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Minimizing the Time Taken Between Hypothesis Generation, Hypothesis Testing and Refinement: A Necessary Adjunct in the Epoch of Fast-Paced Science

Sujay Rao Mandavilli

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Abstract: The objective of this paper is to emphasize the need for minimizing the time taken between hypothesis formulation or hypothesis generation, hypotheses testing and hypothesis refinement, and the role it can definitely play in accelerating scientific progress. We begin this paper by defining what a hypothesis is, delineating the different steps involved in the formulation of a hypothesis, evaluating the different types of hypotheses, and also by distinguishing and differentiating hypotheses, theories and laws. We also then visit the concept of a grounded theory, and explore the types, uses, and limitations of grounded theory. We also then revisit the concept of latency periods, a concept that we had discussed and debated previously, and to show how time crashing techniques can be suitably employed to bring down timeframes in the entire research cycle. We also then provide and furnish a large number of examples from various fields in the social sciences to illustrate how many hypotheses remain untested for long periods in time, or remain dangling in mid-air. We do then hope, anticipate and expect that this will prove to be an important paper in twenty-first century science, and will encourage and embolden researchers to take up hypotheses verification and hypothesis ratification studies in large numbers in the not too distant future.

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I. INTRODUCTION

The objective of this paper is to emphasize the need for minimizing the time taken between hypothesis formulation or hypothesis generation, hypotheses testing and hypothesis refinement, and the role it can definitely play in accelerating scientific progress. We begin this paper by defining what a hypothesis is, delineating the different steps involved in the formulation of a hypothesis, evaluating the different types of hypotheses, and also by distinguishing and differentiating hypotheses, theories and laws. We also then visit the concept of a grounded theory, and explore the types, uses, and limitations of grounded theory. We also then revisit the concept of latency periods, a concept that we had discussed and debated previously, and to show how time crashing techniques can be suitably employed to bring down timeframes in the entire research cycle. We also then provide and furnish a large number of examples from various fields in the social sciences to illustrate how many hypotheses remain untested for long periods in time, or remain dangling in mid-air. We do then hope, anticipate and expect that this will prove to be an important paper in twenty-first century science, and will encourage and embolden researchers to take up hypotheses verification and hypothesis ratification studies in large numbers in the not too distant future. Theories must also be tested across space and time, and we had also proposed diachronic synchronic studies previously. Our paper also highlights the importance of metric and performance measurement measures for scientific processes in general in contemporary, twenty-first century science. This is one area researchers must work towards in the years and decades to come, given that progress in this area is deficient and insufficient.

- *What is a Hypothesis?*

The word hypothesis is thought to have been derived from the following two words, namely: “hypo” and “thesis” which is equal to “Hypothesis”. The term “hypo” means something which is tentative or subject to reverification and “thesis” which means a statement pertaining to a solution of a problem. A hypothesis may therefore be taken to mean a proposed explanation for an observed phenomenon. A hypothesis must always be based on methodologically and systematically carried out observations over a period in time.

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Hypotheses must also make testable and reproducible prediction about real-world phenomena, generally beginning with a hunch or an educated thought, but progressively refined as and when additional data becomes available. Hypotheses, after constant verification and repeated observations, morph into theories, which are further processed with additional data to become incontestable laws. To generate a hypotheses, we must collect as much data and information about a given area of study. After data collection, we must corroborate the data through additional information, and look for potential underlying causes for the problem. We may also generate a set of parallel hypotheses, and prove or disprove some of them as necessary. Therefore, a working hypothesis may be generated. Hypotheses generation also typically involves the identification and generation of independent and dependant variables or cause and effect variables. Intervening variables may also be defined. [1] [2] [3] [4] [5] [6] [7]

There are many different types of hypotheses in common use, and examples of these are simple hypotheses, complex hypotheses, directional hypotheses, non-directional hypotheses, null hypotheses, and alternative hypotheses. A simple hypothesis postulates a simple relationship between one independent variable and one dependent variable alone, while a complex hypotheses postulates a relationship with at least three variables, perhaps even more. A directional hypothesis indicates or specifies the direction of relationships between variables, while a non-directional hypothesis does not. A null hypothesis assumes there are no significant differences between means, while an alternative hypothesis does. An associative hypotheses proposes relationship between variables without implying causation, while in the case of a causal hypotheses, causation is implied. An empirical hypothesis is based mostly or entirely on observations and experimentation while a statistical hypotheses involves correlation between large volumes of data. A research hypothesis is one which is used as a basis of further downstream research, while a working hypothesis is a preliminary hypothesis that is a launch pad for further investigation. A logical hypothesis on the other hand, is one where logic and reasoning are primarily or extensively used.

