

**Patterns of change in epistemic frameworks: a reformational
perspective**

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“Come break my bones, come spread my ashes. Come wear me down, come wear me down.
In life a king, in death a failure. Come help me cry, come help me cry.

I wanted to be changed by the road. I so wanted to change the road. But somehow we both resisted change. Somehow we were both too strong. And yet we have both winded away, unsure of where we head. And it’s like we’re both confused as to who is who. As if, late in the night, you can’t tell the wanderer from the road – the walker from the walked. Maybe I am just the road, dreaming that I walk.

Dust in my throat, dust in my nostrils. Dust in my mouth, dust in my eyes. From dust I come, through dust I wander. Dust I’ll remain – **dust all I am.**” *

* Of Dust, from the album Road Salt One by **Pain of Salvation**

Summary

PATTERNS OF CHANGE IN EPISTEMIC FRAMEWORKS: A REFORMATIONAL PERSPECTIVE

The aim of this project is to discern possible patterns in the changes of epistemic frameworks and in the way in which factors cause or stimulate such changes. Article 1 illustrates forms of consensus between the views of various prominent 20th century philosophers of science on the characteristics and functions of pre-scientific frameworks in scientific activity. This is done by highlighting various helpful insights from the reformational tradition as a point of departure. Article 2 attempts to achieve more clarity on how changes in epistemic frameworks occur, whilst article 3 discerns the factors influencing framework change. Article 4 illustrates and evaluates the relationship between change and constancy in the viewpoints of various philosophers and scientists throughout history. The project suggests that change and constancy can be related to epistemic frameworks according to a pattern referring to the irreducibility of coherents where change and constancy exist in cohesion. As a consequence, change is never completely random or absolute. Although a broad variety of factors play a role in framework changes, a pattern can be discerned in the sense that some factors play a regulative role, so that change is dynamic but not arbitrary.

Keywords:

Epistemic frameworks

Change

Constancy

Factors shaping science

Reformational philosophy

Philosophy of science

Opsomming

PATRONE VAN VERANDERING IN EPISTEMIESE RAAMWERKE: 'n REFORMATORIESE PERSPEKTIEF

Die doel van hierdie projek is om moontlike patrone in die veranderinge van epistemiese raamwerke, asook die wyse waarop faktore sulke veranderinge veroorsaak of stimuleer, te onderskei. Artikel 1 illustreer vorme van konsensus tussen die standpunte van verskeie prominente 20ste eeuse wetenskapsfilosowe, aangaande die karakteristieke en funksies van pre-wetenskaplike raamwerke in wetenskaplike aktiwiteit. Dit word gedoen deur verskeie nuttige insigte van die reformatoriese tradisie uit te lig as vertrekpunt. Artikel 2 poog om duidelikheid te verkry oor hoe verandering in epistemiese raamwerke plaasvind, terwyl artikel 3 die faktore wat raamwerkverandering beïnvloed onderskei. Artikel 4 illustreer en evalueer die verhouding tussen verandering en konstantheid in die standpunte van verskeie filosowe en wetenskaplikes deur die geskiedenis. Die projek stel voor dat verandering en konstantheid verband hou met epistemiese raamwerke volgens 'n patroon wat verwys na die onreduseerbaarheid van koherente, waar verandering en konstantheid bestaan in kohesie. As 'n gevolg is verandering nooit volledig willekeurig of absoluut nie. Alhoewel 'n wye verskeidenheid faktore 'n rol speel in raamwerkveranderinge, kan 'n patroon onderskei word in die sin dat sommige faktore 'n regulatiewe rol speel, sodat verandering dinamies is, maar nie arbitrêr nie.

Sleutelwoorde:

Epistemiese raamwerke
Verandering
Konstantheid
Faktore wat wetenskap vorm
Reformatoriese filosofie
Wetenskapsfilosofie

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Introduction

1. Orientation and problem statement

1.1 Basic orientation

Philosophers have been wondering about change and constancy for millennia. Not only the nature of the two concepts, but also the relationship between them, have been articulated in many different ways throughout history. Some of the elaborations seem to regard change and constancy in a dialectical relationship, giving primacy to one of the two poles, while others attempt to balance the two in various ways or even to synthesize them. And while these positions tell us something about the ontological convictions of the various philosophers, they also extend into the realm of epistemology and philosophy of science.

In contemporary philosophy we read of the existence of different types of epistemic frameworks which help us make sense of ourselves, understand the world and even direct our scientific investigations. We are reminded of the work of Popper (1979:344-347) on frameworks, Kuhn (1970a:viii) on paradigms and Dooyeweerd (1979:8-9) on religious ground motives. Along the same lines, Naugle (2002:55-186) has described the history of the idea of worldview (i.e. different notions of usage from Kant to Foucault and others).

In this project, the term “framework” refers in general to clusters of beliefs and convictions (e.g. assumptions, presuppositions, premises, theories and disciplines). Frameworks can be pre-theoretical (like worldviews), theoretical (like scientific theories) or even both, i.e. partially theoretical and partially pre-theoretical (like Kuhnian paradigms). For some, like Dooyeweerd (1979:8-9), the most fundamental frameworks are religious ground motives and for others, like Polanyi (1969:170-172) the same function is provided by a fiduciary commitment. Frameworks can be held more or less consciously and have an intimately personal nature, as well as a collective character.

Concomitantly with the acceptance of the role of epistemic frameworks in the philosophy of science, a sophisticated use of terminology surrounding these frameworks developed as well, giving the impression of considerable dissension among scholars, as well as among different schools of thought. This raises a first question: Is there any consensus on the role and nature of epistemic frameworks? A clarification of these issues forms a necessary groundwork for the investigation of change and constancy in epistemic frameworks.

Through the history of philosophy, some kind of capacity for change seems to be attributed to frameworks and this raises a second basic question: how does change in epistemic frameworks take place? On the one hand it has been argued, in contemporary philosophy, that changes in frameworks occur according to a relatively constrained or pre-determined pattern. In the case of the theoretical domain, for example, Holton (1973:13-18) has argued that changes are not random, but follow at least some predictable lines. Vollenhoven (2005:113,114) does not categorize epistemic framework changes according to a rigid determination, but he does seem to suggest that

changes occur according to some kind of underlying structure in philosophy. For Vollenhoven, the “types” are constant (because they have to do with ontological structure and therefore describe the same reality), while the “time currents” are dynamic. Dooyeweerd (1979:11-14) describes a “pendulum” dynamic between the opposing poles of a religious ground motive, giving some pattern to changes.

But a further study of contemporary literature also provides arguments in support of the opposite view, claiming that changes in epistemic frameworks are to a large extent random or free and unpredictable. In theoretical terms, Kuhn (1970a:176 cf. 1970b:260-263) might be interpreted as viewing changes in paradigms as being the result of persuasion or propaganda (Lakatos, 1970:177-180;140 fn. 3), while Feyerabend (1975:40,43-46 & 1985:xiii) proclaims that “anything goes” in terms of method and that changes occur randomly. Rorty (1990:3-15) and Lyotard (1984:83-86) also seem to support the idea that changes are quite unpredictable. With regard to changes in the pre-theoretical domain, Klapwijk (1986:138-143, 143 fn. 9, 149, 150) promotes freedom for change by stating that ideas should not be incarcerated by worldviews and that we should be free to choose and appropriate ideas from different “paradigms” in a creative way. Between these rather polarized views, examples can be found of authors attempting to find some kind of middle ground, or synthesis. Here arguments by Popper (1963:132; 222 & 1970:57) and Lakatos (1970:91-195) come to mind. Surely these different approaches warrant some exploration: do changes in epistemic frameworks occur in a random or patterned manner?

Intuitively, changes in frameworks are also influenced by various factors and historically, several of these factors have been considered important for science: the logical and psychological factors (e.g. the positivist tradition), the physical and logical (e.g. Popper), the social and historical (e.g. Kuhn), the social and political (e.g. neo-Marxism, cf. Habermas, 1971:198; 308-314), the social and linguistic (e.g. Rorty) and the certitudinal factors (e.g. Feyerabend). The relationship between the different change-factors becomes particularly problematic when some of the factors are absolutized, whilst others are simultaneously reduced. A third question, therefore, may be: which factors shape science (which factors have a more regulative role)? And, which factors should legitimately have a shaping influence?

The previous considerations about change and its factors can lead to a fourth question: Does change or constancy have ontological primacy? Conceptions emphasizing randomness seem to regard change as foundational, to the point that change becomes the only constant. This position is very popular in postmodern times, yet its internal coherence looks at least problematic. In fact, in order to register any change, some kind of constancy must be present and the idea that change itself becomes the only constant, seems rather paradoxical. Other conceptions of change may regard constancy as being foundational to the point that change is denied. This can lead to positions that grant ontological primacy to constancy to the extent that change becomes unthinkable, for example in the viewpoints of Von Varga (1953:59-61). The apparent dialectical tension between the different conceptions of change demands an ontological clarification of these issues. In this project the dialogue occurs especially between the humanist and reformational traditions.

1.2 Problem statement

The above contextualization leads us to the following statement of problem: Are there patterns in the changes of epistemic frameworks and in the way factors cause or stimulate such changes?

1.3 Sub questions

The central problem statement is divided into four sub questions as follows:

- i) Is there consensus on the role and nature of epistemic frameworks?
- ii) Do changes in epistemic frameworks occur in a random or patterned manner?
- iii) Which factors shape science (and which factors should have a more regulative role)? Furthermore, which factors should legitimately have a shaping influence?
- iv) What is the ontological relationship between change and constancy?

1.4 Central theoretical assumption

The central theoretical assumption of this thesis is that change and constancy can be related to epistemic frameworks according to a pattern referring to the irreducibility of coherents where change and constancy exist in cohesion. As a consequence, change is never completely random or absolute. The assumption can further be clarified by stating that, although a broad variety of factors (economic, etc.) play a role in framework changes, a pattern can be discerned in the sense that some factors play a regulative role, so that change is dynamic but not arbitrary.

