Research Methods for Simple and Complex Systems

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Chapter 9) Hypotheses, Theories, and Scientific Research And the Influence of Human Nature and Perception

Over 2,550 words

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Hypotheses & Theories, and Related Terminology for this Chapter

What is a Hypothesis?

Based on the way I am using the terminology a hypothesis is an assumption, idea, or concept that maybe **true or false**, or **partly true, and partly false**, or it may be **conditionally true.** This, can **usually** be determined by observational and/or experimental research. When a hypothesis cannot **NOT** be **confirmed OR refuted** by experimentation or observation, it should be classified as scientific speculation, **or** as a philosophical concept or belief.

What is a Theory?

Based on the way am using the terminology, a theory is a hypothesis that has been widely accepted by many scientists within a discipline. Theories might be supported by varying levels of experimental and/or observational evidence. However, the evidence supporting some theories is questionable, incomplete, or in some cases nonexistent.

A Note on Terminology for this Chapter

The concepts that I am presenting in the following paragraphs, apply to both hypotheses and theories. Thus, to simplify the

text, I will use hypotheses and theories interchangeably in some of the following paragraphs.

I am using the word **true** for **correct**, and **false** for **incorrect**, in some of the sections of this chapter.

In some portions of the text I am using the phrase **scientific evaluation**, **scientific research, or research** to represent **experimental** and/or **observational research**.

The Truth or Falsity of a Hypothesis, or Theory, For Simple and Complex Systems

A General Example of a Theory or Hypothesis for Simple Systems

For a general example, I am using the following statement as a hypothesis (or theory) **X and Y results in P,** for a simple system that is highly predictable. This hypothesis is either **TRUE** or **FALSE**, which can be determined by experimentation and/or observations. If scientific evaluations indicate that the above hypothesis is **FALSE**, then **X and Y DOES NOT result in P** is **TRUE**. However, if scientific evaluations indicate that **X and Y results in P** is **TRUE**, then the statement in the previous sentence is **FALSE**. *The idea to keep in mind, is both of the statements presented in red type, can represent useful information.*

Theories and Hypotheses and Complex Systems

If the concepts presented above were applied to a complex system, such as in the social, psychological, ecological, and medical sciences, experimentation and/or observations might **not** indicate a simple result that can be represented as **TRUE** or **FALSE**. This is partly because complex systems are sometimes one-of-a-kind entities, that display behaviors and results that are not always 100% predictable, or reproducible.

Experimentation with complex systems might indicate that the hypothesis is sometimes true and sometimes false, or perhaps it is true X % of the time. This is more likely to be the case, if a number of researchers evaluated the hypothesis, based on their own philosophy, and experimental setup.

Summing-Up the Above, Potential Truth Value for Theories & Hypothesis of Simple and Complex Systems

Generally, theories and hypothesis have a truth-value that fits one of the following:

- ***Correct or Incorrect*** (This usually applies to concepts based on the simple systems in the hard sciences that are predictable.)

- ***Conditionally correct or conditionally incorrect*** (This can apply to the simple systems of the hard sciences, especially when a hypothesis is not adequately developed. This can also apply to complex systems, whether the theory is developed or not.)

- ***Correct a certain percentage of the time, and incorrect a certain percentage of the time, in a way that is partly or totally unpredictable*** (This usually applies to complex systems that are somewhat unpredictable, such as the systems of social, psychological, and medical sciences.)

Human Nature, Influencing Observations and Experimental Results For Simple and Complex Systems

My Assessments, and Criticism

The **some** of the material in the following three sections are based on my analysis, evaluations, and experience with scientific literature. Thus, there are many writers that would disagree with my assessments. However, there are a large number of articles that agree with my evaluations, and the criticisms I am presenting in the following paragraphs. **Some of these articles can be found at the end of this chapter.**

Questionable Theories

Theories in the soft sciences, especially psychology are sometimes based on philosophy or personal opinions of famous psychologists. These theories may have little or no supporting scientific evidence. Often the practitioners of these theories are **not** interested in evaluating the degree of validity of their theories with scientific techniques.

Theories in the **developing areas** of modern physics are often based on speculation of famous physicists. These theories may be supported by little or no scientific evidence. This is because it can be difficult or impossible to obtain supporting observational or experimental evidence for these theories. This applies especially to astrophysics, and to some areas of particle physics.

Theories that are not supported directly by observational or experimental research are usually defended by the supporters of the theory. They might present observational or experimental results that could occur for an almost limitless number of reasons, to support their questionable theories.