There are many distinct steps involved in the process of hypothesis generation. In order to generate a strong and a robust testable hypothesis, we must always begin with a research question in a specified area of study or topic of investigation, conduct preliminary research or preliminary investigations, and then arrive at a testable hypothesis that clearly identifies and establishes the relationship between variables so that they can be tested further. Therefore, we may identify several elements of a good hypothesis. For example, a good hypothesis must be specific, clear, unambiguous, empirical, testable, and must also as far as possible address real-world problems or fill gaps in knowledge while avoiding philosophical questions or non-scientific areas. A good hypothesis must also correlate variables clearly, though this may not always be possible in the case of qualitative research. There are also fundamental differences between a hypothesis and a theory. A theory offers a better tested and a better substantiated explanation than a hypothesis, and is often derived from it. It therefore represents a subsequent stage in a scientific exploration or study. A theory is then tested further, so that it may become a law. The distinction between all three is however not often clearly implied or established, and they are sometimes used loosely and carelessly. [8] [9] [10] [11] [12]

- *What is Grounded Theory?*

The idea and the general concept of a grounded theory, we believe is an extremely important one, though it does not appear to have been popularized the way it should be. Grounded theory in sum, refers to a qualitative research techniques whereby theories are systematically developed from data collected and analyzed often in a short span of

[1] Hempel, C. G. (1952). *Fundamentals of Concept Formation in Empirical Science*. Chicago: University of Chicago Press

2 Hilborn, Ray; Mangel, Marc (1997). The ecological detective: confronting models with data. Princeton University Press. p. 24

[3] McRaney, David (2022). *How Minds Change: The Surprising Science of Belief, Opinion, and Persuasion*. New York: Portfolio/Penguin

[4] Bolsen, Toby; Druckman, James N. (2015). "Counteracting the Politicization of Science". *Journal of Communication* (65): 746

[5] Towards 360 degree approaches to hypothesis formulation and evaluation: Another epochal milestone in twenty-first century science Sujay Rao Mandavilli Published in IJISRT, July 2025

[6] Envisaging a new era in interdisciplinary and transdisciplinary research: Presenting the COMPASS model for interdisciplinary and transdisciplinary research Sujay Rao Mandavilli IJISRT, June 2025

[7] Towards "Thick analysis" of statements, propositions and assertions: Compendious evaluations with immense benefits in research Sujay Rao Mandavilli Published in SSRN, July 2025, IJISRT, July 2025 and elsewhere

[8] Groh, Arnold (2018). *Research Methods in Indigenous Contexts*. New York: Springer

[9] Talja, Sanna and Pamela J. Mckenzie (2007). Editor's Introduction: Special Issue on Discursive Approaches to Information Seeking in Context, The University of Chicago Press

[10] Creswell, John W. (2008). *Educational Research: Planning, conducting, and evaluating quantitative and qualitative research* (3rd ed.). Upper Saddle River, NJ: Pearson

[11] Kara, Helen (2012). *Research and Evaluation for Busy Practitioners: A Time-Saving Guide*. Bristol: The Policy Press

[12] Amplifying the importance of synchronic-diachronic approaches in social sciences research: Unleashing the power of this technique for better sociocultural analysis Sujay Rao Mandavill Published in IJISRT, July 2025, SSRN, July, 2025

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time. Sometimes, a more prolonged approach is adopted. This methodology allows researchers to carefully and methodologically collect theories based on real-world observations and interpretations, rather than proceeding from a pre-existing hypothesis that was developed without the use of data. In case of grounded theory, inductive reasoning is used, coupled with an iterative process, and theoretical sampling. A constant comparison of different sources of data is often employed, and cross-verification or cross-validation is often performed. We also have the concept of theoretical saturation. This refers to the point where additional data that was proposed to be collected no longer provides vital clues or insights into a given problem, and the marginal utility of collecting new and additional data is negative. Researchers also indulge in constant reflexivity, and retrospect on their own errors, biases and prejudices. While grounded research may not always be possible due to time, cost, and practical concerns and considerations, hypotheses must be generated with some initial data at east, preferably formally collected data. These need to be tested and validated as quickly and as efficiently as possible, preferably within a specified timeframe. [13] [14] [15]

