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# New Semiotics: Canada's New Initiatives

**Abstract:** Canada's relationship to semiotics has been one of engagement, isolation, continued interest, and convergence. Semiotics in Canada has existed for a considerable period of time and, recently, has made itself a niche in the academic landscape by focusing on applications in three specific fields—forensics, robotics, and mathematics. Through our survey of the evolution of semiotics in adjacent and parallel fields, we demonstrate how semiotics serves as a veritable bridge between the sciences and the humanities. Providing a historical, contextual, and heuristic mapping of semiotics as it is currently used in Canadian institutions provides new inroads and applications that are required for the continued success of semiotics.

**Keywords:** forensics; mathematics; robotics; semiotic applications

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## 1 Introduction

The divergent nature of semiotics in Canada today may be its greatest asset. Although the current thought (and in many places the current trend) is to create a homogenized and unified semiotic approach that is applied to the study of the very cultural context out of which it is taught and practiced, Canada's purview of semiotic inquiry has become highly diversified and applicative, allying itself with scientific disciplines, and specifically, forensics, robotics, and mathematics. With the Program in Semiotics at the University of Toronto being one of the largest in Canada and, probably the English-speaking world, the semioticians involved in collaborating with the Program have forged partnerships with other universities where semiotics is taught, especially Ryerson, and with scientific institutes in order to make semiotics a veritable bridge between the sciences and the humanities.

In an overview of the institutionalization and evolution of semiotics in the United States, the late American semiotician Thomas A. Sebeok (1991) painted a bright picture of the spread within academia of the discipline as an applied tool, especially in collaboration with scientists. Sebeok followed this up in 2001 with

a plea to make semiotics the "queen of sciences", as mathematics has often been called, throughout the globe, uniting the humanities and the sciences in a seamless fashion, which he often called the "semiotic web". Sebeok did more to establish the field of semiotics in modern times than any other single scholar. And in many ways, his assessment, which drew upon his personal experiences, was intended to support his life-long goal of inserting semiotics permanently into the scientific and intellectual landscape of North America. But in some ways, Sebeok's plea has remained largely a dream. Taking our cue from his work, the authors of the present paper have taken his appeal seriously and have initiated efforts to transform semiotics into a scientific tool—a tool for scientists to use in carrying out their discipline-specific research. The areas where we have inserted (or are in the process of inserting) semiotics are forensics, robotics, and mathematics. The purpose of this essay is to provide a schematic overview of these efforts, what they entail for the profession of semiotics, and what they imply for the development of semiotic theory and practice.

## 2 Forensics

Forensic science is subdivided into various branches that characterize it as a maximally interdisciplinary science. In addition to criminology, medical forensics (involving DNA analysis), and other specialized branches (forensic ballistics, forensic entomology, forensic dentistry, and so on), there is also a forensic psychology, a forensic linguistics, and a forensic anthropology, among other sub-branches, which bring their tools to bear on crime. From several research projects at the University of Toronto, examining the role of symbols in criminal organizations and gangs (for example, Danesi and Nicaso 2013), it was decided to set up a research centre for the specific purpose of making *forensic semiotics* a reality and promoting it to scholars, researchers, and the general public. The centre is called Research in Forensic Semiotics (RIFS) and it has already produced findings, discussions, and ideas that would seem to be of value to both criminology and semiotics itself.

Forensic science uses scientific methods for solving crimes, including fingerprint analysis, DNA analysis, and so on. But it also enlists such specialized sciences as psychiatry, toxicology, and pathology**.** In most crimes, the evidence is collected either by police officers or by technicians associated with a crime laboratory. But in such serious crimes as murder, criminalists often go to the scene of a crime. They gather the evidence and, if possible, try to reconstruct the crime and subsequently rely on experts in various fields to help them track

down the culprit. The relevant thing to note here is that fingerprints, footprints, DNA samples, and the like are really types of signs. A crime laboratory uses a number of techniques to identify and analyse evidence. Interpreting them is also part of the process. Clearly, a semiotician trained in forensic science will be especially helpful in decoding many of the signs and clues that clutter crime scenes.