2. Objectives of the research

The objective of this project is to explore possible patterns of change in epistemic frameworks and this necessitates the following:

- i) A broad historical overview of the pre-theoretical and theoretical frameworks identified by the humanist and reformational traditions in contemporary philosophy of science. In particular, the terminology will be ordered and classified to give an indication as to how the specific terms will be used throughout the rest of the project.
- ii) An investigation of literature supporting either the notion that changes occur according to some kind of constrained structure, or freely and without any predictability. This needs to be done whilst keeping in mind positions supporting some sort of middle ground in which both change and constancy occur together. This is followed by a proposal of my own position.
- iii) An investigation of literature proposing change-factors for science and the proposal of my own approach.
- iv) An exploration of different conceptions of change and constancy in order to compare different philosophical positions giving ontological primacy to either of the two. Subsequently, the formulation of my own position.

3. Leading theoretical arguments

- i) On the basis of an analysis of some characteristics and functions of pre-scientific frameworks, I argue that it is possible to reach a level of consensus concerning the terminology surrounding epistemic frameworks. The clarification of terms and analysis of characteristics and functions forms the necessary background for the rest of the discussion.
- ii) I argue in favor of a position of patterned framework changes, in which change is neither completely random, nor is it rigidly pre-determined.
- iii) I argue for a position where there is a pattern in the way factors influence framework changes: many factors play a role in change, but the activities of science are historically founded and logically qualified, so that these aspects have a regulative role.
- iv) I argue for a position where change and constancy go together, because they are both rooted in primitive domains (modalities) which are irreducible, where change is based in the physical aspect of reality and constancy is rooted in the kinematic aspect.

4. Methodology

The project is in the form of a qualitative literature analysis focusing mainly on two forms of criticism:

- Immanent critique: in this form of analysis, important text references are scrutinized for internal logical coherence and consistency.
- Transcendental critique: this form of analysis functions on an ontological level and aims at uncovering the transcendental conditions pre-supposed by the views given, not only in the seminal text references, but also in the new viewpoint that the project contributes. More specifically, I follow the method of Herman Dooyeweerd (1953, I, 37-38).

5. Proposed contribution

This project provides a clarification and detects some agreement on the much debated issue of pre-scientific epistemic frameworks. In addition, this project provides a clarification of the way in which epistemic frameworks change on both pre-theoretical and theoretical level. This will hopefully stimulate further discussion between two traditions (humanist and reformational) that proceed from very different starting points. By concentrating on the theoretical level and in order to point out some problems, this project evaluates different approaches favoring specific change-factors. Subsequently, an alternative pattern following the reformational theory of qualifying functions is proposed. Finally, this project contributes a systematic clarification of framework change in terms of the relationship between change and constancy on ontological level.

6. Outline of chapters

This thesis, in article-format, is in accordance with the A-regulations (A.8.2) of the North-West University.

The **Introduction** provides a contextualization of the basic problem statement. The latter is divided into four sub questions aiming at appropriate analysis. This is followed by a formulation of the central theoretical assumption. The research objectives and leading theoretical arguments, as well as the utilized methods are indicated. Finally, the proposed contribution is followed by a layout of the chapters.

The aim of the **Introduction** is to indicate how the four sub questions (discussed in the four articles) are related and integrated.

Article 1: Tracing some consensus on the nature of pre-scientific frameworks in philosophy of science illustrates segments of consensus between the views of various prominent 20th century philosophers of science on the characteristics and functions of pre-scientific frameworks in scientific activity. This is done by highlighting various helpful insights from the reformational tradition as a point of departure. In the first part of the article, I focus on the most fundamental frameworks by specifically referring to the work of Dooyeweerd (section 1.1) and Polanyi (section 1.2). Subsequently (in section 1.3), further instances of consensus are identified in reformational philosophy (Clouser, Klapwijk, Duvenage), as well as in the broader humanist tradition (Feyerabend). In the second part of the article, I deal with worldviews and world pictures. Concerning consensus in the reformational tradition, the work of Wolters (section 2.1), Olthuis (section 2.2) and Klapwijk (section 2.3) is explored, while Kuhn (section 2.4) provides some insights from a humanist perspective. The instances that were displayed are presented as sufficient justification for the thesis that fundamental ground motives and worldviews are recognized as frameworks in scientific thinking. **Article 1 has been accepted for publication in *Acta Academica*.**

Article 2: Changes in epistemic frameworks: random or constrained? attempts to achieve more clarity on how changes in pre-scientific and scientific frameworks occur. In contemporary philosophy of science three main approaches to framework-change can be detected in the humanist tradition: (1) changes occur according to a rather constrained, predictable or even pre-determined pattern (section 2) or (2) changes occur in a way that is more random or unpredictable and free from constraints (section 4). Between these approaches, a middle position (3) can be found, attempting some kind of synthesis (section 3). In section 5 the article also provides transcendental criticism of the above positions and suggests that the above-mentioned positions are not fully satisfactory, as change and constancy are not sufficiently integrated. An alternative model is suggested (4) in which changes in epistemic frameworks occur according to a pattern, neither completely random nor rigidly constrained, so that change is dynamic but not arbitrary (see section 6). Position (4) is integral, rather than dialectical and therefore does not correspond to position (3). **Article 2 has been accepted for publication in *Koers: Bulletin for Christian scholarship*.**

Article 3: Factors shaping scientific framework change discerns the factors shaping framework change. Through the history of philosophy of science, several different change factors are proposed as crucial for scientific theory change: the logical and psychological factors (section 2), the physical and logical (section 3), the social and psychological (section 4), the social and political (section 5), the social and linguistic (section 6) and the certitudinal factors (section 7). The relationship between the different change factors becomes particularly problematic when some of the factors are absolutized, often simultaneously under-evaluating the others (see section 8). The article suggests a pattern in which changes in epistemic frameworks occur as the result of many factors, but that the activities of science are historically founded and logically qualified, so that these aspects should play a more regulative role (section 9). The latter position does not reduce the aspects qualifying some factors to sub-aspects of an absolutized aspect and suggests a normative direction for framework change. A few hypothetical questions on the role of the non-qualifying aspects conclude the article. **Article 3 has been prepared for submission to a journal such as *Koers: Bulletin for Christian scholarship*.**

Article 4: An ontological exploration of change and constancy illustrates and evaluates the relationship between change and constancy in the viewpoints of various philosophers and scientists throughout history (section 2 and 3). Some views regard change as foundational, to the point where constancy is denied (section 2.4). Other views regard constancy as so important, that change becomes unthinkable (section 2.5). The apparent dialectical tension between the different conceptions demands an ontological clarification of these issues. The article does so by referring to a reformational insight that change and constancy exist in cohesion. The article argues (in section 4) that the relationship between change and constancy is not dialectical, but rather one of integration, seated in irreducible primitive domains (modalities). **Article 4 has been prepared for submission to a journal such as *Tydskrif vir Christelike wetenskap*.**

In the **Conclusion**, I provide an integration of the most important conclusions drawn from the four articles. This is done by briefly stating the findings of the articles (necessarily introducing some repetition) and relating the findings back to the issues raised in the **Introduction**.

Appendix 1 contains the detailed guidelines for authors required by each of the respective journals. The articles retain the formatting style prescribed by the various journals and this implies that the formatting style of these sections may vary or seem inconsistent.

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Article 1: Tracing some consensus on the nature of pre-scientific frameworks in philosophy of science

Contemporary philosophy of science presents a wide and sophisticated terminology seemingly pointing towards a multitude of different pre-scientific frameworks (e.g. worldviews, philosophy) directing our scientific investigations. Such a multitude of- and difference between terms may be taken to evidence helpless lack of consensus among scholars and schools of thought. This study, however, illustrates forms of consensus between the views of various prominent 20th century philosophers of science (on the characteristics and functions of pre-scientific frameworks in scientific activity). It does so specifically by highlighting various helpful insights offered by Reformational philosophy as its point of departure. This study finds that (on the pre-scientific level) fundamental motives and worldviews are usually recognized as pre-theoretical frameworks (with specific characteristics and functions) influencing scientific investigation. By introducing Reformational notions such as the “ground motive” and certain definitions of “worldview” (which have not originated in the context of “philosophy of science”) the purpose of the article is twofold: (a) a fruitful dialogue is established between Reformational philosophers and more recognized philosophers of science and we are better equipped to (b) trace what their views have in common.

Naspoor van konsesus oor die aard van pre-wetenskaplike raamwerke in wetenskapsfilosofie

In kontemporêre wetenskapsfilosofie verwys ‘n wye en gesofistikeerde terminologie oënskynlik na verskillende pre-wetenskaplike raamwerke (b.v. wêreldvisies, filosofie) wat ons wetenskaplike ondersoek rig. So ‘n veeltaligheid van- en verskille in terminologie mag moontlik geïnterpreteer word as ‘n hulpelose gebrek aan konsensus tussen denkers en denkskole. Daarenteen word daar in hierdie studie vorme van konsensus tussen die standpunte van verskeie 20ste eeuse wetenskapsfilosowe (wat betref die karakteristieke en funksies van pre-wetenskaplike raamwerke in wetenskaplike aktiviteit) geïllustreer. Dit word spesifiek gedoen deur verkeie nuttige insigte vanuit die Reformatoriese filosofie uit te lig as uitgangspunt. Die studie vind dat (op die pre-wetenskaplike vlak) fundamentele motiewe, asook wêreldvisies gewoonlik herken word as pre-teoretiese raamwerke (met spesifieke karakteristieke en funksies) wat wetenskaplike ondersoek beïnvloed. Deur die invoer van Reformatoriese begrippe soos die “grondmotief”, asook sekere definisies van “wêreldvisie” (wat nie in die konteks van “wetenskapsfilosofie” ontstaan het nie) is die doel van die artikel tweeledig: (a) ‘n vrugbare dialoog word gevestig tussen die Reformatoriese filosowe in meer erkenne wetenskapsfilosowe en laat ons beter toegerus om (b) na te speur wat hulle standpunte in gemeen het.