Problems that can Interfere with the Scientific Evaluations of Hypotheses and Theories

In the physical, biological, and social sciences, scientists often carry out experiments to prove that a hypothesis or theory is correct. This appears to be quite logical, but when you evaluate human nature, it is problematic. When human beings attempt to **PROVE** a hypothetical or theoretical concept, they are likely to inadvertently or intentionally ignore alternative explanations, especially if it might contradict the concept they are trying to prove. The above is more likely to happen, when researchers **truly believe** that the hypothesis or theory they are trying to prove is correct.

Researchers are **unlikely** to carry out experiments that might disprove their hypothesis. When experiments indicate negative results they might assume that there was an error in their experimental method. Results of this nature are unlikely to be submitted (or accepted) for publication, especially if they contradict current theoretical frameworks. This can interfere with the development of alternative theoretical concepts, and slow scientific progress.

Interference From Emotional Dynamics and Funding

The **ideas presented in the previous subtopic** are more likely to happen, if the researcher has an emotional and/or financial interest in obtaining results that confirm a theory or hypothesis. Very often scientists and research organizations obtain funding for experimentation that is focused on a specific theory. Shedding any doubt on the theory, might result in a reduction or elimination of research funding. This might be more likely to happen, when government funding is involved, which can be influenced by public opinion.

Interference with Scientific Evaluations From Social Dynamics

Social dynamics can inhibit the development of experiments and theoretical frameworks that might contradict widely held beliefs within a discipline. This is more likely to be the case if the beliefs

involve theories that were created by famous scientists. This can slow-up scientific progress because almost all theories are incomplete or do not explain all aspects of related phenomena.

Many widely held theories might be partly, or totally, incorrect. Often, scientists tried to use establish theories as the foundation to build additional theoretical frameworks. This might work out quite well, if the theories they are using for the foundation are entirely correct. However, if there are any weaknesses in the theoretical framework they are building upon, they may arrive at erroneous conclusions.

The above difficulties can be avoided, by reevaluating every theory, before using it as a framework to create new hypotheses. This should include experimental reevaluation when feasible.

The difficulties mentioned above can also be avoided by deliberately creating hypotheses that are not based on, or limited by establish theoretical frameworks. This can result in hypotheses that can be evaluated experimentally to determine if they are true, false, or sometimes true. The important idea to remember both **true**, **false**, or **sometimes true**, can represent valuable information if it is confirmed with high quality experimentation or observational evidence.

Potentially Valid and Erroneous Hypotheses and Theories

If a Hypothesis or Theory Fits all Available Evidence, Does that Prove that it is Correct?

If a theory fits all available evidence, the logical but **incorrect conclusion** is, the theory is correct. This type of reasoning **FAILS**, because, it is usually possible to devise an almost limitless number of theories that will explain observations and experimental results. To obtain a better understanding of this fallacious reasoning, try to create a number of theories that relate to the planning and actions of an individual you know well. If you let your imagination run wild, you will be able to create a large number of logical, but erroneous theories that explains their planning, motivations and behaviors. The theories you create may be possible, but highly unlikely. Sometimes, erroneous theories of this nature can even be used to partly or totally predict experimental results and future outcomes. This certainly does **not** represent proof of their validity.

What is the Optimal Criteria for Creating Good Theories and Hypotheses

The previous subsection raises the question, *what is the optimal strategy for creating valid hypotheses and theories.* *Usually, the simplest theory that fits experimental results and observations is the best,* ***providing it does NOT contradict logic, cause-and-effect, and experimentally verified concepts.*** In addition, **hypotheses and theories** must be verifiable by experimentation or direct observation. Another important criterion for valid theories is presented below.

A Sequence of Assumptions Leading to a Theory

When a theory is based on a sequence of assumptions, or inadequately proven concepts, there is a high probability that the theory is partly or totally incorrect. Theories that involve long sequences of assumptions, or inadequately proven concepts, are more likely to be **incorrect**. This is because any false idea in the sequence of reasoning will result in an incorrect theory.

Theories that are based on a sequence of experimentally proven ideas are more likely to be correct. This is especially the case if the sequence is relatively short. However, theories of this nature should be carefully evaluated experimentally to determine if they are truly correct.

Philosophy and Scientific Speculation

The ideas presented in this section are based on the assumption that you are attempting to create scientific concepts, as opposed to devising philosophy, or engaging in scientific speculation. However, there is nothing wrong with creating philosophy or devising speculations, providing it is **not** confused with science. That is philosophical ideas, and scientific speculations, should be labeled and classified appropriately, so they are not confused with scientifically verified concepts.

Scientific Disciplines with Valid and Questionable Theoretical Concepts

Theoretical Concepts that are Truly Scientific

Theories and laws in biology, chemistry, electronics, engineering, mechanics, and computer science, **usually** (but certainly not always) represent perfection, based on the criteria presented in the previous subsections. This is because it is **possible** to carry out extensive observations and experimentation that confirms or refutes hypotheses in these disciplines.