There are different types of grounded theory, such as classic grounded theory and constructivist grounded theory. Classic grounded theory as developed by Barney Glaser and Anselm L. Strauss in 1967, (The discovery of grounded theory) emphasizes the generation of abstract, formal theories. As per this approach, the core concerns and requirements of research participants and parties to the study are critically identified, and factored into the research study. The research study must then explain how the concerns of the participants are resolved. Patterns and interrelationships between data must also be then identified and discovered. Theoretical knowledge must be possessed by researchers, and a constant comparison of data and data sources carried out. Classic grounded theory also speaks about different types of coding such as open coding, selective coding and theoretical coding which are somewhat outside the scope of this paper. Classic grounded theory also emphasized processes and a data-driven approach. Constructivist grounded theory was developed by the sociologist Kathy Charmaz, and it focuses more on socially constructed processes and realities. Researchers' perspectives and interpretations of reality are also factored into the process. However, data-driven processes are indeed emphasized in such a case.

Grounded theory, which is primarily used as a qualitative research approach in the social sciences, has had to face several important and significant criticisms. These include time considerations, cost considerations, and researcher interest or patience. It is also often demanding in nature, is accompanied by potential for researcher bias, and is associated with unresolved issues in theoretical and methodological frameworks. There are different versions and variants of it, and the core concepts may often be at variance with each others. Some argue that such an approach is not even necessary, and reliable hypotheses can be formulated with minimal data as long as sound logic and reasoning is used. Hypotheses can be tested at later points is time, as and where more data becomes available, or when there is additional research funding. We do accept the limitations of grounded theory, though decisions must always be taken on a case to case basis. Even if hypotheses are formulated based on limited data (including scenarios where only limited data is available when hypotheses are constructed), they must be ratified and tested adequately, thoroughly and completely as and when more and more data or information becomes available. This may be accomplished as a concerted activity either by the researcher involved or in question, or by another researcher or teams or groups of researchers.

- *Latency Period*

We had written extensive about latency period earlier, and had even devoted and dedicated large sections of a paper to it. The terms is widely used in communications science, and in information technology, though not as commonly used in scientific method, and in the philosophy of science. Indeed, we had argued that the term needed to be commonized and popularized in various fields of the science. In sum, the term latency may be taken to mean the delay between a request for information or action and a resultant response, or even in some cases, the time it takes for data to travel from one point of a system or a network to another. It is therefore, often seen as a yardstick for performance or efficiency. Therefore, the time taken for various steps or stages in a scientific process to be completed, must be brought down, otherwise inefficiencies, inordinate delays, or tardiness might result. [16]

- *Time Crashing Techniques*

Fast-tracking and time crashing techniques are important and widely utilized techniques in project management with a view to accelerating project schedules, and intensifying activities. These techniques, are however not commonly used in scientific methods, but may have important implications for

[13] Charmaz, Kathy (2009) 'Shifting the grounds: Constructivist grounded theory methods', in J. M. Morse, P. N. Stern, J. Corbin, B. Bowers, K. Charmaz and A. E. Clarke (eds.), Developing Grounded Theory: The Second Generation. Walnut Creek: Left Coast Press. pp. 127–154.

[14] Mills, Jane, Bonner, Ann, & Francis, Karen (2006) 'Adopting a constructivist approach to grounded theory: Implications for research design' International Journal of Nursing Practice, 12(1): 8–13.