In contemporary¹ philosophy of science we read of the existence of different types of epistemic frameworks² (e.g. worldviews, philosophy) which direct our scientific investigations (Popper 1979: 344-

¹ By using the adjective “contemporary”, I refer to the period beginning from the emergence of an anti-positivist approach (in Popper) and continuing with subsequent elaborations (by philosophers of science like Kuhn, Polanyi, Feyerabend, Dooyeweerd) of the role of pre-suppositions in science. To contextualize further, this turn occurred circa the time of the Second World War, although, according to Suppe (1974: 11,168) the turn was anticipated to an extent by earlier works (e.g. Poincaré 1905).

² I accept that some frameworks, such as ground motives and worldviews are not merely “epistemic” frameworks, but also have other functions and can perhaps also be regarded as “religious” or “psychological” frameworks.

347; Kuhn 1970a: viii; Dooyeweerd 1979: 8-9; Naugle 2002: 55-186). While the awareness of the role of pre-scientific frameworks in science became increasingly accepted in the history of 20th century philosophy of science, a sophisticated use of terminology³ surrounding these frameworks developed as well, giving the impression of considerable confusion or dissension, not only among authors, but also among different schools of thought.

This raises the problem statement of the article: is there consensus on the role and nature of epistemic frameworks? In this article, the term “framework” refers in general to clusters of beliefs (e.g. assumptions, premises, presuppositions, theories or axioms) embedded in a pre-scientific or scientific structure, fairly coherent in terms of its functions. The term “nature” refers to both characteristics and functions of frameworks, the term “characteristics” refers to (for example) the number, content and context of elaboration of such frameworks, while the term “functions” refers to the role played by frameworks in scholarship (e.g. mediation, integration, connection and filtration). By analyzing these themes systematically and historically in the humanist and reformational traditions in philosophy of science, it will be shown that consensus is available to an adequate extent, even among “rival” schools of thought.

In doing so, this article will contribute to a systematic clarification of the much debated issue of epistemic “frameworks” on a pre-scientific level. These issues have often been surveyed in contemporary philosophy of science, without focusing on them specifically. The result has been that authors have often stated their approaches, rather than arguing them rigorously.

A systematization and clarification of these issues will constitute the necessary and preliminary groundwork for further studies in the way in which epistemic frameworks change. Furthermore, the study may facilitate dialogue between the two above-mentioned traditions.

This systematic and historical analysis focuses especially on the pre-theoretical⁴ frameworks, such as (e.g.) fundamental ground motives (Dooyeweerd, Polanyi) and worldviews (Klapwijk, Popper, Kuhn, Feyerabend, Naugle). Concerning the theoretical frameworks: philosophy, special sciences, theories, axioms *et cetera*, are usually widely recognized. This is not to say that there are no disagreements on their status: the issue of the demarcation criterion is a major example (cf. Coletto 2011b). Nevertheless, the recognition of these frameworks and the relative agreement on their nature is supposed to constitute a basis at least for dialogue. Given such relative agreement and also due to space constraints, this article will therefore limit its scope to the pre-theoretical frameworks. Two words on the philosophical schools examined in this study.

The reason for the choice of the specific humanist thinkers is that they are among the most influential contemporary philosophers of science and, as a consequence, cannot be neglected. But,

However, the focus of this study is on science and knowledge and therefore the “epistemic” qualification for the term “framework” seems to be the most applicable. Furthermore, I am aware that in some contexts, e.g. Popper’s *The myth of the framework* (1996: 33-67 cf. also 1970: 55-58) the term framework has incurred a negative connotation. Popper (1970: 55) was opposing Kuhn’s interpretation of the role of paradigms. However, I am using the term in a more general sense, which does not imply negative connotations.

³ For example, we find “ground motive” in Dooyeweerd (1979: 8-9), “premisses” in Polanyi (1946: 45), “paradigm” and “disciplinary matrix” in Kuhn (1970a: viii and 1974: 463), “horizon of expectations” in Popper (1979: 345), “worldview” in Naugle and others (2002: 55-186), “hard core” and even “protective belt” in Lakatos (1978: 4).

⁴ In keeping with the acceptable convention in Reformational circles, I am using the terms “pre-theoretical” and “pre-scientific” as synonyms.

valuable insights into the nature-freedom ground motive⁵ driving humanist thinking, as well as on epistemic frameworks, have also been developed by the reformational tradition. The latter proceeds from an integral, biblical starting point. In this sense, although being less well known than some of the more prominent traditions within Christian philosophy (e.g. Scholasticism), the reformational school has made a valuable and original contribution. Therefore, I have also included the most important reformational philosophers of science. One advantage of this choice is that the comparison is made between schools of thought which are (at least ideologically) rather “far” from each other, thus making any consensus particularly valuable.

The reason why the focus of this article is on philosophers of science, rather than epistemologists in general, is that frameworks are discussed more often and in detail in philosophy of science, while epistemology deals with broader themes (e.g. types of knowledge). In order to give some attention to frameworks that are perhaps not always readily recognized, let us start from the fundamental pre-theoretical frameworks.

1. The most fundamental frameworks?

The history of contemporary humanist philosophy of science shows increasing reliance on subjectivism accompanied by growing relativism and marked unease about the possibility of scientific objectivity. Concomitantly, the recognition of the role of pre-suppositions in scientific investigations formed a stark contrast to the conception of science according to the “received view” dear to the positivists (Coletto 2007a: 583-584). This may have had the effect that pre-theoretical frameworks became more “acceptable” in the post-positivist period. In particular, frameworks regarded as originating in the knowing ability of the subject, or from the historical influence of social dynamics were readily recognized. Popper, Kuhn, Feyerabend all seem comfortable accepting such frameworks, but they seem to be somewhat less comfortable with frameworks characterized by religious sources⁶. Nevertheless, in the humanist tradition, Polanyi started to recognize fiduciary frameworks as well. When it comes to the reformational tradition Dooyeweerd, because of his contribution regarding *religious ground motives*, can be taken as representative of an abundance of authors (e.g. Clouser, Klapwijk, Botha and others) who discussed the role of fundamental frameworks in scientific thinking.

1.1 Herman Dooyeweerd

In his work *A new critique of theoretical thought*, Dooyeweerd demonstrates how pre-scientific frameworks (in particular religious ground motives) influence our theoretical thinking. In fact,

⁵ The nature-freedom ground motive is a fundamental duality in humanist thinking where the freedom of the human personality is placed in opposition to a rather deterministic view of nature.

⁶ In using the word *religious*, I follow Clouser (2005: 22-23) who states that “a belief is religious if it is a belief (1) in something(s) or other as divine or (2) a belief concerning how humans come to stand in proper relation to the divine”. The divine, according to Clouser, is something that has absolute status, i.e. is not relative to or *dependent* on anything else. This can include ultimate realities, such as matter, rationality, *et cetera* and thus concerns “believers” such as naturalists, positivists, atheists, and so on. One practical implication is that debating about religious frameworks becomes possible and necessary, not only among members of the “classical” religions, but among all human beings.

theoretical thinking is possible and meaningful precisely because of a fundamental commitment of a religious nature. To understand what Dooyeweerd means with “religious ground motive”, it is necessary to look at the dynamics that, in his view, influence theoretical thinking.

1.1.1 Religious ground motives

Dooyeweerd (1953, 1: 68-69) describes how theoretical thought “gains a successively concentric direction to the presupposita which alone make it possible, no matter if the thinker has become aware of them in a really critical way of self-reflection”. The “presupposita” in this case refer to transcendental ideas in the form of an “answer” to a threefold fundamental question. The first question, which makes the theoretical attitude of thought possible, has to do with the idea of an Origin of all meaning. This Origin can either have an integral character (in which case only one Archè is accepted) or a dialectical character (in which case two or more principles of origin are accepted alongside one another).⁷

A thinker’s answer to the first question will determine his answer to the second question: whether or not one accepts the integral religious unity at the root of a diversity of aspects⁸ in reality, which grants a concentric expression to their totality of meaning. This answer will in turn influence a thinker’s attitude towards the third fundamental question: how one understands the mutual relation and coherence of a diversity of aspects of reality. According to Dooyeweerd (1953, 1: 69) these transcendental ideas “form an indissoluble unity”.

Answers to these questions are always related to a “religious ground motive” which drives theoretical and “historical development via certain cultural powers” (Dooyeweerd 1979: 9). The religious ground motive can either be internally dualistic and fragmentary, or internally unified (depending on the thinker’s answer to the threefold question). In the case of dualistic religious ground motives, a “religious dialectic” arises, in which the “discord pushes one’s posture of life to opposite extremes that cannot be resolved in a true synthesis” (Dooyeweerd 1979: 11). To understand what Dooyeweerd means by a religious dialectic, it is important to consider the difference between what he calls *theoretical* and *religious* antithesis.

1.1.2 Ground motives and antithesis

According to Dooyeweerd (1979: 12) *theoretical* antithesis concerns relative opposites which can be synthesized into a higher unity and as such resist any attempt by theoretical thought to absolutize them.

⁷ Meaning in this case refers to “the being of all that has been created and the nature even of our selfhood. It has a religious root and a divine origin” (Dooyeweerd 1953, 1: 4). Philosophical thought should be directed towards a point of reference (or Archimedean point) “to which this modal diversity (of meaning) can be related, and to which I am to return in the process of reflecting thought” (Dooyeweerd 1953, 1: 8). An actual view of totality can only be obtained by “transcending the speciality of meaning” (1953, 1: 8). Even after finding such an Archimedean point a view of totality is not possible “apart from a view of the origin or *Arché* of both totality and speciality of meaning” since “meaning cannot exist by itself, but supposes an *Arché*, an origin which *creates meaning*. All meaning is *from, through, and to* an origin, which cannot itself be related to a higher *Arché*” (Dooyeweerd 1953, 1: 8-9).

⁸ In Dooyeweerd’s (1979: 40-41) ontology, created reality displays several modes (i.e. aspects or modalities) of being in the temporal order. Although the modes are irreducible to each other, they have analogical coherence. Dooyeweerd distinguishes between the numerical, spatial, kinematic, biotic, psychical, logical, historical, lingual, social, economical, aesthetic, judicial, ethical and certitudinal modes of being.

