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10. Study of Cause Effect Relationship, Causality, Causation in Contemporary Sciences

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Abstract:

Since causality affects practically every aspect of science and society, it is a crucial idea. The concept that investigates the relationship between a "cause" and a "effect" is known as causality. The majority of scientific studies of natural phenomena rely on the determination and measurement of cause-and-effect correlations.

Correlation alone examines the relationship between trends or patterns in measurements; it is not the same as the concept of causality. We examine many concepts of causation in this article, with a particular emphasis on determining causality from time series data. The human mind has an extremely sophisticated system for determining and assigning the reason of an occurrence, according to social psychology researchers.

It has also been discovered that determining the cause-and-effect relationships between statements and occurrences is a crucial component of reading comprehension, particularly for narrative texts. There are numerous linguistic terms for clearly expressing cause and effect, even if many of these relationships are implied and must be deduced by the reader. Furthermore, it has been discovered that some words contain "causal valence," which predisposes the reader to attribute cause in particular ways. A causal scenario comprises multiple participating subrules, and cause-effect linkages can be classified into various categories. We will talk about it in this paper. investigation of causality, cause-and-effect relationships, and causation in modern sciences

Keywords:

Cause Effect Relationship, Causality, Contemporary Sciences, Correlation, Decision-Making, Managing, Direct Cause, Indirect Cause, Biology, Medicine

10.1 Introduction:

The relationship between a "cause" and a "effect," when the consequence results from the cause, is known as causation. It is the idea that enables us to comprehend the relationships and changes between things. In a nutshell, causation is the study of relationships and changes. It is the connection between an occurrence and its result. A foundation for selecting an action that is likely to produce the intended outcome, causality plays and has played a significant role in human cognition, particularly in human decision-making. This concept is the subject of numerous works and theories. Since the ancient Greeks three thousand years ago, philosophers, scientists, physicists, mathematicians, computer scientists, and many others have investigated the concept of cause. [1]

When one occurrence (the cause) influences or results in another event (the effect), this is referred to as a cause-and-effect relationship. Every action or occurrence has repercussions, and those repercussions can be linked to an underlying cause, according to this idea.

"Cause-Effect Relationship" is a significant phrase that emphasizes the relationship between two variables, where one influences the other. It is important in Ayurveda and research because it shows how every event has a unique origin that affects health and disorders.

In scientific terms, the cause-effect relationship describes how one variable affects or decides another, which is crucial for productive study.

This idea is essential to Ayurveda since it pinpoints the causes of symptoms associated with both health and illness. It is essential to comprehend this link since it emphasizes that every action has a cause and sheds light on the causes of various health issues. This interdependence highlights how crucial it is to understand the underlying causes of both health and illness. [2]

The idea of determinism and causality. Recognizing causality is the foundation for all confidence in our interactions with the outside world. Causality is a genetic relationship between phenomena whereby one thing (the cause) under specific circumstances results in or causes another item (the effect). The creation and determination of one phenomena by another is the fundamental aspect of causality. In this way, causality is different from many other types of connections, such as the regularities of accompanying processes or the mere temporal sequence of experiences. For instance, a pinprick hurts. Mental illness is caused by injury to the brain. Causality is an active relationship that transforms possibility into reality and gives life to something new. An active, primary factor in relation to an outcome is called a cause. However, "because of this" is not always what "after this" means. Saying that there must have been a crime in order for there to be punishment would be a mockery of justice.

A fundamental idea and phenomenon that is accepted as true about nature and the cosmos as a whole is causation, also known as causality. Since practically all information, and particularly scientific knowledge, depends on it, it is extremely important. Causation is the process by which one thing affects another, which could be an occurrence or a process, resulting in a change or the creation of something. In this context, the latter is called an effect, while the thing that impacts another is called a cause. Therefore, the binary terms "cause" and "effect" are typically used to complete any definition of causality. From ancient times to the present, philosophers have maintained that everything in nature has a cause.

