Theory Development and the Logic of Discovery

Maj-Britt Råholm, PhD, RN
Stord/Haugesund University College

Abstract
The aim of this article is to discuss the importance of theory development within caring science and whether abduction, as a distinctive type of inference, can contribute to this. We need to understand the role of theory in our discipline, the strategies used to develop it, the criteria used to critique it, and the possibilities for abductive reasoning to enhance theory development within caring science. Abduction paves the way for a deeper knowledge of understanding and is closely connected to the ontological questions.

Key Words: Caring, caring science, theory development, abduction, scientific inquiry, qualitative, understanding, Peirce, ontology

Introduction
In the past 30 years, caring science has grown, but the opposition has also increased. According to Walker and Redmond (1999) the current call for evidence-based nursing practice has set the debate in a conventional, atheoretical, medically dominated, and empirical model of evidence, which threatens the foundation of caring’s disciplinary perspective on theory-guided practice. According to Gaut (2001), knowledge within caring has developed by both extension and intensification. In contemporary caring science growth by intensification occurs when a, “…partial explanation of a whole region is made more and more adequate and outlines for subsequent theory and observations are clarified” (2001, pp. xii-xix).

The English word “theory” comes from the Greek word “theoria,” which means “to see,” that is, to reveal phenomena previously hidden from our awareness and attention (Watson, 1999). The necessity of a humanistically oriented caring science was pointed out earlier in the United States as well as in the Nordic countries (Eriksson, 1981, 1988; Parse, 1985; Stevenson & Woods, 1985; Watson, 1988). The development of caring science in the Nordic countries goes back to the late 1970s, when professorships and doctoral programs were established. At least three distinct positions operate in Nordic caring research: a clinical and applied oriented position, a profession and knowledge oriented position, and a theoretical and concept oriented position. According to Larsen and Adamsen (2009), the positions are of a spontaneous, cyclical, and “break” character. The discussions have also been affected by issues of whether caring is a profession or a scientific discipline and the possible relation between caring research and clinical practice (Larsen & Adamsen, 2009).

Past generations of nursing professors were educated in disciplines other than nursing and, largely, in the positivist/post positivist, natural science tradition. The infiltration of alternative conceptions of the caring discipline is very slow (Pilkington, 2002). The early works within nursing science that emerged from curricular efforts were conceptual models, which were implicitly or explicitly linked with various theories by nurse educators. According to Alligood (2002), a conceptual model is “…a set of interrelated concepts that symbolically represent and convey a mental image of a phenomenon” (p. 643) and “…theory is regarded as a grand theory because it is almost as abstract as the conceptual models itself” (p. 649). Results of tests of theories have major implications for the conceptual model. If the results of repeated studies do not support the propositions of the theories, then the conceptual model would be discarded and researchers would use another conceptual model to guide their studies.

Theory of science plays a fundamental role when constituting a discipline. The theory of caring science aims to provide an overall picture of it as an academic discipline. Developing original knowledge that crosses boundaries signifies the quest for what is likely (true), ethical and good for the patients (Eriksson & Lindström, 1999, 2003). The theory of science, which will be drafted here, constitutes a caring science based on a humanistic scientific tradition. It is by nature Aristotelian. That is, it is grounded in the basic thought system that originates from Aristotle’s (1970, 1972) theory of knowledge and is also the basis for Gadamer’s (1999) hermeneutics. Preponderance of nursing literature, certainly nursing research, is often grounded in knowledge bases from other disciplines, shuns any discussion of nursing philosophy or theory, and relates to caring/nursing primarily as biomedical/technical nursing. In current literature, typically a procedure or intervention is presented in isolation from the theory that undergirds that procedure or intervention and in isolation from the value of the evidence (Fawcett, Watson, Neuman, Walker, & Fitzpatrick, 2001). Without their own knowledge base, nurses will be easier to control by other disciplines and under-developed theoretical knowledge means that nursing can remain at the technical or vocational levels. The challenge lies in further developing the substance of caring science. According to Eriksson & Lindström (2003), research should be based on a discipline-specific theory that gives the discipline its
unique perspective (Eriksson, 1997). Lundgren, Valmari, and Skott (2008) found in their study that dissertations from the Nordic countries oriented toward basic research, or based on the context of meaning and the inner condition of science itself, was regrettably rare. The authors concluded that this can be a negative influence on the future development of the discipline.

The aim of this article is to discuss the importance of theory development within caring science and whether understanding of the logic of discovery, or abduction, as one distinctive type of inference, can contribute to this.