In this *theoretical* sense, the proposition that one opposite absolutely excludes the other is nonsensical, since the opposites are just two different ways in which temporal reality unfolds. Dooyeweerd (1979: 12) states that “instead of excluding they presuppose each other” and that “their mutual dependence points to a third element in which the two are united”.

By contrast, a *religious* thesis “penetrates behind theory to the sure, absolute ground of all temporal, and therefore relative existence” (Dooyeweerd 1979: 8). This means that a *religious* thesis either claims absoluteness or abolishes itself (since the absolute has a right to exist in religion only) and when the antithesis it poses is also considered absolute, no higher synthesis is possible. The *religious* dialectic therefore arises when “a religious ground motive deifies and absolutizes part of created reality” (Dooyeweerd 1979: 13). But the poles of a religious ground motive are necessarily related to each other. This has the effect that the poles will alternately (in turn) be absolutized and depreciated. In this manner a tension is created that is impossible to dissolve – the *religious* dialectic drives theoretical thinking (and practice) from pole to pole in a “pendulum dynamic”, which is discussed further in the next section.

1.1.3 Fundamental driving forces in the history of Western thought?

In the history of Western thought, Dooyeweerd (1979: 15) has identified four main religious ground motives characterized by such a dialectical drive: the Form-Matter ground motive of Greek antiquity, the power-law motive of the Roman Imperium, the Nature-Grace ground motive of Roman Catholicism and the Nature-Freedom ground motive of modern humanism. In these dialectical ground motives (constituted by two poles in opposition) a “pendulum dynamic” can be observed in “phases” (e.g. from rationalism to irrationalism or *vice versa*) that come and go throughout the history of Western thought.

Apart from the four dialectical ground motives, a single ground motive exists unaffected by the pendulum dynamic, namely the Creation-Fall-Redemption ground motive of Biblical revelation (Dooyeweerd 1979: 15).

These ground motives “not only place an indelible stamp on the culture, science and social structure of a given period but determine profoundly one’s whole worldview” (Dooyeweerd 1979: 9). In this way, these “religious drives control the development of western culture” (Dooyeweerd 1979: 14). The Greek ground motive, despite modifications, has continued to operate in Roman Catholicism and humanism, while the Roman Catholic ground motive has sought to combine the Greek motive with the Biblical ground motive of Creation-Fall-Redemption (1979: 14).

Since the ground motives control the direction of cultural development in general, they would also direct specific cultural endeavors, for instance special scientific inquiry. However, because the ground motives exert their influence on a religious level⁹, rather than on a merely rational level, their existence and influence were not readily accepted by philosophers of science in the wake of the “received view”.

⁹ One of the implications of the Nature-Freedom ground motive is that it attempts to define the place of human beings in the world, as simultaneously (1) above nature (supra-natural) by, for instance absolutizing human freedom over nature in the form of rationalism and (2) as part of nature (natural) for instance in certain types of naturalism, by believing that nature is all that is necessary to explain nature. For an indication of the practical implications of this paradox in terms of sustainable environmental management, see Loubser & Venter (2009).

Michael Polanyi did however, since the 1940's begin to realize the potential influence of such fundamental commitments.

1.2 Michael Polanyi

To understand Polanyi's appreciation for the role of fiduciary frameworks in scientific thinking, it is necessary to briefly look at his epistemology. Polanyi (1946: 45) argues that what determines the nature of knowledge is "personal commitment to ideals" and is in a sense more akin to "religious" belief (*fides quaerens intellectum*) than to rationality. For Polanyi (1969: 170) the transition from particular clues to universal concepts cannot be achieved by "explicit logical inference". Our ability to cross this gap illustrates "the most striking powers of tacit knowing" and we employ tacit knowing to "focus our attention on the joint meaning of particulars, even when the focus to which we are attending has no tangible centre" (Polanyi 1969: 171).

Furthermore, the joint meaning of particulars is revealed as a "new quality" that is "more real" than the tangible particulars themselves, because it is "likely to show up in a wider range of indefinite future manifestations" (Polanyi 1969: 168). Knowing the way in which certain particulars cohere in a focal center, involves commitment in the form of assent from the knower. Universal concepts must be held in universal intent as "the meaning of their particulars" and as "distinct from the clues by which they happen to manifest themselves" (Polanyi 1969: 170-171). On the basis of his epistemological background, Polanyi was prepared to recognize the more fundamental, pre-scientific frameworks.

1.2.1 Polanyi's theory of presuppositions

Polanyi seems to agree with Dooyeweerd, that what gives the "focal centre" or "concentric direction" of meaning to theoretical thought is belief or commitment. Such commitment forms a fundamental framework that shapes scientific perception (Polanyi 1946: 44) and directs the selection of scientific problems (Polanyi 1958: 122-124).

Polanyi (1946: 42) initially classifies the premisses¹⁰ underlying science into two classes, namely the (1) general assumptions (dealing, for example, with the nature of everyday experience in terms of a naturalistic, as opposed to magical, mythological, *et cetera* outlooks) and (2) particular assumptions, underlying the process of scientific discovery and its verification. These assumptions are not inborn and because they are "never formulated and transmitted in the form of definite precepts", they are usually acquired through "practice guided by intelligent imitation" which usually occurs in "close personal association with the intimate views and practice of a distinguished master" (Polanyi 1946: 42-43).

The young scientist, in her effort to understand science, must be driven by the belief that there is something valuable and meaningful that can be understood. Because this belief points towards things that are still beyond her intellectual grasp, she has no choice but to accept the "authority" of what she is yet to learn and by implication also the authority of those that guide her in their manner and outlook (Polanyi 1946: 44-45). Even though she is expected to eventually outgrow her reliance on such authorities the initial act of trust is fundamental.

¹⁰ In the sections dealing with Polanyi's work, I maintain his spelling of the word "premisses".

Later, by relying more on her own judgment, her “intuition” and “conscience” will harmonize sufficiently with that of a community of other scientists (Polanyi 1946: 45-46). What forms the “shared ground” of this community is a third class of premisses called (3) ideals. The ideals of science foster a kind of morality (or love of science) and consist of a fourfold proposition: (3.1) “that there is such a thing as truth”, (3.2) “that all members love it”, (3.3) “that they feel obliged” and (3.4) “are in fact capable of pursuing it” (Polanyi 1946: 71).

In addition to the premisses (classes 1, 2 and 3) which are located at pre-scientific level, Polanyi (1946: 85) also distinguishes a fourth class of premisses, namely (4) ultimate suppositions¹¹, which “present remarkable diversity even though fundamentally based on common ground”. The ultimate suppositions are theoretical in nature which can be illustrated through various scientific examples¹².

All the premisses included in classes 1, 2 and 3, are pre-theoretical in nature since “they are of the kind which can be invalidated by the mere process of doubting them” (Polanyi 1946: 71) and our adherence to them is an act of *ultimate conviction* (Polanyi 1946: 81). As such, they form a “common ground of transcendent obligations” in which individuals are “rooted” (Polanyi 1946: 72) and which cannot be “explicitly formulated” but are found “authentically manifested only in the practice of science” (Polanyi 1946: 85). This means that, although some of Polanyi’s premisses can be located at worldview level, there seems to be other premisses pointing towards the gradual disclosure of a more fundamental level:

“It would thus appear that when the premisses of science are held in common by the scientific community each must subscribe to them by an act of *devotion*. These premisses form not merely a guide to intuition, but also a guide to conscience; they are not merely indicative, but also normative. The tradition of science, it would seem, must be upheld as an unconditional demand if it is to be upheld at all. It can be made use of by scientists only if they place themselves at its service. It is a *spiritual reality* which stands over them and compels their allegiance” (Polanyi 1946: 54) (italics A.L).

The next section of this article compares the spiritual reality referred to by Polanyi, to Dooyeweerd’s fundamental ground motives.

1.2.2 Fiduciary frameworks and scientific thinking

Although Polanyi does not explicitly refer to a religious ground motive in the Dooyeweerdian sense, he does seem to agree with Dooyeweerd that the beliefs in the pre-theoretical domain form the basis of all theoretical knowledge:

“We must now recognize belief once more as the source of all knowledge. Tacit assent and intellectual passions, the sharing of an idiom and of a cultural heritage, affiliation to a like-minded community: such are

¹¹ The phrase *ultimate* suppositions can have different meanings in different authors. In Polanyi, the phrase refers to premisses that are scientific and derived from other pre-scientific premisses i.e. “fundamentally based on common ground” (Polanyi 1946: 85) almost like “branches” are derived (or emerge) from “roots”. On the contrary, in other authors (e.g. Collingwood 1998) *ultimate* refer to the “roots” rather than the “branches”.

¹² Polanyi (1946: 85-88) explains, through examples ranging from Pythagoras to Einstein’s work, that the universe was initially assumed to be governed by “numerical and geometrical rules” and relates how the features of this “materialistic and mechanical picture” were gradually abandoned to yield the presuppositions of science in the twentieth century.

the impulses which shape our vision of the nature of things on which we rely for our mastery of things. No intelligence, however critical or original, can operate outside such a fiduciary framework" (Polanyi 1958: 266-267).

Furthermore, Polanyi's fiduciary framework seems to point towards a religious dimension, or in his own words, a "spiritual reality" (1946: 54) confirmed by "faith" (1946: 55). Like Dooyeweerd, Polanyi seems to recognize that fiduciary frameworks form a pre-theoretical driving force, that cannot be denied theoretically. He describes the hold of beliefs over theoretical thinking as follows:

"But though our thinking has contrived these artifices, yet they have the power to control our thought. They speak to us and convince us, and it is precisely in their power over our own minds that we recognize their justification and their claim to universal acceptance" (Polanyi 1958: 265).

There is however, also a notable difference between Polanyi's fiduciary frameworks and Dooyeweerd's idea of religious ground motives. Polanyi tends to see the foundation (at least initially) as common to all scientists, while Dooyeweerd seems to recognize the existence of several different ground motives.

