Occam's Razor and Hickam's Dictum: The Transformation of a Theoretical Discussion into a Modern and Revolutionary Tool in Oral Diagnostics

Corresponding Author:
Dr. William J Maloney,
Clinical Associate Professor, New York University, 345 East 24th Street, 10010 - United States of America

Submitting Author:
Dr. William J Maloney,
Clinical Associate Professor, New York University, 345 East 24th Street, 10010 - United States of America

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Author(s): Maloney WJ

Abstract

In the fourteenth-century William of Ockham formulated a philosophical theory based on the principle of lex parsimoniae. This theory became known as Occam's Razor. The Razor demands that one hypothesis be selected over another hypothesis, both being equally sound hypotheses, based on which one makes the fewest new assumptions. Occam's Razor has survived and endured through the centuries making vital contributions to the work of Sir Isaac Newton, Albert Einstein, and, finally, to William Osler who introduced the theory to medicine.

The twentieth-century saw many dramatic advances in medicine. Due to these great advances a shift in the hierarchy of diagnostic theories was in order. Dr. John B. Hickam, a 1940 graduate of Harvard University Medicine School and Chairman of the Department of Medicine at the University of Indiana, provided the medical community with a much needed counterargument to Occam's Razor. Dr. Hickam basically stated that a patient's signs and symptoms could be brought on by any number of ailments.

Today, many individuals are living relatively symptom-free lives with such chronic ailments as diabetes, asthma, HIV, and epilepsy. This can lead to diagnostic challenges for the medical community as the patient might develop new ailments which might go undiagnosed due to the incorrect attribution of new signs and symptoms to disorders which had been previously diagnosed. Many times the dental profession is presented with a rare and precious opportunity to diagnose certain ailments in their earliest stages before an individual's physician would be made aware of such new signs and symptoms.

A collaborative effort is proposed. This collaboration would seek to apply a theoretical mathematical formula to the theories of Occam and Hickam with the development of a computer-based program to allow for the diagnosis of certain ailments (e.g. oral cancer) of the oral cavity and head/neck region in the earliest of stages.

Introduction

Discovery. The word discovery conjures up many different images and awakens various emotions inside each of us. The images can range from those visible only under the scientist's microscope to the images of far-away planets and galaxies brought to us by satellites and telescopes. It can range from the toddler learning how to put one foot in front of the other to the explorer setting foot upon virgin territory. No matter the modality or scope of the discovery, one thing remains constant—discovery is always a learning process.

WILLIAM OF OCKHAM

William was a 14th century logician and Franciscan friar born in a village known as Ockham (also spelled Occam) in the English county of Surrey (1). While studying at Oxford University, Occam composed “Questiones Super Libros Sentenciarum”, “Quodlibeta, Tractus de Successivis” and “Summulae in Libros Physicorum”. It was during this period that he began his study of physics and logic (2).

Occam never received the degree in theology that he was pursuing from Oxford University as he was summoned to the papal court in Avignon, France in 1324 by Pope John XXII (2). His teachings were seen to be in contrast with Thomas Aquinas (1224-1274) who perfected the synthesis of faith and reason and was canonized a saint by the Catholic Church (3).

Occam was a fideist in a theological manner. He stated that belief in God is a matter of faith rather than knowledge. He went on to state that theology is not a science and, therefore, rejects all alleged proofs of God's existence (3).

As Pope John XXII was about to issue a condemnation, Occam and two other Franciscans fled Avignon to seek the protection of Louis of Bavaria. They were excommunicated and hunted down. They were never captured (3). He is thought to have died in 1349 as a victim of the Black Death in Munich. The streets and restaurants of Munich bear his name to this day (2).
OCCAM’S RAZOR

Occam’s Razor is a principle which, through the centuries, has played a fundamental role in science and philosophy. Occam wrote “pluritas non est ponenda sine necessitate” which translates from the Latin as “plurality should not be posited without necessity” (1). The Razor simply states that entities should not be multiplied unnecessarily. It has been reworded by numerous individuals over the centuries to express basically the same thought. However, certain individuals have cited Occam’s Razor in stronger terms than Occam himself had intended (1). Occam used his own Razor to support his theory that “God’s existence cannot be deduced by reason alone” (1).

In modern times, the Razor has been stated as “simplicity is better” (4) or in the colloquial “keep it simple, stupid” (2). In medical science, it has become traditionally interpreted as diagnostic parsimony or as “when you have two competing theories that make exactly the same predictions, the simpler one is better” (1).

SUPPORT FOR OCCAM’S RAZOR

Throughout the centuries, Occam’s Razor has garnered much support from a very diverse group of individuals. The Razor has been used in fields ranging from physics to medicine, from pattern recognition problems (4) to philosophy. Those theories that have favored the Razor have usually been more universally accepted than their counterarguments. In physics, Newton’s Law of Motion had been preferred over Kepler’s Laws of Planetary Motion. Even though both theories made generally the same predictions about the motion of the planets, Newton’s theory was simpler and made less assumptions. The discovery of the planet Neptune from the predictions of Newton later supported his theory (5).

In medicine, Osler’s Rule states that each patient is limited to one diagnosis which is capable of explaining all the symptoms of the patient. It is very important to note that Osler’s Rule was derived in an era where the prevalence of an infectious disease was far greater than that of multiple system diseases (6).