**Theory Development as the Goal of Scientific Work**

The development of knowledge in caring science has to a great extent been characterized by vocational reasoning without any anchoring in a theoretical framework with clearly articulated ontological contention. According to Meleis (1997), theory is no longer a luxury in nursing but a part and parcel of the nursing lexicon in education, administration and practice. Theory is the goal of all scientific work. Theorizing is a central process in all scientific endeavors and theoretical thinking is essential to all professional undertakings. According to Fawcett (1999a, b), it is important to develop discipline-specific research to advance the science of nursing and to ensure the survival of the discipline. A narrow and simplified view of caring science as an exclusively practical and applied form of science lacks a theoretical foundation and there is a risk that the ideals become diffuse and thus the historical and ethical perspective is blurred. Developing the theory of caring science and core area ought to be self-evident when constructing an autonomous field of science. If one argument is that our concepts constitute our reality, where does the focus area lie today within research in caring science in particular and theory development in general? The purpose of basic research is to pose new questions. Any scientific field loses its essence when no further questions can be asked. In order to be open to knowledge, the components of the issue need to be analyzed. This is done through thematizing with the clinical context or philosophical texts (Eriksson, 1988; Eriksson & Lindström, 1999). The fruitfulness of a theory within caring science is evaluated through how well it reflects the clinical reality of caring and how it manages to open new horizons. These horizons are locked until our creativity and our questions open them up. The right reasoning is fundamental in progressing in the scientific work. This reasoning has an inner logic.

**Scientific Opening – Induction**

According to Parse (2009), it is more difficult to demonstrate paths of inquiry for faculty members in the discipline of nursing, where there are less discrete knowledge guidelines but many avenues of choice. What constitutes a coherent pattern of knowledge development within the discipline also varies (Parse, 2009). Our present language and our concepts are insufficient to describe reality and the task of science is to refine our concepts and our minds regarding different basic questions. Questions, such as, What constitutes reality? and What do we mean by science, truth, text, and reading? (Eriksson, 2002). Human sciences require specific, fine-tuned language to describe its subject matter. This leads to interpretations of words that differ from the prevailing interpretations in the dominant scientific paradigm (Parse, 2001a, b). Our search for knowledge is by nature historical-hermeneutical and takes place in a dynamic alteration between the natural world and the world of science. Gadamer (1999) claimed that perception is never a simple reflection of what the mind meets—conception of something as something, i.e., having a meaning. He believed that seeing is a way of reading, of looking into that which does not exist and articulating that which does exist by excluding a great deal of what comes from seeing. Our ethos and our ontological assumptions are the starting point and the building blocks of a theory of science. Epistemological choices are directed by an explicit ontology that forms the sounding board for the outlines of the theoretical perspective. The data that are collected always bear signs of the suffering human being’s story and this data provide answers and open a different preunderstanding of the phenomena of caring. The pattern that arises as a result of the pendulation between the empiricism and theory gives life to science and practice (Lindholm, Neiminen, Mäkelä, & Rantanen-Siljamäki, 2006). The researcher gets a picture of the clinical reality as it is experienced or comprehended by patients or relatives, inductively (Figure 1). Inductive reasoning is open-ended and exploratory, especially at the beginning. On the other hand, deductive reasoning is narrow in nature and is concerned with testing or confirming hypothesis. According to Minnameier (2004), we, even in the simplest induction, first abduce to some explanation that make some sense for us and only then do we come to accept (or possibly reject) this explanation.

There is also a practical objection that laws or principles in science are rarely found by enumerating and summarizing observations. Induction may be a method for testing a finished theory, but it does not explain how the theory was arrived at (Popper, 1959). Induction can never originate any new idea, it simply confirms what was already tentatively contributed to knowledge. At the very most it corrects the value of a ratio or slightly modifies a hypothesis in a way that had already been contemplated as possible. According to Eriksson and Lindström (1997), we get a more or less plausible and descriptive knowledge by an inductive approach. Thus, this knowledge does not lead to real scientific progress within the discipline. The movement between the reflective readings of the empirical material in the light of the research question is an important step of scientific building. Within qualitative research one can explore new dimensions in the experiences of the patients. However, the re-
searcher may run a risk to reduce the empirical material, i.e., disclosing the important messages of the text.