For Polanyi (1946: 56) the community of scientists is "jointly rooted in the same ideals recognized by all". Later however, the "common ground" on which Polanyi's ultimate and even the general and particular assumptions are based seems to become eroded as his work increasingly follows the general pluralist trend towards post-modernism in philosophy of science (Coletto 2007b: 74-75). In my opinion, Dooyeweerd's (1953, 1: 3-67) recognition of a plurality of confessional presuppositions influencing the theoretical domain (Dooyeweerd 1953, I: 93-102) is a step in the direction towards a more satisfactory epistemological model.

1.3 Consensus on the nature and functions of fundamental ground motives

Herman Dooyeweerd and Michael Polanyi are not the only philosophers who recognize fundamental pre-theoretical frameworks. The existence of fundamental ground motives gained general consensus in reformational philosophy with a line of authors, such as Clouser (2005: 1-5), Klapwijk (1984: 166), Duvenage (1985: 31-36) and Botha (2002: 181, 214). But even in humanist philosophy, in addition to Polanyi, several authors can be mentioned, e.g. Feyerabend (1975: 19-20, 180, 276; 1978: 70). In the case of authors who ignore the existence of fundamental pre-theoretical frameworks, it may be argued that the subliminal nature of these frameworks has caused the authors to be unaware of holding such frameworks. It was shown, for instance by Stafleu (1987: 204, cf. also Coletto 2007b: 33, 72-73) that Popper's work, even though ignoring the existence of fundamental pre-theoretical frameworks, was not free of them. At this point, it may be helpful to briefly summarize the consensus regarding the nature and epistemic role of fundamental pre-theoretical frameworks.

The commonly recognized characteristics of fundamental frameworks include the following: they are pre-theoretical in nature. Because of their pre-theoretical nature, they cannot always be articulated theoretically and in some cases may be held subliminally. Furthermore, fundamental frameworks represent a commitment or assent to presuppositions that may not be the result of conscious (theoretical) choice and which cannot be denied theoretically. As such, fundamental frameworks form an ultimate reality which transcends what can be otherwise perceived.

The common functions of fundamental frameworks are presupposed by their nature, and include giving direction and meaning to theoretical thought by driving it towards a concentric focal point of presuppositions. In this manner they not only make theoretical thought possible, but also drive cultural developments like science. Because fundamental frameworks exert their influence on a religious (rather than theoretical) level, they can “take hold” of people, forming a “common ground” of convictions which yields universal claims.

Apart from fundamental frameworks, worldviews and world pictures also function as pre-theoretical frameworks and this will be the topic of the next section.

2. Worldviews and world pictures

Historically, humans have viewed the world in many different ways. Venter (1996: 205-207) describes how human beings can understand their place (status and task) in the world, in relation to important categories. The categories God-law-cosmos are prevalent in the reformational tradition. This interpretation of the world becomes the person’s and/or group’s worldview and is a total view of life, providing basic orientation. Sometimes a worldview can come into existence when the orientation is attempted in the absence of a supra-cosmic, supra-temporal (Archimedean) point from which a totality perspective can be attained. Because of this lack of an Archimedean point, the human subject has to orient herself by using a model derived from everyday experience (a vantage point from inside created reality). Through such a model, features of created reality (e.g. living organisms) are extended to the whole of “life” (e.g. in an organismic worldview). In other instances, worldviews do employ transcendental (Archimedean) vantage points.

Among others, Venter (1996: 205-207) also distinguishes worldviews from world pictures. World pictures, according to him, are representations of the physical structure of the world. As such, world pictures often find expression in the natural sciences (e.g. the Newtonian view of the universe) but may (when taken to be also description of life in general sense) also influence a worldview (e.g. a mechanistic worldview) (Venter 1996: 206-207).

I trust it is clear through this description, that worldviews and world pictures emerge from fundamental frameworks (such as ground motives) but also have a very personal or communal character which remains historically and culturally relative. Furthermore, world pictures (as views of the physical world) may be considered as part of worldviews (broader views of life). In the following sections I will in fact include them implicitly in the discussion of worldviews.

Although worldview literature in the reformational tradition is quite abundant, I will specifically examine the contributions of three authors (Wolters, Olthuis, Klapwijk). The reflections of these authors are taken as a representative selection of the mature reflection regarding worldviews in reformational circles. It should be noted that in humanist philosophy, worldviews are discussed especially in relation to natural science, while in reformational philosophy they are related to all the special sciences. Once again my thesis is that a degree of consensus on the nature and role of worldviews can be detected between the reformational and humanist philosophies.

The historical nature of worldviews will be further elaborated in section 2.1, while the functions of worldviews will be made more explicit in section 2.3. Worldviews will be related to reality in section 2.2 below. Let us begin with the reformational tradition.

2.1 Albert Wolters: the pre-theoretical nature and historicity of worldviews

Wolters (1989: 18) notices that the term *Weltanschauung* (worldview) became pervasive in the spirit of German idealism and romanticism. During this period of reaction against the Enlightenment, the historically individual was re-valued. According to Wolters (1989:18) “a great reversal of values occurred wherein the universal was depreciated in favor of the particular, the abstract in favor of the concrete, the eternal in favor of the temporal, the identical in favor of the unique”. This observation leads Wolters to interesting insights regarding the historicity of worldviews.

Apart from the “cognitive orientation towards the whole” as “associated with the optical metaphor”, a worldview “places emphasis on the particular, concrete, temporal, and unique character of that viewing” (Wolters 1989: 18-19). This makes *Weltanschauung* a world outlook from a particular vantage point, unable to escape from its own historicity. Of course, this particular outlook can also be more than individual. It can be collective and as such be “held by anyone belonging to a given nation or class or period” (Wolters 1989: 19). In fact, precisely because of its pre-theoretical character, *Weltanschauung* is available to the mass of people, rather than being accessible only to the scientific elite. It should be noted, however, that the reformational school does not accept the idea that worldviews are less “rational” or correct than other types of frameworks, for instance, philosophy.

The paradoxical nature of worldviews as time and context-bound reflections, claiming at the same time universality, caused Olthuis to propose an alternative understanding of worldviews.

2.2 James Olthuis: worlds and views in interaction

In the model proposed by Olthuis (1989: 30) “a worldview functions as a vehicle of mediation and integration in a two-way movement between faith commitment¹³ and other modes of human existence”. According to Olthuis (1989: 27-28) not only do ideas shape human action and culture, but ideas are also shaped by language (Von Humboldt, Heidegger, Gadamer, *et cetera*), scientific frameworks (Polanyi, Kuhn), psychological personality types and development (Freud), our preoccupation with orthodoxy and resultant orthopraxis (Frankfurt School and Liberation Theology), genetic and organic predispositions (sociobiology).

Olthuis further observes that “in the movement from life experience to faith experience, a worldview first shapes itself to the world and then shapes faith to itself, attuning and adjusting images of the cosmic order so that they mirror experienced reality. As it shapes itself to the world, a worldview is confronted by the demands of life as a whole” (Olthuis 1989: 32). This view gives worldviews a kind of double function: both descriptive and normative (Olthuis 1989: 29). The descriptive lens will shape itself to our experience, while the prescriptive lens will shape experience to itself.

¹³ It is important to note that Olthuis, in an earlier text (1985) recognizes the distinction between “religion” and “faith”, however later (1989: 31-32) he seems to use the two terms “religion” and “faith” interchangeably. I do not agree with Olthuis on this point, since “faith” refers specifically to the meaning-nucleus of the certitudinal aspect of reality, whilst “religion” refers to the normative direction of all of the aspects of reality in coherence.

“Through both lenses of its dual focus, a worldview purports to give the true picture of reality. For its adherents, a worldview gives the truth about history, life and existence, and reveals the way to salvation and healing” (Olthuis 1989: 29-30).

While worldviews are mostly argued from, they can (and ought) also be argued to. Experiences of aspects of reality may necessitate re-articulations of the worldview, increasing insight (Olthuis 1989: 33). But such worldview changes do not necessarily mean that the underlying “faith” (i.e. ground motive) automatically changes. The reason for this, according to Olthuis (1989: 32) is that “our basic beliefs receive their meaning in terms of how they fit into a particular worldview” so that “we often have diverging worldviews emerging from the same basic underlying faith commitment”.¹⁴ In fact, the process of worldview re-articulation (or even change) can sometimes deepen one’s faith.

Let us hear from another reformational author: according to Klapwijk, Olthuis refers to what it means to have a worldview in his phenomenological description, rather than providing a precise definition of “worldview” itself (Klapwijk 1989: 42).

2.3 Jacob Klapwijk on the functions of worldviews

According to Klapwijk (1989: 41-43) a worldview is always presupposed in scholarly work and by “being a *transcendentale*” to philosophical rationality, it becomes impossible to define it in a “closed, rationally adequate” manner. In this sense, Olthuis’ omission to define “worldview” is acceptable to Klapwijk, who further notes that, our failure to conceptualize “worldview”, does not imply that worldviews do not exist or are inconsequential. It rather reinforces the idea that worldviews are a pre-theoretical type of framework influencing our theoretical reflections and discussions. This awareness cautions against rationalism.

In further appreciation of Olthuis’ work, Klapwijk (1989: 42) notes that the term “worldview” may be contaminated by a visual metaphor¹⁵. For Klapwijk, this is problematic because it implies an all-encompassing “view of the world” whilst being trapped inside the very world, leaving us with a “perspective of life and the world that a fish has of the water” that it is swimming in. Secondly, it leads us to a “somewhat resigned” understanding of worldviews as being “contemplative”. For Klapwijk (1989: 42) the metaphor of seeing conveys “overtones of the medieval notion of *visio Dei*” as well as notions of German romantic idealism in which “worldview is primarily conceived as an idea”. The concepts of “contemplation” and “viewing” was connected in the ancient Greek term “*theorein*” (cf. Wolters 1989: 18).

Admittedly, Olthuis’ phenomenological approach corrects this overly contemplative direction, by also pointing to the practical and normative implications of worldviews as sources of action in the world (Klapwijk 1989: 42-43). This means that worldviews function both as a “vision of life” and a “vision for life” (Klapwijk 1989: 42) and have practical and normative implications for concrete human existence. Worldviews are not just a matter of reflection, but also shape our culture.