One of the first crime laboratories was established in Lyon, France, in 1910 by Edmond Locard, a physician. Locard helped work out scientific methods to investigate crimes, looking back to the work of Alphonse Bertillon, a French statistician, who developed a method of identifying persons according to their body measurements—a method first used in Paris in 1879, spreading throughout the world shortly thereafter. Also in the same period of time, a British colonial administrator in India, Sir William J. Herschel devised a workable method of fingerprint identification, which inspired Sir Francis Galton, a British scientist, to develop Herschel's methods into a modern system of fingerprint identification in the 1880s. By the late 1910s, fingerprinting had replaced the Bertillon system almost entirely as a more accurate method of identification. In the United States, the FBI established a fingerprint file in 1930. The first crime laboratory was set up in Los Angeles in 1923.

Although forensics is now an established science, it is highly likely that it surfaced also in part because of fictional portrayals of crime and especially the detective story, as studies in the well-known collection of studies, *The Sign of Three,* edited by Sebeok, and Eco (1983). These suggest that the appearance of the detective genre in the work of Edgar Allan Poe's *The Murders in the Rue Morgue*, in 1841, inspired criminology to surface as a science. As is well known, Peirce admired the qualities of the first hero detective, Poe's Auguste Dupin. To Peirce, Dupin exemplified how abduction can be used brilliantly to solve crimes, with a mixture of practical logic and of inferential hunches based on experience. So, given the connection between the birth of modern-day semiotics in the writings of Peirce and the detective genre in the writings of Poe, the case for a forensic semiotics seems to be a straightforward one. As a branch of both semiotics and forensics, it will look at various uses of semiotic notions, methods, and techniques in the area of crime detection, criminal behaviour, and so on. But since semiotic theory also involves the use of representations of crime, then forensic semiotics will be subdivided into two branches—the factual and the fictional. The former will study sign systems such as facial expressions, body language, tattoos, gang rituals, the conversations of criminals and so on. The latter will look at representations of crime in fiction and the media and how these affect real crime, using the notion of the simulacrum between fiction and reality. The image of criminals and mobsters as heroic figures has become

iconic. A primary goal of forensic semiotics is to demystify such representations as self-serving.

One factor that crops up regularly in the data on gangs is the role of symbolism in determining gang structure and in communicating appeal to young people. The role that clothing, hairstyle, tattoos, and other forms of symbolic self-presentation play in inducing specific individuals to join gangs has been pointed out throughout the literature from various disciplinary angles. But most of the studies simply acknowledge its presence as a factor without delving into the nature and strength of its attraction. There seems to be virtually no work assessing the role of symbolism vis-à-vis gang membership and allegiance. Symbols are the ersatz means through which individuals satisfy their need to belong to some social grouping. Symbolism plays a fundamental role in all kinds of group-specific lifestyles and philosophies, from religious ones to political and artistic ones. It thus comes as no surprise to find that it plays a similar role in gangs. This is why each gang develops its own system of symbols, which allows it to define itself and to establish its distinctive existence across social spheres. These constitute the "emotional glue" that binds gang members together. In our view, the whole field of gang study should take this aspect of gangs much more seriously, relating symbolism in society as a whole with the kind that induces young people to join gangs.

Connected to forensic semiotics is the long-established field of *legal semiotics,* which is growing in leaps and bounds. Apart from the many studies on the part of experts on legal semiotics (for example, Wagner and Broekman 2011), semiotics is making its way, incredibly, into the criminology domain. For example, the Center for Homicide Research in New Orleans has adopted semiotic techniques to investigate crime scenes and to decode the symbolism used by criminals and gangs. Using various research methodologies, the rituals of criminal organizations can be understood through the process of semiotic deconstruction (interpretation by decoding the signs and symbols of the gangs). The courts are also beginning to use semiotic evidence in criminal proceedings. In the city of Edmonton, Canada, for example, the Court may look at whether or not an accused person uses a name, word, symbol, or other form that identifies, or is associated with, a criminal organization, in order to determine whether the accused participates in the criminal organization.