Minnameier (2004) argued that we are well aware that ordinary induction can, at best, produce “more of the same” instead of novel kinds of knowledge, let alone more abstract ones. We also have evidence that classical inductive generalizations from larger samples hardly play any role in actual science (Suppe, 1997). Qualitative induction may also result in a theory’s refutation as certain facts one has come to habitually subsume to a given theory prove to be in conflict with it or with other parts of one’s theoretical knowledge based on caring science.

Scientific Creation – Deduction

Deductive reasoning works from the general to the specific. This is also called a top-down approach. Deduction is valid inference, but it is analytic in character and does not provide new knowledge. Deduction helps render this indefiniteness definite or precise (Fann, 1970). To demonstrate deduction, Peirce used the following example: we have a bag that contains only white beans and from it we take out a few beans. Since we know the bag contains only white beans, we can deduce that the beans in our hand must be white. Thus, deduction explicates hypothesis, deducing from them the necessary consequences that may be tested (Anderson, 1987; Bird, 1959).

The role of deductive inference in one study (Råholm, 2003) was to derive the consequences of what is assumed in the caritative theory of Eriksson (2006). According to Gadamer (1999), tradition is not something we can consciously evaluate, as to whether we will accept or reject it. Rather, “…we stand in traditions, where we know these traditions or not” (Gadamer, 1999, pp. 390-391). It could be said that our traditions are the medium (the ontological background) in which we do our thinking and out of which evolves the conversation we bring to the other. In Gadamer’s (1999) philosophy, language assumes a supreme role as a medium for dialectical and historical experience of understanding, fusion of horizons, assessing prejudices, and disclosing hidden meanings embedded in the historical nature of man. Deduction plays an important role in setting forth creative and successful hypothesis that allow the researcher to begin generating promising new ideas. Thus, the researcher gets to the next stage or mode of reasoning—deduction and theory-
filled empirics. The ontological reality is seen as complex, infinite, and inexhaustible (Eriksson & Lindström, 2000) but it is through deductive reasoning (by reflecting and mirroring contextual phenomena against the ontological assumptions) that a context reveals the caring reality and thus receives a concrete face. The clinical context (e.g., in intensive care, in elderly care) gives color and tone to the pattern of caring and these experiences are deduced by the researcher. One way of enhancing the understanding of the phenomena is to recontextualize, reflect, and examine these phenomena (suffering, unbearable suffering, struggle, alleviation of suffering) against the ontology, but also in relation to central supporting theories (Levinas, 1988; Tillich, 1977) of interpretation.

Understanding the patient’s existential situation implies a hermeneutic movement between alienation and dedication. This means that the researcher has to, in the creative act, remain in the course of events as long as needed, without breaking the “ice of meaning” but making way for the dialectic stream of thought and interpretation. In remaining, there is a yearning for understanding. The research process proceeds in accordance with the hermeneutical circle, where understanding increases step by step in the form of still pictures, where the horizons are changed and expanded in a regular process in the light of the basic caring science pattern (Råholm, 2003). Openness is important in the scientific creation. The hermeneutical movement is a reflective movement that can open up new horizons and make the invisible perceptible (Ekebergh, 2001). However, the researcher may run the risk of getting into a “conceptual prison” by exclusively creating categories from a biomedical perspective or by inviting models of explanation that may prevent rather than prepare the way of deeper understanding (Eriksson & Lindström, 1997). Since the interpreted empiricism is a basis for abduction, it stands to reason that induction and deduction serve as a springboard for the abductive leap (Figure 1).

Logic of Discovery or the Theory of Right Reasoning

It is often remarked that in philosophy of science the discussions around the logic of discovery are quite confusing (Laudan, 1980). The term “logic” in “logic of discovery” can be interpreted in several ways. For some it means valid systems of deductive logic. For others it means formal or normative methods of inquiry or rational elements involved in discovery. Charles Sanders Peirce (1839-1914), the founder of pragmatism, struggled more than 50 years to lay bare the logic by which we get new ideas (Fann, 1970; Peirce, 1958, 1990). As a system builder, Peirce considered logic to be the foundation of his philosophy. Peirce’s work on logic may be interpreted as an attempt to provide a theory of methods for the further advancement of science. He realized that he was a pioneer in this field and remarked, “It must be confessed that we students of the science of modern methods are yet but a voice crying in the wilderness, and saying prepare ye the way for this lord of the sciences which is to come” (Fann, 1970, pp. 25-30).