¹⁴ Olthuis (1989: 32) gives examples of a variety of worldviews emerging from Buddhism, Hinduism, Islam and Christianity.

¹⁵ Klapwijk (1989: 42) detects this inclination specifically in Dilthey who took the idea of “worldview” or “lifeview” quite literally and notes that, since the time of Dilthey, this understanding of the term has often been predominant in worldview debates.

In another original contribution, Klapwijk proposes that ideas should be exchangeable between different frameworks in a (more free and) creative way, rather than being trapped in a particular worldview. This requirement arises because research is practiced in a “complex society” where communication between researchers is part of the “nature of the scholarly, scientific way of thought” and where an “exclusively antithetical” position would isolate Christian researchers (Klapwijk 1986: 143). However, since non-Christian ideas cannot simply be synthesized into Christian thought, he (1986: 144) suggests that these ideas should be “transformed”, i.e. appropriated in a critical manner. For Klapwijk, ideas should not be “prisoners” of frameworks, so that scientific communication can occur more freely. This may point to a disagreement (rather than consensus) between Klapwijk and Kuhn.

At this point, it is necessary, for the sake of evaluating the possibility of consensus, to consider contributions from authors (e.g. Kuhn) in the humanist tradition, regarding the nature and function of worldviews in more detail.

2.4 Thomas Kuhn

We have already seen that the worldview level was present in the work of Kuhn’s tutor, namely Polanyi. Thomas Kuhn proposed his idea of the paradigm as a hybrid framework, which spanned both the theoretical and pre-theoretical domains. In doing so, he presented a particular form of worldview as an epistemic framework. Although paradigms are different from worldviews, we will see that the idea of a worldview is not absent from Kuhn’s theorizing.

2.4.1 Paradigms

According to a well-known critique by Masterman (1970: 61-65) Kuhn describes paradigms in “no less than twenty-one different senses” in *The structure of scientific revolutions*¹⁶. From these descriptions however, Masterman (1970: 65) distinguishes three main facets of paradigms:

- (1) Paradigms of a philosophical sort (metaphysical paradigms or metaparadigms): Paradigms are equated with “a set of beliefs” (Kuhn 1970a: 4), “myth” (Kuhn 1970a: 2), “standard” (Kuhn 1970a: 102), “organizing principle governing perception itself” (Kuhn 1970a: 120), “map” (Kuhn 1970a: 108) or “something which determines a large area of reality” (Kuhn 1970a: 128).
- (2) Sociological paradigms: Paradigms are “universally recognized scientific achievement” (Kuhn 1970a: x), “as like a set of political institutions” (Kuhn 1970a: 91), “like an accepted judicial decision” (Kuhn 1970a: 23).
- (3) Construct paradigms (artefact paradigms): Paradigms are “actual textbook or classic works” (Kuhn 1970a: 10), “actual instrumentation” (Kuhn 1970a: 59-60), linguistic or “grammatical paradigms” (Kuhn 1970a: 23), illustrative “analogies” (Kuhn 1970a: 14), “gestalt-figures” (Kuhn 1970a: 85), *et cetera* (Masterman 1970: 65).

¹⁶ Kuhn’s concept of “paradigm” consisted of several “items” and was revised during the course of his work. A complete explication of the nature of the Kuhnian paradigm lies outside of the scope of this article. For a more detailed analysis of the paradigm concept, see Masterman (1970: 59-89), Botha (1988: 33-62) and Coletto (2007b: 86-89).

Other authors who accept Masterman's classification include Botha (1988: 47) and Coletto (2007b: 88-89). I agree with the classification because it indicates that, for Kuhn, paradigms contain some elements that function on the pre-theoretical (worldview) level (n. 1), as well as other entities that are more theoretical in nature.

Studying the roles of the facets of this hybrid framework may be useful to explain the antithesis accompanying scientific revolutions. In fact, according to Kuhn, after revolutions, a radical theoretical antithesis is created between the old and new paradigm, possibly (I would argue) this happens because of changes in the metaparadigm (the metaphysical or philosophical facets of paradigms). The implications of such a theoretical antithesis confirm the important role of presuppositions for science (theoretical frameworks). Subsequently, in *Second thoughts on paradigms*, Kuhn (1974) elaborated his idea of a hybrid framework further, by introducing what he termed the "disciplinary matrix".

2.4.2 The disciplinary matrix

As a hybrid framework, a disciplinary matrix can be conceived of as an integral unity, or as consisting of four separate facets (also recognized by Coletto 2007b: 88-89). These facets are:

- (1) Shared symbolic generalizations: formalized universal propositions regarded as natural laws, "routinely" used "without felt need for special justification" and "seldom challenged" by other members of the community. The symbols used to form expressions are "uninterpreted, still empty of empirical meaning or application" but the "shared commitment to the set of generalizations justifies logical and mathematical manipulation and induces commitment to the result" (Kuhn 1974: 464).
- (2) Models: preferred analogies providing the scientific community "when deeply held, with an ontology". The models can be both heuristic at one extreme and "objects of metaphysical commitment" at the other (Kuhn 1974: 463).
- (3) Values: "standard criteria for evaluating the adequacy of a theory" which "provide the shared basis for theory choice". These characteristics include: accuracy, consistency, broadness in scope, simplicity, fruitfulness of new research findings, *et cetera* (Kuhn 1977: 321-322).
- (4) Exemplars: concrete problem solutions that are accepted by the group. The term "exemplar" becomes the new and more fundamental sense of the term paradigm (Kuhn 1974: 463).

Disciplinary matrixes need to be "attached to nature" by the human subject (Kuhn 1974: 467). Because some of the facets of the disciplinary matrix, particularly models (2) and values (3) are pre-theoretical in nature, a disciplinary matrix can be said to have a worldvish component. This means that worldview as an epistemic framework is, once again, recognized in Kuhn's philosophy of science. In the case of both paradigms and disciplinary matrixes, the worldview component is integrated by a theoretical component. This idea is confirmed by the fact that Kuhn (1970a: 111) occasionally defines scientific revolutions "changes of worldview". Furthermore, according to Kuhn (1970a: 175) in one sense, the term "paradigm" can be defined as "the entire constellation of beliefs, values, techniques, and so on shared by the members of a given community".

This idea of a hybrid framework is not absent in reformational circles, and is called, for example, a "scientific worldview" by Stafleu and Botha. Stafleu (1987: 242-249) describes a scientific worldview as

a “theoretical view of reality” consisting of four aspects, namely “the ontological (what does the world look like?), the epistemological (what are the sources of knowledge?), the logical one (what counts as proof?), and the heuristic aspect (how are theories found?)”. Botha (2002: 59-65) also recognizes that “scientific worldviews” play a role in directing scientific theories. However, Coletto (2011a) has pointed out that it is not completely clear whether a “scientific worldview” differs significantly from the philosophy of specific disciplines.

2.4.3 Thomas Kuhn on the nature of worldviews

In agreement with an author in the reformational tradition (Wolters), Thomas Kuhn also recognizes the historicity of paradigms. For Kuhn (1970a: 208) scientific development can be portrayed as “a succession of tradition-bound periods punctuated by non-cumulative breaks”. This means that a paradigm contains worldviewish elements, which are perceived (by Kuhn) to be historical or “tradition-bound”. In fact, for Kuhn, “scientific knowledge, like language, is intrinsically the common property of a group or else nothing at all” (1970a: 210).

In line with Olthuis, Kuhn also seems to think that paradigms and reality are mutually interrelated, so that changes in the one influence the other and *vice versa*. On the one hand, paradigms specify which entities the universe does contain and which it doesn’t (Kuhn 1970a: 7). This means that, for Kuhn (1970a: 6) scientific revolutions transform the scientific imagination “in ways that we shall ultimately need to describe as a transformation of the world.” On the other hand, nature occasionally violates the “paradigm-induced expectations” of normal science (Kuhn 1970a: 52-53). This has the effect that, after exploration of the area of *anomaly*, a paradigm can be adjusted to fit the previously anomalous facts (Kuhn 1970a: 53) or can enter a period of crisis eventually leading to a revolution.

Furthermore, Kuhn seems to suggest that different versions of a paradigm may stem from the same underlying framework. Kuhn refers to some changes as “episodes that were not so obviously revolutionary” (1970a: 6-7) as they only affected a smaller professional group. This may suggest that there are “main” paradigms which underlie several (slightly different) “smaller” paradigms (Kuhn 1970a: 49-50). This points to a further moment of agreement between Kuhn and Olthuis.

Kuhn argues that after a scientific revolution, scientists are *responding* to a different world and that the change affects both what the scientists *see* and *do* (Kuhn 1970a: 111). On this point, Kuhn seems to concur with Klapwijk: frameworks are not merely reflective, but also influence our actions. More authors in the humanist tradition also seem to agree: Paul Feyerabend (1975: 224-225) considers the natural sciences somewhat like languages. According to this view, languages are “not merely instruments for describing events (facts, states of affair), but they are also shapers of events (facts, states of affair)” (Feyerabend 1975: 223). This means that languages contain a “cosmology, a comprehensive view of the world, of society, of the situation of man which influences thought, behavior, perception.” Feyerabend (1975: 224) believes that, since scientific theories are “sufficiently general” and “have developed in sufficiently complex ways”, theories, like languages, contain elements of worldviews.

Before concluding it is necessary to summarize the points of agreement on the characteristics and functions of worldviews.

2.5 Consensus on the nature and functions of worldviews

Worldviews as frameworks are recognized by philosophers in both the reformational (Wolters, Olthuis, Klapwijk) and humanist traditions (Kuhn) in philosophy of science. These authors are not the only philosophers of science to agree on the existence of worldviews as epistemic frameworks (see further references to Feyerabend and Popper at the end of this section) but due to space constraints all of the authors could not be examined. The instances that were displayed are presented as sufficient justification for the thesis that worldviews are recognized frameworks in scientific thinking.

The common characteristics of worldviews include the following: worldviews represent a view of reality in terms of the human being's place in relation to important ontological entities and imply an ontic relation between these entities.