Perhaps more importantly, the concepts from the disciplines mentioned above are often used to create new products. Applying theoretical concepts that are speculative or questionable would result in products that do **not** function, which would result in financial losses. In actual practice, if any false, erroneous, or less than perfect hypotheses, are applied to the development of a product, the difficulty will be spotted in the initial stages of engineering, or in the development of experimental prototypes. Thus, erroneous theoretical or hypothetical concepts would be quickly weeded out, with the scientific disciplines that are often used to create new products.

Theoretical Concepts that are Less-Than-Perfect

In some disciplines, it is difficult to create theories that are truly sound, (based on the criteria presented in the previous subsections). In many cases this is because the systems are

extremely complex, such as the social and psychological sciences, which ultimately deal with the human mind. In other cases, the systems are too small or too large to be precisely evaluated with conventional scientific techniques. For example particle physics, involves extremely small particles that cannot be viewed directly. Astrophysics involves extremely large systems that cannot be re-created in the laboratory. The systems are usually many light years from Earth, and they cannot be examined directly with robotic devices.

Very often theoretical concepts in the disciplines mentioned above, represent philosophy, or scientific speculation, as opposed to true science.

Theories in some disciplines, such as the above, are usually not apply to the production of products, and incorrect theoretical concepts do **not** result in an adverse financial impact. Strange or unusual theories that are unproven, or contradict logic may receive additional funding, especially if they were created by famous scientists.

When Theories Contradict Logic

When theories contradict logic, or they failed to explain phenomena in terms of cause-and-effect, what is the correct conclusion? Generally if observations, experimental results, or even a theoretical framework does not make sense, there are unknown dynamics involved. The unknowns can relate to:

- The distortions produced by social and/or psychological dynamics (When this is the case, the theory is usually partly or totally erroneous.)

- Mysteries of nature that have not been fully unraveled, or unknown phenomena (The theory may or may not be valid. The above can result incomplete or erroneous theories that contradict logic.)

Conclusion

In general, the influence of others, especially famous people and authority figures, can sometimes result in erroneous interpretations, hypotheses, and theories. In addition, there are various psychological components that can result in erroneous theoretical and hypothetical concepts. Beliefs, expectations, and hopes, can distort perception and interpretation of experimental results and observations.

The difficulties mentioned in the previous paragraph, is **not** limited to the scientific disciplines. Distortions in our reasoning and hypotheses probably happen more often in everyday life, when we try to solve a major problem, obtain a challenging goal, or create plans for the future.

An awareness of the distortions, and problems discussed in this chapter, might reduce or prevent their occurrences, in the sciences as well as in everyday life.

See the Following Websites from other Authors for Additional Information, and Alternative Perspectives on A System, and System Theory

1) "Unthinking respect for authority is the greatest enemy of truth." -Albert Einstein Physics New Suit, **2)** Discover Interview: Roger Penrose Says Physics Is Wrong, From String Theory to Quantum Mechanics Erroneous theories and models science Erroneous theories in modern physics, **3)** Physics Myths and Physics Facts Flaws in Concepts and Theories of Modern Physics, **4)** Stephen Hawking: 'There are no black holes' Notion of an 'event horizon', from which nothing can escape, is incompatible with quantum theory, physicist claims., **5)** Scientific method: Defend the integrity of physics George Ellis& Joe Silk 16 December 2014 Attempts to exempt speculative theories of the Universe from experimental verification undermine science, argue George Ellis and Joe Silk., **6)** Is Scientific Materialism "Almost Certainly False"? By John Horgan, **7)** The Black Hole, the Big Bang, and Modern Physics website by Stephen J. Crothers, **8)** The Black Hole Theory is a Modern Physics Myth Jamal Shrair energy researcher at green energy visions, **9)** Quantum Equations Suggest Big Bang Never Happened by Stephen Luntz, **10)** Absurdities in Modern Physics: A Solution, by Paul Marmet, **11)** Freud's false memories Psychoanalysis and the Recovered Memory Movement RICHARD WEBSTER From Why Freud Was Wrong: Sin, Science and Psychoanalysis, **12)** Evolutionary

Psychology: Why It Fails as a Science and Is Dangerous by Callie Joubert, **13)** The Fallacy of Thimerosal Removal & Autism Increase: A Failure of Science, A Bigger Failure to Children, **14)** That's not autism: It's simply a brainy, introverted boy, **15)** Is Psychology Science? Peter Rickman tells us why it isn't., **16)** Is psychology a "real" science? Does it really matter? By Ashutosh Jogalekar, **17)** The Real Problems With Psychiatry,

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