Our comprehension of how the world functions is based on the idea of cause and consequence. It enables us to draw links between incidents, spot trends, and provide an explanation for why particular results happen. Numerous disciplines, including physics, philosophy, psychology, sociology, and more, study and analyze cause-and-effect correlations.

The relationship between occurrences or phenomena where one event (the cause) influences or results in another event (the effect) is known as cause and effect in scientific research. Scientists use rigorous methodology, experimentation, and observation to try to explain causality. They seek to ascertain the causal mechanisms at play and to uncover and elucidate the correlations between variables. Finding and comprehending cause-and-effect linkages is a common foundation for scientific theories and laws.

In certain situations, cause and effect may be simple and obvious, while in others, it may be intricate and involve several variables. A number of variables, including time, context, and the existence of additional contributing causes, can affect the cause-and-effect relationship, which can be either instantaneous or delayed.

It is essential to comprehend cause-and-effect linkages in order to conduct scientific research, solve problems, make decisions, and forecast results. It assists us with event analysis, causative component identification, and decision-making based on possible outcomes. We may better understand the world around us and create management and influence strategies by recognizing cause and effect links. [3]

10.2 Types of Causal Relationships:

Knowing the kind of causal relationship aids in organizing your research and making your conclusions more understandable. Below is a summary of typical types:

- **Direct Cause and Effect:**

What it is: The cause and consequence are clearly and immediately related.

Example: The lightbulb illuminates when a light switch is turned on (cause) (effect).

- **Indirect Cause and Effect:**

What it is: The relationship between the initial cause and the final result is less clear and may involve intermediate processes or circumstances.

For instance, changes in employment rates (intermediate effect) may result from economic policies (cause), which in turn may have an impact on consumer spending (final effect).

- **Contributory Causes:**

What it is: An effect is the result of several elements working together. Even if one factor is more prevalent, others are still involved.

Example: Genetics, lifestyle decisions, and environmental variables (contributory causes) all have an impact on an individual's health. [4]

10.3 Review of Literature:

The idea of causation was covered in the preceding section. In order to make sense of what happens in the world and to direct their interactions with it, people reflexively use causal inference. It has been discovered that automatic causal inference plays a significant role in reading and text comprehension. Finding connections between the different events, states, and concepts that are expressed in a text is a necessary part of text comprehension. This enables the reader to mentally create a cohesive, interconnected representation of the text.

A large amount of research suggests that understanding narrative texts, or stories, requires the ability to recognize and deduce cause-and-effect relationships between occurrences (Van den Broek, 1989). [5]

Humans are capable of generating thoughts from impressions as they may have never seen something. According to Hume, concepts naturally relate to the mind through cause and effect. In particular, he credits the philosophical idea of causation with being essential to people's ability to comprehend the world outside of their senses and gain knowledge later on (Kessler 68).

When it comes to mental processes that involve the philosophical side of reasoning, cause and effect theory is crucial. Causation is related to the above-mentioned induction problem, which occurs when people tend to correlate related occurrences and fall victim to reductionism (Kessler 69). [6]

10.4 Objectives:

- To Study of Cause Effect Relationship and Causality
- To explain Causation in Contemporary Sciences
- To epistemology of causality and mechanisms

10.5 Research Methodology:

The results of this study, "Study of Cause Effect Relationship, Causality, Causation in Contemporary Sciences," are based on secondary data collected from reliable sources, including books, magazines, publications, and the internet.

The study's research design is mostly descriptive. Journal readings Search engine platforms like Google Scholar, international business and economics journals, free educational resources, and other well-known websites were used to find these credible publications.

10.6 Result and Discussion:

A. Causality in Science:

The role of causation varies depending on the subject of analysis. It is a question of behavior and outcome in legal contexts, while it is the outcome of empirical investigations and data in scientific fields like physics. The concept of causation is listed in this section across a number of fields.

Science:

To ascertain causality in the physical world, scientists conduct experiments utilizing the scientific method. All other occurrences in the cosmos are caused by four fundamental forces, which include gravity, the strong and weak nuclear forces, and electromagnetic. Nonetheless, the question of how reproducible a scientific experiment has been brought up and debated frequently.