Worldviews have a historical, culturally relative character and can be held collectively (by everyone in a certain class or period) but at the same time can be very concrete (personal). Worldviews are pre-theoretical in nature. Hybrid frameworks (such as paradigms) are supposed to contain worldview elements (pre-theoretical) as well as more theoretical elements. Worldviews can be re-articulated (changed) following experience of reality. This change does not always necessitate a change in the fiduciary frameworks underlying the worldview, since different worldviews can be formed from the same ground motive.

The common functions of worldviews include the following: worldviews provide a cognitive orientation towards the whole in the form of a descriptive and normative "guide to life". This means that worldviews can both be argued "from" and "to" and that basic beliefs receive their meaning in terms of how they are elaborated in a particular worldview. In fact, one of the most important functions of worldviews seems to be their role in integration, by providing a unifying framework for experience. Finally, worldviews are not only reflective, but a source of action and motivation with practical and normative implications.

3. Conclusion

During late-modern times, the "received view" of science has been increasingly challenged by a growing emphasis on the role of the human subject in the generation of scientific knowledge. With this emphasis came a proliferation of terms indicating different epistemic frameworks (especially pre-theoretical) proposed to explain how the human subject comes to know. Although there seems to be wide differences in the terminology employed to describe such frameworks, I have argued that some common ground actually exists, at least between the humanist and reformational traditions in philosophy of science.

Further exploration of the theoretical frameworks could shed light on the interrelations between the pre-theoretical and theoretical frameworks and explain how they cohere with one another. The present study is a necessary first step for further questions, for example: how does change (and constancy) in epistemic frameworks take place – are changes random or somehow constricted? Which change factors are the most important in science? Should epistemic frameworks be regarded as primarily changing or constant? These questions should be the focus of further research and will hopefully stimulate further discussion about the relevance of epistemic frameworks.

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Article 2: Changes in epistemic frameworks: random or constrained?

Since the emergence of a solid anti-positivist approach in philosophy of science, an important question has been to understand how and why epistemic frameworks change in time, are modified or even substituted. In contemporary philosophy of science three main approaches to framework-change can be detected in the humanist tradition: (1) in both the pre-theoretical and theoretical domains changes occur according to a rather constrained, predictable or even pre-determined pattern (e.g. Holton) or (2) changes occur in a way that is more random or unpredictable and free from constraints (e.g. Kuhn, Feyerabend, Rorty, Lyotard). Between these approaches, a middle position (3) can be found, attempting some kind of synthesis (e.g. Popper, Lakatos). Because this situation calls for clarification and systematization, this article in fact tries to achieve more clarity on how changes in pre-scientific frameworks occur, as well as provide transcendental criticism of the above positions. This article suggests that the above-mentioned positions are not fully satisfactory, as change and constancy are not sufficiently integrated. An alternative model is suggested (4) in which changes in epistemic frameworks occur according to a pattern, neither completely random nor rigidly constrained, which results in change being dynamic but not arbitrary. Position (4) is integral, rather than dialectical and therefore does not correspond to position (3).

Verandering in epistemiese raamwerke: willekeurig of beperk?

Sedert die eerste verskyning van 'n soliede anti-positivistiese benadering in wetenskapsfilosofie, is 'n belangrike vraag hoe en waarom epistemiese raamwerke verander in tyd, gemodifiseer en selfs gesubstitueer word. In kontemporêre wetenskapsfilosofie kan drie hoof benaderings tot raamwerk-verandering in die humanistiese tradisie bespeur word: (1) in beide pre-teoretiese en teoretiese domeine vind verandering plaas volgens 'n taamlike beperkte, voorspelbare of selfs voorafbepaalde patroon (b.v. Holton) of (2) verandering vind plaas op 'n wyse wat meer willekeurig of onvoorspelbaar en sonder beperkings is (b.v. Kuhn, Feyerabend, Rorty, Lyotard). Tussen die benaderings kan 'n middel posisie (3) aangetref word, wat 'n tipe sintese probeer handhaaf (b.v. Popper, Lakatos). Hierdie situasie noodsaak verduideliking en sistematisering en die artikel poog dan om meer duidelikheid te bied oor hoe verandering in pre-wetenskaplike raamwerke plaasvind. Verder word transendentale kritiek van die bogenoemde benaderings in die artikel aangebied. Die artikel stel voor dat die bogenoemde benaderings nie volledig bevredigend is nie, aangesien verandering en konstantheid nie tot 'n voldoende mate geïntegreer is nie. 'n Alternatiewe model word voorgestel (4) waarin verandering in epistemiese raamwerke plaasvind volgens 'n patroon wat nie heeltemal willekeurig of beperk is nie, sodat verandering dinamies is, maar nie arbitrêr nie. Posisie (4) is integraal, eerder as dialekties en stem dus nie met posisie (3) ooreen nie.

1. Orientation

In a previous study (Loubser, 2012a) I have explored the characteristics and functions of epistemic frameworks that are recognized, to a fair extent, by contemporary philosophers of science in both the humanist and reformational tradition. The conclusion of the investigation was that several pre-scientific frameworks are widely recognized as influencing scientific inquiry. Concomitant with the recognition of the role of pre-suppositions in science, it has also become evident that epistemic frameworks seem to have some kind of plasticity or capacity for change and this raises a basic question: how does change in epistemic frameworks take place? This is the problem statement of my current article, which is

(together with the previous study abovementioned) part of a research project, consisting of four articles in total, on patterns of change in epistemic frameworks.

Unlike the previous article, in this research both pre-scientific and scientific frameworks are considered (the latter being the most discussed). In contemporary philosophy of science the demarcation between pre-scientific and scientific thinking has been complex and problematic (cf. Coletto, 2011) and falls outside of the scope of this article. However, I should at least clarify that in this article terms like “pre-scientific” (or “pre-theoretical”) refer to frameworks such as religious ground motives and worldviews, whilst terms like “scientific” (or “theoretical”) refer for example to philosophy, a theorem, a special science and other related frameworks. In some cases frameworks contain both scientific and pre-scientific elements, for example Kuhn’s idea of the paradigm and subsequently also the disciplinary matrix (cf. Loubser, 2012a).

The term “change” refers to variations in the presuppositions, content and convictions embedded in epistemic frameworks. These variations can be either intrinsic (causing more profound change) or peripheral (causing only superficial change). I do *not* imply, however, that an epistemic framework (e.g. a worldview) can be transformed into a different type of framework (for instance a religious ground motive). The issue of change should be regarded as related but not identical to the theme of progress. In fact, the main question of this article is not whether or not, or how scientific progress occurs but how change (progressive or not) occurs.

In some cases, in contemporary philosophy of science it has been argued that changes in epistemic frameworks occur according to a constrained pattern (in both the theoretical and pre-theoretical domains). For example, in the case of the theoretical domain, Holton (1973:13-18) has argued that changes are not random, but follow at least some predictable lines.

In other cases, however, arguments are provided in support of the opposite view, namely that changes in epistemic frameworks are to a large extent random or free and unpredictable. For example, Kuhn (1970a:176, cf. 1970b:260-263) might be interpreted as viewing changes in paradigms as being the result of persuasion as a result of propaganda (Lakatos, 1970:177-180; 140 fn. 3), whilst Feyerabend (1975:40; 43-46 & 1985:xiii) proclaims that “anything goes” in terms of method and that changes occur randomly also at worldview level. Contributions from Rorty (1990:3-15) and Lyotard (1984:83-86) also seem to support the idea that changes are quite unpredictable. Between the above mentioned opposite views, a middle position, attempting a kind of synthesis, is found. Arguments by Popper (1963:132; 222 & 1970:57) and Lakatos (1970:91-195) seem to be in support of such a middle position. These rather polarized approaches call for clarification and systematization: do changes in epistemic frameworks occur in a random or patterned manner?

The hypothesis underlying this article is that change and constancy are related to epistemic frameworks according to a pattern referring to the irreducibility of coherents¹, where change and

¹ The “coherents” refer to an ontology of modal aspects (or modes of being) of temporal reality. Dooyeweerd (1979:40-41) distinguishes between fifteen modalities (the numerical, spatial, kinematic, physical, biotic, psychological, logical, historical, lingual, social, economical, aesthetic, judicial, ethical and certitudinal) which are irreducible to each other, but none the less display an analogical coherence. The mutual relationships between the aspects can be seen in the form of anticipations (where one aspect refers to another aspect later in the modal order) and retrocipations (where an aspect refers to another aspect earlier in the modal order). As an example of

constancy exist in cohesion. Constancy is the necessary substrate for change in a way that change cannot occur or be detected without reference to constancy. In this hypothesis, I agree with Strauss (2009:13 cf. 163-167) that change can only occur “on the basis of something persistent or constant”. This means that change does occur but is never completely random or absolute. Instead, it is deeply integrated with constancy. Although at this stage this hypothesis can only be introduced, a full discussion and justification are provided in a further article (Loubser, 2012b).

The issue of change and constancy is one of perennial interest in philosophy and will continue to have relevance as long as philosophy is alive. This article only focuses on a limited time period and on a limited field of study (philosophy of science). Nevertheless, the historical survey presented here is rather extended, stretching from the 1920s to the 1990s. The reason is that it is necessary to trace the development of the specific themes in a sufficiently broad range of examples in order to illustrate the three main positions mentioned above. At the same time, to avoid excessive extension of the historical part, the more recent decades are not taken into account. (In the process, however, the most prominent contemporary philosophers of science are considered).

The leading theoretical arguments in support of my analysis will take the following form. I will give a description of three viewpoints held in the humanist tradition in philosophy of science: (1) changes in frameworks occur in a way that is rather structured, constrained or pre-predetermined (2) changes in frameworks occur in a rather free and random manner and (3) framework changes occur in a manner which is partially constrained and partially random. In all these “models”, I will argue that change and constancy are not sufficiently integrated. In turn these positions, I suggest, are related to the two poles (nature and freedom) of the humanist ground motive. After formulating a hypothesis on the pre-theoretical foundations of these three positions, I will propose an alternative that follows the work of Stafleu (1987:153-157) in the reformational tradition. I will argue in favor of a position of patterned framework changes, in which change is neither completely random nor rigidly pre-determined, but always integrated with constancy.