Peirce (1958) defined logic as the theory of right reasoning, of what reasoning ought to be. We are held responsible for our reasoning, just as we are morally responsible for our conduct. This conception of logic throws considerable light on the nature of abduction. It is obvious that the process of hypothesis construction and selection is a conscious, deliberate, voluntary, and controlled conduct, and thus open to criticism at every step. Hanson (1958) appealed to Aristotle and especially to Peirce’s abduction and maintained that although there is no manual for making discoveries, there is a conceptual and logical issue how hypotheses are suggested. He opposed both the hypothetico-deductive and the inductive methodologies as inadequate because they both neglect the abductive process, which moves from data to theories and to new explanations, hypotheses, and conceptual patterns (Hanson, 1958). Peirce may be seen as providing a foundation for the contemporary claim that a scientist does not know fully what he/she is going to create until he/she creates it. For Peirce, spontaneity was the essence of creativity; it provided the discontinuity between the past and the future in which something new was able to rise (Fann, 1970).

Peirce (1958) distinguished three independent forms of reasoning: abduction, induction, and deduction. Abduction is the first step of scientific reasoning, induction is the concluding step. The great difference between induction and abduction is that the former infers the existence of phenomena, such as we have observed in cases which are similar, while abduction supposes something of a different kind from what we have directly observed, and frequently something which would be impossible for us to observe directly. Induction can never originate any new idea but simply confirms a hypothesis, thus, induction is the final testing of the created hypothesis. It mediates between abduction and deduction by testing the “must be” against “what is.” It is only after induction that we can attach any significant value to hypothesis. Thus induction must develop what is already known, whereas abduction is free to introduce new ideas. Peirce’s understanding of deduction is entirely traditional. There is a sense in which abductive hypotheses are initially indefinite, that is, they are indeterminate from the perspective of the scientific creator.

In his earlier papers, Peirce (1958, 1990) treated abduction as an evidencing process but the first full statement of Peirce’s later theory of abduction is contained in his 1901 manuscript, On the Logic of Drawing History from Ancient Documents. When surprising facts emerge, an explanation is required. The explanation must be such a proposition as would lead to the prediction of the observed facts. A hypothesis then has to be adopted that is likely in itself and renders the facts likely (abduction). The first thing that will be done, as soon as a hypothesis has been adopted, will be to trace out its necessary and probable experimental consequences (deduction). When we find that prediction after prediction is verified by tests we begin to accord to the hypothesis a
standing among scientific results (induction) (Anderson, 1987) Although Peirce was interested in the entire range of abductions, because each plays some role in the growth of signs, he was most interested in those abductions that allowed science to grow (Fann, 1970). The abductive form was first called hypothetical, then abductive, then retroductive, and later abductive consistently. Peirce saw the discovery of gravity as a case of creative abduction. The concept of gravity is a hypothesis in an abductive inference. Gravity is in the premises in the sense that there is a logical relation between premises and conclusions. Thus, gravity is implicit in the nature of universe, but it is not known until it is discovered (Fann, 1970; Peirce, 1958, 1990). In creative abductions the hypothesis involved will be original in the sense of being distinguished for the first time. Peirce (1958) stressed that abduction, despite its weakness as an argument form, is nevertheless that logical form on which all scientific reasoning depends. According to Peirce (1958), abduction is the only type of inference that is creative in the sense that it leads to new knowledge, especially to theoretical explanations of surprising facts.

The Scientific Synthesis – Abduction
Abduction, a term borrowed from Aristotle is, thus, the first stage of a three-stage account of scientific inquiry (Figure 1). Abductive reasoning, besides induction and deduction, may be a necessary step when in reaching a deeper knowledge in caring science. Whenever our concepts do not seem to correspond to reality in caring science, abduction may help us to a better understanding. Abduction focuses on what is vague and possible, from what hypotheses could be created (Eriksson & Lindström, 1997). It is evident that abduction alone can supply new ideas. It is the only kind of reasoning which is, in this sense, synthetic. Induction can never originate any new idea whatever, for it simply confirms what was already tentatively contributed to knowledge. Regarding changes and progress of scientific knowledge, deductive systems need to be viewed as fields of acceleration instead of goals in themselves. A theory becomes rational and empirical as we are able to examine it critically by subjecting it to refutations and observable tests. A valid theory will endure this criticism as well as the tests that disproved their predecessors. The rationality of science lies in the reason-based selection of a new theory (Popper, 1997). Abduction seeks a theory. Induction seeks facts. The abductive suggestion appears as a flash. It is an act of insight, although of extremely fallible insight. All the ideas of science come to it through abduction (Peirce, 1958). Peirce (1958) generalized the notion of abduction in his later writings and viewed it as the process by which any hypothesis is made. On the other hand, he demoted induction and deduction to merely stages of checking the validity of an already formed hypothesis.