Physics:

It's helpful to understand some physical theory concepts as causes and others as effects. Accordingly, in classical (Newtonian) mechanics, a force acting on a body represents a cause, and the acceleration that results, as quantitatively stated by Newton's second law, is an effect. The concepts of cause and effect may vary between physical theories.

Engineering:

A causal system is one that solely depends on the input values from the past and present. It has internal states and output. An acausal system is one that depends on future input values to some extent, in addition to potential past or present input values; an anti-causal system is one that only depends on future input values. In this discipline, there are numerous ways to visually depict causality.

For instance, the so-called fishbone diagrams, also known as cause-and-effect diagrams, are frequently used to identify probable elements causing an overall effect in product design and quality defect prevention.

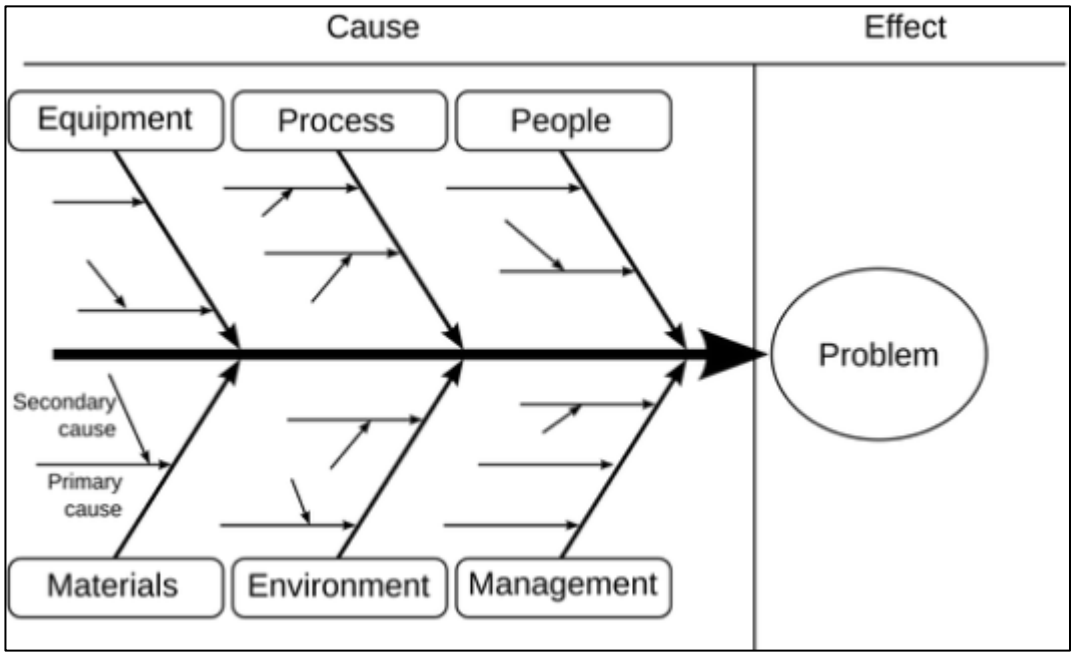

Figure 10.1: Representation of a fishbone diagram [7]

Biology and Medicine: According to Bradford Hill, in an epidemiological setting, the following characteristics of a connection must be taken into account in order to differentiate causal from non-causal associations:

1) Strength:

This is the correlation's numerical strength, which is represented as the relative risk of contracting an illness.

2) Consistency:

It describes occurrences that have been seen by numerous witnesses under various conditions in numerous locations at numerous periods.

3) Specificity:

This refers to the fact that the effect is restricted to specific workers in particular circumstances and that there is no other correlation between the work and other death-related circumstances.

4) Temporality:

This pertains to the causality's direction. As demonstrated in the example "Does the patient's diet cause the disease or does the disease alter the patient's diet?" this aspect is especially pertinent when dealing with slowly progressing disease.