The overall objective for establishing a forensic semiotics is to get to the bottom of crime, why it occurs, and why we continue to be fascinated by it (through our narratives and other representations). As Peirce certainly knew, the semiotician is essentially a detective, who searches for clues to the meaning of life, much like the protagonist does in Michelangelo Antonioni's 1966 movie *Blow-Up*.

# 3 Robotics

At Ryerson University in Toronto, semiotics has started to branch out into one of the areas catching the eye of many computer scientists and researchers in the Arts and Humanities —namely, the applications of semiotics to robotics. Falling under the auspices of *Computer semiotics*, a growing branch of semiotics going back to the 1990s, even though it is based on work that goes back even further, the thrust of the on-going research in this branch inheres in using computer programming and robot design to test out theories of semiosis and thus to identify the properties that make human semiosis unique—a form of meaning-making derived from lived experience and developed through historical forces and thus not programmable in its entirety. This is the main theme in Peter Bogh Andersen's *A Theory of Computer Semiotics* (1997). Nonetheless, the computer can be used to model all kinds of semiotic systems and to assess how the human-computer interface unfolds. That is the objective of Shaleph O'Neill's *Interactive Media: The Semiotics of Embodied Interaction* (2008). Kumiko Tanaka-Ishii's *Semiotics of Computer Programming* (2010) suggests using computer programming as a means for proving or disproving specific semiotic notions and models of the sign.

Work is under way at Ryerson to apply similar semiotic notions to the design and understanding of robots. To the best of our knowledge, among the first to apply semiotic theory in this particular way was the engineer Alexander Meystell (1995), who worked for the American government in the 1980s and 1990s. His work shows that theories of the sign can easily be used to understand how robots work and can be made to efficiently carry out routine tasks. Essentially, robotic semiotics is actually a fledgling branch that Danish semiotician Søren Brier (2007) calls *cybersemiotics*, which is a blend of cybernetics and semiotics.

Cybernetics is the science of regulation and control in animals (including humans), organizations, and machines, viewed as self-governing entities consisting of parts and their organization into wholes. It was conceived by mathematician Norbert Wiener, who coined the term in 1948 in his book *Cybernetics, or Control and Communication in the Animal and Machine*. Wiener may not have known that the same word was used in 1834 by the physicist André-Marie Ampère to denote the study of government in his classification system of human knowledge. Ampère, in turn, had probably taken it from Plato's *The Laws* where it is also used to signify the governance of people. Wiener popularized the social implications of cybernetics, drawing analogies between machines and human institutions in his best-selling 1950 book *The Human Use of Human Beings: Cy-*

*bernetics and Society*. Cybernetics views communication in all self-contained complex systems (biological and mechanical) as analogous. It is not interested in the material forms of such systems, but in how the ways in which such forms are organized. Because of the increasing sophistication of computers and the efforts to make them behave in humanlike ways, cybernetics today is closely allied with artificial intelligence and robotics, drawing heavily on ideas developed in information theory.

As used in communication studies, the term applies primarily to systems in which the feedback and error-correction signals control the operation of the systems. Such signals (or signal systems) are called *servomechanisms*. Servomechanisms were first used in military and marine navigation equipment. Today they are used in automatic machine tools, satellite-tracking antennas, celestial-tracking systems, automatic navigation systems, and antiaircraft control systems. The primary task in the cybernetic study of communication is to understand the guidance and control servomechanisms that govern the operation of social interaction and then to devise better ways of harnessing and intervening in them

The cybernetic approach to communication is often used to ask fundamental questions such as what differentiates communication systems and organisms. It encompasses a taxonomy of notions, principles, and procedures for understanding the phenomenon of communication in its globality. The term *information* invariably comes up in any cybernetic or robotic discussion of semiosis, which is defined simply as any form of data that can be received by humans or machines. In the modern theory of information, it is considered as something mathematically probabilistic—a ringing alarm signal carries more information than one that is silent, because the latter is the "expected state" of the alarm system and the former its "alerting state". The one who developed the mathematical aspects of information theory was the American telecommunications engineer Claude Shannon (Shannon 1948, Shannon and Weaver 1949). He showed, essentially, that the information contained in a signal is inversely proportional to its probability. The more probable a signal, the less information "load" it carries with it; the less likely, the more.