Eriksson and Lindström (1997) distinguished between three different forms of abduction through action, which they term explorative (pattern seeking), generative (pattern creating), and pragmatic (renewing patterns). Clinical researchers describe the clinical reality of caring (Figure 1) from the viewpoint of a given theory while trying to deepen and cross the prevalent horizons through so called abductive leaps (boundary crossing theory formation). The abductive leap signifies a synthetizing abstraction, where theory incessantly determines the direction of further scientific work (Råholm, 2003). Simultaneously, it means creating new scientific concepts that have a stronger ability to explain matters, for example, regarding suffering and health. Theory development is a means of shifting back and forth between theory-filled empirics and empirics-filled theory. We develop new ideas as building blocks for our own hypotheses. This is described in a citation by Rumelhart, McClelland and the PDP Research Group:

One of the great joys of science lies in the moment of shared discovery. One person’s half-baked suggestions resonate in the mind of another and suddenly takes a definite shape. An insightful critique of one way of thinking about a problem leads to another, better understanding. An incomprehensible simulation result suddenly makes sense as two people try to understand it together. (1986, p. ix)

Abduction, as a logic of discovery, paves the way for a deeper knowledge of understanding of different phenomena in caring reality and through the aid of it the interpreted knowledge (empirics-filled theory) shall be further processed in order to reach a deeper and clearer knowledge pattern. Abduction portrays the potential, the possibilities, and is closely connected to the ontological question. In a study among coronary artery bypass patients (Råholm, 2003), abduction paved the way for deeper understanding and knowledge – a molding of the substance of four patterns of life among the patients: to endure, to struggle, to sacrifice and to become. Being rooted in the basic patterns of caring science, this made new crossings of the dividing line possible in the form of abductive theses. The addition of theory, according to Larsson (1994) signified how well the researcher was able to relate to previous theory and whether the results might change theory. The logic of discovery through abduction has the potential of exploring creative theoretical insights and, thus, developing caring science as an academic discipline in the long run. Researchers risk remaining preoccupied with surface structures that comprise a whole succession of repeated empirical summaries. Therefore, researchers should be aware of the vageness of caring knowledge and anticipating “the maybes” for a deeper understanding and have the courage to take the leap into the unknown (Eriksson & Lindström, 1997).
Conclusion

The aim of this article has been to discuss theory development within caring science and whether abduction as one distinctive type of inference can contribute to this. Peirce (1958) was well aware that successful inquiry also demands certain positive qualities of mind. According to Peirce (1958), these qualities of mind rest at bottom on no more than “…a hearty and active desire to learn what is true” (p. 45).

Processes of discovery involve such things as creativity, surprising coincidences, and happy guesses. Abduction is involved when the researchers struggle for new kinds of intelligible patterns in some puzzling data or phenomena. This long process, where various pieces and elements are put together to their final form, is an essential part of the process of discovery, not just those rare moments when some big ideas are discovered.

The need for nurses to articulate a coherent theoretical foundation and to enhance theory development within caring science has never been greater. There have been, on the whole, fewer publications on ontology and epistemology, and there may be many reasons for this. One main reason may be the strong traditional professional-oriented paradigm emphasizing a narrow practical approach in favor of an open scientific paradigm. The fruitfulness of theory and perspective is evaluated by how well it reflects the clinical reality of caring and the opening of new horizons. The most important questions are: Is the knowledge useful? Does the knowledge lead to better care for patients? Are patient outcomes better when caring knowledge is used than when it is not used?

Nursing theory opens doorways to new understanding through abstract notions and concepts that help nurses to understand the particulars they encounter in practice and research. These new scientific concepts explored and described, through abductive reasoning, may have a stronger ability to explain matters, for example, regarding suffering and health.

References


Larsen, M., & Adamsen, L. (2009). Emergence of nursing research: No posi-
tion is an island. Scandinavian Journal of Caring Sciences, 23, 757-766.


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Author Note

Maj-Britt Råholm is an Associate Professor/Head of Research and Development, Faculty of Health, Stord/Haugesund University College, Vikby, Finland.

Correspondence concerning this article should be addressed to Maj-Britt Råholm, Kvarnbacksvägen 12A, 65480 Vikby, Finland.

Electronic mail may be sent via Internet to majbritt.rahholm@hsh.no or mraholm@netikka.fi