5) Biological gradient:

Sometimes referred to as a dose-response relationship, this phenomenon occurs when a rise in the alleged cause is linked to an increase in the reaction (or disease). Lung cancer, for instance, is more common in smokers than in non-smokers, and it is more common in heavy smokers than in light smokers.

6) Plausibility:

This pertains to the relationship's scientific credibility. Because cigarette smoke is recognized to contain numerous known chemicals, smoking is a likely cause of cancer.

7) Coherence:

The notion that the biology and natural history of the disease should not be at odds with the potential for a causal relationship.

8) Experimental:

Appropriate proof is required. An experiment including the installation of dust filters, for instance, would be acceptable if it were suspected that dust is the cause of the sickness. If the experiment is successful, it would support the notion that dust is a causal factor in the disease's incidence.

9) Analogy:

It is the process by which reasoning is derived from comparable occurrences. [8]

Proper scientific practice depends critically on our ability to comprehend how we discover causes and mechanisms. Theoretical and philosophical language, however, seems to conflate causes and mechanisms into the idea of producing or being accountable for an effect. Although there are still some questions, scientists are more inclined to view these two as distinct. Here, I want to make the case that causes and mechanisms are separate components of a larger causality picture.

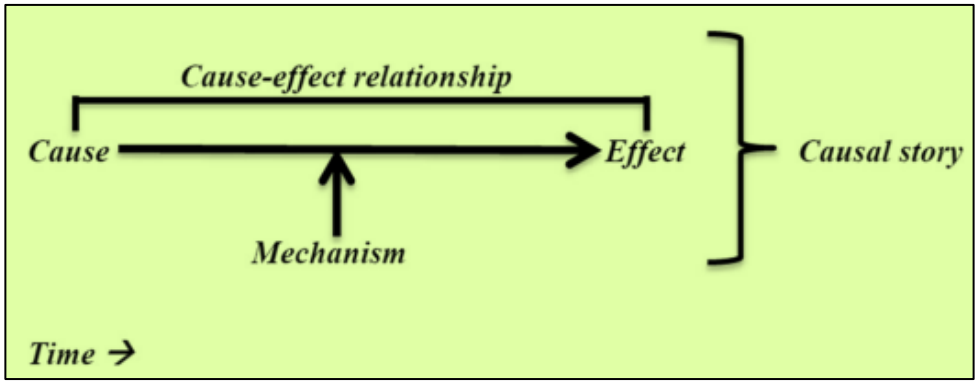

Figure 10.2: Schematic of causes, effects, mechanisms, cause–effect relationships and causal stories [9]

In contrast to the metaphysical nature of causes and mechanisms (see Mackie 1974), this essay focuses on the epistemology of causality and mechanisms [10].

The existence of causal links is frequently justified by knowledge of the existence, validity, or lack of mechanisms. In addition, the lack of a recognized mechanism is frequently invoked in scientific discussions to cast doubt on the veracity of a causal conclusion.

We make the case that this leap from mechanism knowledge to cause-and-effect knowledge is unnecessary and maybe deceptive.

The practice of science is affected in several ways by this essay. Furthermore, incorrect causal exclusion and faulty causal inference are two categories of errors that are frequently encountered by the scientific and popular communities.

When a cause-effect relationship is rejected because there is no recognized mechanism, this is known as flawed causal exclusion.

When a cause-and-effect link is inferred from the understanding of how the alleged cause would result in the effect, this is known as flawed causal inference. I contend that the entanglement of causes and mechanisms is the reason for these errors. [11]

10.7 Conclusion:

With a focus on cause-effect relationships in text, we have provided a thorough analysis of the cause-effect relationship from the viewpoints of philosophy, psychology, and linguistics. It is obvious that the idea of causation is intricate and multidimensional.

The concept of causation is defined differently in different contexts and applications. A causal situation includes numerous facets or roles that may be pertinent to a given application, and there are numerous forms of causation as well.

The use of cause-and-effect relationships in their respective sectors has been studied by researchers from a variety of fields.

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