. The sociological theory of structural-functionalism, which emphasizes the interconnectedness of various components of a social system and the necessity for those components to cooperate to sustain social stability, was influenced by Durkheim's views. Several sociologists have expanded on the idea of social equilibrium by using it to investigate social systems and social change, including Talcott Parsons and Niklas Luhmann. The condition of balance exists in a social system when its components are in harmony with one another using the notion of social equilibrium. He maintained that social systems seek balance and that when the equilibrium is disturbed, social change takes place (Parsons, 1951). Developed the idea of social systems theory, which holds that social systems are self-referential and self-organizing and that they aim for a state of equilibrium. A diverse range of evidence, both indirect and direct, demonstrates the essential nature of Parsons' belief in the significance of a social system for the development of scientific and progressive sociology (Barber, 1994). According to Luhmann, social systems have a variety of strategies for preserving equilibrium, such as feedback loops and the use of knowledge to control system behavior (Luhmann, 1984).

Conclusion

For many years, there has been curiosity about the connection between physics and sociology. To explain social phenomena, sociologists have looked to physics, whereas physicists have turned to sociology for an explanation of physical phenomena. The way social scientists perceive and study the world is influenced by Newtonian physics, which is used as an example and dominates the social scientific approach. The vast majority of social scientists based their study on the techniques and ideas of Newtonian physics. As a result, the study conducted by social scientists frequently uses quantitative techniques and justifications. Also, social scientists often gather data and conduct analyses using the scientific method. This research examined the complex link between physics and sociology from epistemological and methodological angles. While these two disciplines have different foundations and techniques, they nevertheless have many similarities and may provide useful insights when combined. Physics has progressed from a search for natural explanations to a complex framework of mathematical descriptions and physical interpretations. Sociology, a relatively contemporary scientific field, seeks a secular understanding of human society based on actual data. A classical understanding of science based on Newtonian physics and Cartesian Dualism has shaped both fields' methods and approaches. The nineteenth-century notion of "social physics," established by Auguste Comte, is important to this work. Social physics uses statistical data to analyze society using physics' accuracy and analogies quantitatively. This new subject was called "sociology" although its roots are in a study of society, similar to physics' methodical observation and empiricism.

The epistemic basis of physics and sociology vary significantly. Physics emphasizes empiricism, or sensory experience and observation, to learn. Sociology includes positivism, interpretivism, and postmodernism, representing the complicated interaction between social reality and knowledge. The study emphasizes observation, experimentation, mathematical modeling, and reductionism to show how physics is a template for science. It also examines how sociology uses these ideas, such as in the rational choice theory, which uses logic and arithmetic to describe human behavior. Emile Durkheim, Talcott Parsons, and Niklas Luhmann popularized the physics-based idea of social equilibrium in sociology. These sociologists have investigated the premise that societies, like physical systems, seek balance and stability and that disturbed equilibrium may cause social change. This study highlights the complicated relationship between physics and sociology, showing how they have borrowed ideas and methods. Each discipline has its peculiarities, yet their discourse enhances both, providing fresh insights into the natural and social realms. This multidisciplinary study will illuminate the physical and social laws that govern our cosmos and inspire future research and intellectual inquiry.

References

Barber, B. (1994). Talcott Parsons on the Social System: An Essay in Clarification and Elaboration. *Sociological Theory, 12*(1), 101. https://doi.org/10.2307/202038

Bernardo, G. D. (1983). LE REGOLE DELL'AZIONE SOCIALE. *Saggiatore, Milano,*

Bernardo, G. D. (2010). La conoscenza umana. Dalla fisica alla sociologia alla religione. *Venezia:Venezia:*.

Bhaskar, R. (2008). *A Realist Theory of Science.* 2 Park Square, Milton Park, Abingdon, Oxon, 0X14 4RN: Routledge.

Bierstedt, R. (1970). *the social order*. New York: McGraw-Hill.Inc.

Bill, G. (2014). What is Physics? *Science 341*, 101-113.

Comte, A. (1830). *Cours de Philosophie Positive.* Paris.

Latour, B. (2005). *Reassembling the Social. An Introduction to Actor-Network Theory*. New York: Oxford University Press.

Latour, B., Woolgar, S. (1986). Laboratory Life: The Construction of Scientific Facts. United Kingdom: Princeton University Press.

Lyotard, J. (1984). The Postmodern Condition: A Report on Knowledge. United Kingdom: the University of Minnesota Press.

Nigel Parton, the Social Construction of Reality: A Treatise in the Sociology of Knowledge,
Peter L. Berger and Thomas Luckman, *Harmondsworth, Penguin Books, 1967, pp. 249, ISBN 978-0140135480*, *The British Journal of Social Work*, Volume 38, Issue 4, June 2008, Pages 823–824, https://doi.org/10.1093/bjsw/bcn068
Open the Social Sciences: Report of the Gulbenkian Commission on Restructuring the Social Sciences. (1996). United States: Stanford University Press.

Parsons, T. (1951). The Social System. Free Press.

Pickering, A. (2010). The Mangle of Practice: Time, Agency, and Science. Ukraine: University of Chicago Press.

Pentland, A. (2014). Social Physics: How Good Ideas Spread--the Lessons from a New Science. *Penguin Press*.

Sjoberg, G., & Nett, R. (1968). *A Methodology for Social Research.* Waveland Press, Inc.

Stewart, J. Q. (1948). Demographic Gravitation: Evidence and Applications. *American Sociological Association*, pp. 31-58.

Turner, R. H. (1979). *STRATEGY FOR DEVELOPING AN INTEGRATED ROLE THEORY Author (s): Ralph H . Turner Source : Humboldt Journal of Social Relations, FALL / WINTER 1979 / 80, Vol . 7, No. 1 Published by : Department of Sociology, Humboldt State University Stable URL : htt*. *7*(1), 123–139.

Wayne, J. J. (2013). Physics Laws of Social Science.

Zeitlin, I. M. (1981). Ideology and the Development of Sociological Theory. United Kingdom: Prentice-Hall.