In physics, the Razor has been used to eliminate metaphysical concepts which could not be detected. Einstein’s Theory of Special Relativity and Lorentz’s theory that rulers contract and clocks slow down when in motion through the ‘ether’ make, generally, the same predictions. However, Einstein, in formulating his Special Theory of Relativity, followed Occam’s Razor in eliminating the undetectable ‘ether’ (1). Stephen Hawking, the Lucasian professor of mathematics at the University of Cambridge, states in ‘A Brief History of Time’ that “we can still imagine that there is a set of laws that determine events completely for some supernatural being, who could observe the present state of the universe without disturbing it. However, such models of the universe are not of much interest to us mortals. It seems better to employ the principle known as Occam’s Razor and cut out all the features of the theory that cannot be observed” (7). Wilhelm Gottfried Leibniz was faithful to the Razor in his ‘Identity of Indiscernibles Principle’. Leibniz’s Principle raises questions about the factors which individuate qualitatively identical objects (1).

John Milton (1608-1674) is credited with the earliest defense of free speech in Western history due to his statements in “Areopagitica” (3). However, Occam used his minimalist thinking in “Dialogues I.2.22” centuries before he stated that “…purely philosophical assertions which do not pertain to theology should not be solemnly condemned or forbidden by anyone, because in connection with such assertions anyone at all ought to be free to say freely what please him …” (3)

Even in popular literature, Occam’s Razor has been a focal point. Sir Arthur Conan Doyle’s Sherlock Holmes adopted and reinvented the Razor into his own principle. Holmes states in ‘The Sign of Four’ that “when you have eliminated the impossible, whatever remains, however improbable, must be the truth” (8).

DR. JOHN B. HICKAM

John Bamber Hickam was born in the Philippine Islands on August 10, 1914 to Colonel and Mrs. Horace Hickam (9). His father was an American aviation pioneer and was honored (9), after his passing, with the naming of an airfield, Hickam Field, adjacent to Pearl Harbor U.S. Naval Base in 1935 (10). The eponymous airfield was forever brought to international attention on the morning of December 7, 1941 when fifty Japanese dive bombers and fighters struck Hickam Field killing 189 men and wounding 303 (11). Hickam graduated from Harvard University in 1936 and Harvard University School of Medicine in 1940 (9).

Dr. Hickam was recruited from Duke University to head the Department of Medicine at Indiana University School of Medicine in 1958 (12). He published over 75 articles in medical journals and was known for his research on pulmonary function in heart and lung disease and retinal circulation through the use of photography (9). Hickam passed away on February 9, 1970.
HICKAM’S DICTUM

Hickam’s Dictum is the medical profession’s counterargument to Occam’s Razor. It is very simply stated that “a patient can have as many diagnoses as he darn well pleases” (13). It is useful in obtaining a diagnosis when a patient does, in fact, have multiple ailments accounting for their symptoms.

SUPPORT FOR HICKAM’S DICTUM

The Dictum has not had the benefit of existing for the centuries that the Razor has. Hence, it has not garnered the widespread support that the Razor has. Saint’s Triad can be seen to support Hickam’s Dictum. It is named after a South African surgeon, C.F.M. Saint, who stated that when the results of the physical examination were not typical of any single condition, multiple diseases should be considered as the diagnosis (14). Saint’s Triad refers to the association of hiatal hernia, gallbladder disease, and diverticulitis for which there is no pathophysiological reason for the coexistence of these three diseases (15).

PROPOSAL OF A COROLLARY

Throughout the centuries, the Razor of William of Occam has been used to formulate theories in an extremely diversified array of disciplines amongst which are philosophy, medicine, metaphysics and physics. Ergo, it has garnered much deserved support and respect. Hickam’s Dictum, the relative newcomer, has proved to be both a worthy and necessary antagonist.

The twenty-first century poses new and much different situations and puzzles for the present day men and women of science than were posed to our predecessors from the fourteenth through the mid-twentieth centuries. This is true of all disciplines of science but, is especially pertinent today in medicine and dentistry.

Hence, I propose the need for a corollary- a corollary which finds its genesis in both Occam’s Razor and Hickam’s Dictum. This corollary would state that when medical and dental professionals are in the process of forming a definitive diagnosis, the patient’s age and immunocompromised status must be taken into account whether to favor Occam’s Razor or Hickam’s Dictum as a guideline in achieving a correct diagnosis. Occam’s Razor should be followed in seemingly healthy, younger individuals. However, in the elderly and/or immunocompromised individual, the pendulum should swing towards favoring Hickam’s Dictum in a directly proportional relationship to the extreme of a patient’s age and the degree of immunocompetency of the individual. This relationship is attributable to the increased likelihood of multiple diseases causing the presenting signs and symptoms in elderly and immunocompromised individuals. In modern society an individual could have multiple chronic diseases such as hepatitis, HIV, diabetes, and various forms of cardiovascular ailments. The patient might not even be aware of some of these disorders. This complicates the diagnostic process as some diagnosticians might erroneously settle on a diagnosis of one of the patient’s known ailments in order to reach a diagnosis.

All individuals, even a seemingly healthy young person, might have several diagnoses while an older individual might present with several pathognomonic signs of one particular disease. One ailment which could be diagnosed by both physicians and dentists is Celiac Disease (CD). The patient, regardless of age, would most likely be given multiple diagnoses to account for the pathognomonic signs of CD. These signs could include diarrhea, weight loss, mouth sores, fatigue, osteoporosis, infertility, muscle weakness, and peripheral neuropathy. It is easy to see how other ailments (irritable bowel syndrome, various neurological disorders) might be erroneously thought to be the cause of an individual’s symptoms which are truly attributable solely to CD. Similarly, on a global context individuals with CD who emigrate from a rural area to a more urban one might start to develop symptoms of CD due to a new, more diverse diet. Many of these individuals are given multiple diagnoses as CD often goes undiagnosed.

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