Shannon devised his mathematical model in order to improve the efficiency of telecommunication systems. The model essentially depicts information transfer as a unidirectional process dependent on probability factors, that is, on the degree to which a message is to be expected or not in a given situation. It is called the "bull's-eye model" because a sender of information is defined as someone or something aiming a message at a receiver of the information as if he, she, or it were in a bull's-eye target range. Shannon also introduced several key terms into the general study of communication: channel, noise, redundancy,

and feedback. Shannon's model has, over the years, been useful in providing a terminology for describing aspects of communication systems

It is in the study of the relation between robotics and semiosis that a true study of cybernetic communication might come into focus. This is already being examined by others, elsewhere (De Souza 2005). Strictly defined, communication is the exchange of messages among members of the same species. Of course, some interspecies communication can occur, but the signals exchanged in such cases will not have the same function, impact, and content as they do within the same species. In the human species, communication can be interpersonal (between human beings), group-based (between some individual or media outlet and audiences), and mass-based (involving communication systems that encompass entire societies). The study of communication has become important in biosemiotics, which sees communication systems as basic formats for studying semiosis and sign differentiation among species. In semiotics, robotic communication will be studied from the point of view of how "meaning structures" can be processed by machines. The form of the sign and what it refers to are dynamically intertwined, one suggesting the other. This implies that the signifying resources and elements used to make representations are tools, namely extensions of the biology and psychology of the human organism making them. In effect, our signs are derivatives of ourselves.

In the field of applied robotics, researchers have taken to semiotics to evaluate Human-robot interaction (HRI). As intelligent robots are capable of interacting with human beings by mimicking human-like behaviour (through the use of language, body orientation, social clues, etc.), semiotics can be called upon to evaluate the interpretation of the simulated behaviour by humans. To this it is important to add that semiotic methods of inquiry inform decisions made by robotic specialists in the design and implementation of human behavioural traits during various development and programming stages. Early research linking robotics to semiotics has drawn on the Saussurian and Peircean models of the sign in order to develop a communications model informing HRI (Meystel and Albus 2000). Later, Sequeira and Ribeiro (2007) designed a modelling concept representing HRI using Peirce's triadic understanding of the sign. In order to recreate semiosis, including sign transference and the potential for extensive artificial semiosis, research also evaluates modifications and artificial remodelling of the representamen and interpretant. Most recently, the Semiotic Inspection Method (SIM) and other research in semiotics and intelligent systems development provide bridges between Peircean signs and their modelling systems as well as important clues towards the acquisition of signs, namely through abduction. Abduction, Peirce's distinct reasoning form resulting from plausible inference based on consequences, is of particular interest in *Semiotics*

*and Intelligent Systems Development* (Gudwin and Queiroz 2007) as it provides essential clues about the mediated uses of the mind and the essential qualities to be recreated in artificial situations. At Ryerson University, current research in robotics semiotics is gaining insight into the speech patterns and other communication-related behaviours of autistic children. By observing interactions of children with Autism Spectrum Disorder (ASD) and small humanoid robots, advances in robotic technologies to uncover key elements of human communication are underway.

# 4 Mathematics

What is the nature of mathematics? This question has been addressed primarily within the confines of the philosophy of mathematics and mathematics proper, with little, or no, input from other disciplines. In the context of current intellectual developments, this is arguably an unnecessarily narrow approach to the investigation of this significant phenomenon of human cognition and culture. During the last four decades, substantial theoretical and scientific advancements have been made in the study of human thought and its relationship with language, symbols, culture, history, as well as with its biological underpinnings. These advancements have been made through a variety of methods in a broad set of disciplines, from the cognitive sciences (neuroscience, psychology, linguistics, anthropology, etc.) to semiotics, history and archaeology.