[15] Charmaz, Kathy (2008) 'Constructionism and the grounded theory method', in Holstein, J.A. and Gubrium, J.F. (eds.), Handbook of Constructionist Research. New York: The Guilford Press. pp. 397–412

[16] *Foundations of Data Intensive Applications Large Scale Data Analytics Under the Hood*. 2021

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the field nonetheless. One technique in project management is to add more resources. Often, CPM and critical path method is used, along with PERT, or program evaluation and review technique. These are often used for planning and managing large and complex projects, and reducing latency time, reducing cost, or enhancing efficiency. Sometimes fast tracking is also used, and multiple activities are begun or complete in parallel. There are often accompanied by the use of suitable metrics and measurements, and suitable metrics must be devised for the completion of research and research processes too. This is one area needing urgent attention, and one contemporary researchers must work towards. [17] [18] [19] [20]

- *Example of Loose-Ended Hypotheses*

There are many different examples of loose-ended hypotheses, or open-ended hypotheses that may persist over time, or sometimes even nearly into eternity. Ethnography-driven economic planning as a concept was proposed by us in a paper pertaining to anthropological economics, though its core concepts have not yet been implemented in most cases. We also then have the demand curve where demand rises as prices fall, and vice versa. In case of supply, suppliers demand more as prices rise, and vice versa, albeit with a time lag. We also have the concept of elasticity of demand which varies on a case to case basis. Some goods are more elastic, while some goods are less elastic. We had also proposed the concept of cultural elasticity of demand in our previous on anthropological economics. We also have Giffen goods where demand rises as prices rise, and vice versa. This is represented by the Giffen paradox. We also have income elasticity of demand as opposed to the price elasticity of demand, and have inferior goods, luxury goods, and normal goods as well. Science might progress faster, and better quality science may result if the concepts of this paper are borne in mind. Since, researchers are constantly searching for ideas, and since researchers are constantly under pressure from universities and research bodies to deliver, these may open up new avenues and new vistas for research.

We have other concepts such as Hick's compensating variation and Slutsky's model. We also have less useful concepts such as the production possibility curve, production possibility frontier, indifference curves, marginal rate of substitution, and the marginal rate of technical substitution. We also have the theory of diminishing marginal utility, and the theory of marginal utility of money – some consider this to be constant, though it may decline in different cases and scenarios. All these need to be tested over time – across time and space- and comprehensively and thoroughly. This will lead to more meaningful and thorough progress in science. On the contrary what do we find? We have a large number of hypotheses generated over time, and most of them are left dangling in mid-air. They continue to remain unvalidated for perpetuity and for eternity, while more and more counter theories continue to be generated. We also then have less than meaningful theories such as the theory of self-fulfilling prophecy, and social convoy theory. Another hypothesis is this: Do underdogs understand social problems better? Also, how do sub-replacement fertility dynamics work in relation to the economy, economic growth, and the environment? Patterns can be identified through repeated testing, and exceptions identified through the sociological ninety-ten rules. Studies must be constantly performed and reperformed as new data is uncovered, or made available.

II. CONCLUSION

The objective of this paper was to emphasize the need for minimizing the time taken between hypothesis formulation or hypothesis generation, hypotheses testing and hypothesis refinement, and the role it could come to play in accelerating scientific progress. We suitably began this paper by defining the term hypothesis, delineating the different steps involved in the formulation of a hypothesis, evaluating the different types of hypotheses, and also by distinguishing and differentiating hypotheses, theories and laws. We also then visited the concept of a grounded theory, and explored the types, uses, and limitations of grounded theory. We also then revisited the concept of latency periods, a concept that we had discussed and debated previously, to show how time crashing techniques could be suitably employed to bring down timeframes in the entire research cycle. We also then provided and furnished a large number of examples from various fields in the social sciences to illustrate how many hypotheses remain untested for long periods in time, or remain dangling in mid-air. We do then hope, anticipate and expect that this will prove to be an important paper in twenty-first century science, and will encourage and embolden researchers to take up hypotheses verification and hypothesis ratification studies in large numbers in the not too distant future. This will naturally lead to faster progress in many fields of scientific activity.

[17] Sonenshein, Scott (2017). *Stretch: Unlock the Power of Less and Achieve More Than You Ever Imagined*. Harper Business

[18] Rubin, Tzameret H.; Aas, Tor Helge; Stead, Andrew (1 July 2015). "Knowledge flow in Technological Business Incubators: Evidence from Australia and Israel". *Technovation*. 41–42: 11–24

[19] Gomez-Mejia, Luis R.; David B. Balkin; Robert L. Cardy (2008). *Management: People, Performance, Change* (3 ed.). New York

[20] Jacoby, S.M. (1985). "Employing Bureaucracy: Managers, Unions, and the Transformation of Work in American Industry, 1900-1945". *Columbia University Press*