A few semioticians and mathematicians have occasionally looked at mathematics from the standpoint of sign theory—we mention, for instance, Rotman (1988, 1993), Otte (1997), Lemke (2003), Marcus (2003, 2010), Radford, Schubring, and Seeger (2008), Danesi (2008). But overall this field is an open one and maximally suitable for semioticians to enter into, given that mathematics is fundamentally semiotic (dependent on notation, logical markers, and other sign forms). For this reason, a Cognitive Science Network was established at the Fields Institute for Research in Mathematical Sciences at the University of Toronto, which includes semioticians, mathematicians, cognitive scientists, and others collaborating in an effort to understand the nature of mathematics (Bockarova, Danesi, Núñez 2012). A primary influence in the founding of this network is the book by George Lakoff and Rafael Núñez, *Where Mathematics Comes From*: *How the Embodied Mind Brings Mathematics into Being* (2000), which explicitly addressed the question of the nature of mathematics as an *empirical* question, subject to investigations of an interdisciplinary nature. Through the analysis of fundamental concepts in several areas from simple

arithmetic to infinitesimal calculus and set theory, they argued that mathematics is, in fact, a unique type of human conceptual system brought forth via the recruitment of everyday cognitive mechanisms that make human imagination and abstraction possible, such as metaphors and conceptual blends. In *The Way We Think* (2002), Gilles Fauconnier and Mark Turner proposed arguments along the same lines. Data and emerging results in this new domain of inquiry have been collected gradually and published in a variety of peer-reviewed academic documents. And beyond pure theoretical considerations, these new results have profound implications for the teaching and learning of mathematics.

Actually, it was Roman Jakobson who claimed that structuralist notions, such as *value* and *opposition*, could be profitably applied to the study of mathematical structure (see Andrews 1990). Jakobson's implicit entreaty to study mathematics from the structuralist perspective has never really been taken up systematically, either by semioticians or mathematicians, despite the fact that much has been written about the relation between semiotics and mathematics since Jakobson's time, even though there now exists intriguing evidence from the fields of education and psychology that such notions actually explain central aspects of how mathematics is learned and what mathematical cognition is all about. The purpose of mathematical semiotics (as it may be called) is to use semiotic notions in the light of their implications for the analysis of mathematics as a code. Such an approach might make it possible to lay the groundwork for formulating specific questions about the nature of mathematics, as Jakobson had obviously envisaged.

## 5 Concluding Remarks

It is accurate to say that the trends in Canadian semiotics today are no different than those of semiotics elsewhere in the world. The difference is perhaps, that those working in the field have forged partnerships with scientists in other domains and specifically forensics, robotics, and mathematics. Using a blend of Saussurean and Peircean concepts and techniques at various stages of analysis and for diverse purposes, semiotics tends to focus on topics of relevance to the contemporary world, from marketing and advertising to the study of hypertextuality. We would claim that its application to the abovementioned sciences would be even more advantageous, both for the fields where it is applied and for semiotic theory itself. Already, there are many indications that its mode of inquiry is becoming more and more a two-way street, since many ideas developed within semiotics proper are now found scattered in cognate fields across

North American research paradigms and, vice versa, semiotics is being influenced by the fields into which it enters.

The *raison d'être* of semiotics is, arguably, to investigate whether or not reality can exist independently of the signs that human beings create to represent and think about it. This awareness is gaining ground as semiotics is starting to attract a whole new generation of North American scholars and scientists. We believe that in Canada semiotics is a dynamic, vibrant, and constantly growing field, even with a paucity of institutional and governmental funding support. Perhaps its greatest allure is that with barely a handful of notions and concepts, it can be used so insightfully to describe and understand such things as crime, mathematical notation, and how machines work, buildings, and, indeed, anything that is "interesting" in human life. As a consequence, the future, as Sebeok anticipated, is becoming constantly brighter.

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