The purpose of this article is to clarify how epistemic frameworks change and this is intended to provide the basis for further studies into the *factors* that influence these changes. Furthermore, it may facilitate dialogue between two traditions (humanist and reformational) that proceed from rather different starting points. Let us begin by considering the way in which scientific development was conceived by supporters of the Received View of science.

2. Patterned/constrained change

2.1 Cumulative changes in the Received View

According to Suppe (1974:3), during the 1920's philosophers of science construed scientific theories as “axiomatic calculi” which were given “partial observational interpretation by means of correspondence rules”. This analysis (referred to as the Received View) was a product of logical positivism and was to be understood according to the basic tenets of the latter movement (Suppe, 1974:6).

Suppe states that the Received View goes hand in hand with a view of scientific development, known as the *thesis of development by reduction* in that the former is presupposed by the latter (Suppe,

retro-cipation, consider the concept “economical pressure” here the economical aspect refers backwards to the physical aspect.

1974:56). According to this view, scientific theories (when highly confirmed) are accepted as relatively free from the threat of future disconfirmation (Suppe, 1974:55). This means that development in science is supposed to take the following form: (1) confirmed theories are extended to greater scope, (2) new highly confirmed theories are developed for related domains and (3) confirmed theories are incorporated into more comprehensive theories (Suppe, 1974:55-56).

This causes scientific progress to be regarded as a “cumulative enterprise, extending and augmenting old successes with new successes” and furthermore, “old theories are not rejected or abandoned once they have been accepted; they are just superseded by more comprehensive theories to which they are reduced” (Suppe, 1974:56). This can be regarded as an example of constrained or patterned change.

Against this background we can now consider the views of Gerald Holton, who believes that framework changes follow at least recurrent and persistent “themes”.

2.2 Holton and persistent themata

Holton (1978:8) finds that scientific concepts, methods, propositions or hypotheses contain elements that function as “themata” in constraining, motivating, guiding or even polarizing scientific research and scientists (as individuals or communities). These themata (often not explicitly stated in scientific work) can have three different uses: as thematic concept (e.g. the application of the concept of “symmetry” or of “continuum”), as methodological thema (e.g. the preference for expressing the laws of science in “constancies”, “extrema” or “impotency”) and as thematic proposition or thematic hypothesis (e.g. overarching statements like the two principles of special relativity) (Holton, 1978:9).

Some of Holton’s more interesting findings seem to be that themata occur in “antithetical couples” (e.g. evolution and devolution, constancy and simplicity, reductionism and holism, hierarchy and unity *et cetera*) and that this seems to be related to the “dialectical nature of science as a public, consensus-seeking activity” (Holton, 1978:10). Moreover, according to Holton (1978:10) the amount of themata (as singlets, doublets or triplets) is very small, with new additions being very rare. This means that themata are ancient and persistent (Holton, 1978:10) and that old themata fare very well in newly elaborated contexts.

The existence of themata appears to give scientific frameworks some constant identity through growth and changes, even in the most radical advances (Holton, 1978:10-11). In contrast to Holton, however, some authors in philosophy of science seem to occupy a middle position between constrained changes and more random framework changes. In the next section, we will investigate the views of Karl Popper.

3. The “middle position”

3.1 Karl Popper: changes through conjectures and refutations

For Popper, changes in scientific frameworks cannot be sufficiently explained by the psychological propensity of the individual scientist (Popper, 1961:154). Because science is practiced socially (rather than individually) the result can be a free competition of ideas which will eventually lead to progressive scientific change (Popper, 1961:154-155). Of course, this proliferation of many different hypotheses necessitates rigorous methods of testing and falsification.

By “conjectures and refutations” scientists can learn from their mistakes through mutual criticism (Popper, 1963:vii; cf. 1979:260-261). Refuted theories become stepping stones towards improved knowledge and by repeated refutations the most corroborated scientific theories gradually approach the truth (Popper, 1963:245). This means that, for Popper, changes in scientific frameworks occur in a way that is rather gradual, in the sense of a continuous reform of weaker theories. It is important to note that this “linear” growth does not occur automatically (driven by some internal force in the development of science) but is rather the result of a laborious process of falsification (Popper, 1963:365). Furthermore, the surviving theories should not be considered as having reached any kind of ultimate truth, because the “elimination of a finite number of such explanations cannot reduce the infinity of the surviving possible explanations” (Popper, 1979:264-265). Perhaps it is only natural for Popper (1996:1) to describe scientific changes from an “evolutionary” perspective, through a kind of analogy of natural selection.

For Popper (1996:2-3) three levels of adaptation have something fundamental in common: (1) genetic adaptation, (2) adaptive behavioral learning and (3) scientific discovery. In all three levels, progress starts from an “inherited structure” and on the scientific level this corresponds to the dominant scientific conjectures and theories (Popper, 1996:3). On all levels, the structure is transmitted through instruction and specifically by social tradition and imitation on the scientific level (Popper, 1996:3). In all three levels the instruction comes from within the structure and changes on the scientific level will become new instructions that continue to arise from within (Popper, 1996:3). When the instructions are exposed to “environmental pressures”, for instance theoretical problems, they are changed by processes which are partly random and on the scientific level become new and revolutionary tentative theories (Popper, 1996:3). For Popper, scientific change is thus partly originating from within (and therefore partly constrained) and at least partly random.

Furthermore, the next stage of scientific change involves a process of “selection” or a stage of elimination of error (Popper, 1996:3). For Popper (1996:3) this natural selection is a kind of negative feedback on all three levels. This selection process will never reach an equilibrium state, as no perfect or optimal trial solution is likely to be found and because new instructions that emerge will in turn effect change in the environment (Popper, 1996:4). On the scientific level, such environmental changes occur, for example, when new conjectures open up new and unexpected problems (Popper, 1996:4).

The scientific level, however, differs from both the genetic and behavioral levels, by being more creative and revolutionary (Popper, 1996:6). Scientific theories are formulated linguistically and duly become “objects outside of ourselves” which can subsequently be subjected to criticism (Popper, 1996:6-7). The linguistic nature of theories imbues scientific discovery with the creative imagination of “explanatory story-telling, myth making and poetic imagination” (Popper, 1996:7). What this means for changes in scientific frameworks, is that changes are the result of both conservative, traditional or historical elements, as well as more revolutionary or critical elements. Scientific change, although somewhat evolutionary, also displays a linear pattern. In the end, it is “pattern” which gets the priority: in fact, refuted theories become “stepping stones” towards “better” theories, in continuity with the evolutionary line (Popper, 1963:243:245). In the next section, another example of an author adopting a “middle position” is investigated.

3.2 Can framework changes perhaps be predicted? Imre Lakatos

According to Lakatos, great scientific achievements should not be considered as isolated theories, but rather as “research programmes”, to be evaluated in terms of “progressive” or “degenerating” problemshifts² (Lakatos, 1978:110). Scientific change occurs when research programmes supersede each other, that is, one research programme overtakes another in terms of progress (Lakatos, 1978:110). Because it is conventionally acceptable to retain “spatio-temporally singular factual statements”, as well as “spatio-temporally universal theories”, some continuity is present within scientific change (Lakatos, 1978:110). Such continuity evolves from research programmes, which consists of methodological rules instructing scientists on what research paths to take up (“positive heuristic”) or to avoid (“negative heuristic”) (Lakatos, 1970:132).

Lakatos’ research programmes are further characterized by their “hard core” which is considered by provisional decision to be irrefutable and which defines problems, foresees anomalies and turns them victoriously into examples, all according to plan (1978:110-111). The hard core of the research programme further outlines the construction of a belt of auxiliary hypotheses which forms the “protective belt” of the research programme (Lakatos 1978:110). According to Lakatos (1970:133) it is the protective belt which gets tested, re-adjusted and even replaced in order to defend the thus hardened core.

It is interesting to note that, for Lakatos (1970:132 fn. 1), both the positive and negative heuristic indicate (implicitly) the conceptual framework and language of scientific research programmes. This may mean that, in Lakatos’ epistemic model, continuity is not linked to the structural order for reality³, but rather seated in the knowing (human) subject. Scientific change, however, is not simply arbitrary but follows somewhat predictable “methodological rules”. In this sense one may say that even in Lakatos’ moderate position “pattern” retains some priority over randomness.

The authors mentioned in the following sections, however, detect more “freedom” in framework changes.

4. Unconstrained change

4.1 Thomas Kuhn: changes in normal and revolutionary science

In *The structure of scientific revolutions* (1970a) Thomas Kuhn describes scientific change in terms of two distinct phases of science, namely normal and revolutionary science. In the case of normal science, scientists are not aiming explicitly at innovation and therefore change is very limited. The changes are determined by a community of scientists working under the same epistemic framework. According to

² For Lakatos (1978:112) a research programme is progressive when its theoretical growth anticipates its empirical growth, that is, when novel facts are successfully predicted (“progressive problemshift”). Degenerating problemshifts occur when the theoretical growth of the research programme cannot keep up with its empirical growth and it only gives post hoc explanations of chance discoveries or discoveries anticipated and made by rival programmes. In this case, the research programme is said to be “stagnating”.

³ In using the phrase “structural order for reality”, I follow the distinction made by Hart (1984:38, 85). According to Hart the order *for* reality refers to “the order of conditions to which the empirical world conforms”. This can be contrasted with the order *of* reality, referring to the “experienced world of subjective existence”. As such, the structural order *for* reality conditions scientific thought, since science investigates a “system of universality” holding for the world of individual existence (Hart, 1984:38; cf. Coletto, 2007:7).

Kuhn (1970a:168) the members of the group have shared training and experience and as such are the “sole possessors of the rules of the game or of some equivalent basis for unequivocal judgments”. This means that the scientific community will decide which changes are acceptable under their shared paradigm. Their judgment will be in favor of changes that are aligned with the accepted theories. For Kuhn (1970b:246; 1970c:4-5) the aim of normal science amounts to “puzzle-solving”. During normal scientific practice the premises of the ruling paradigm will define the puzzles to be solved, guarantee that the puzzles are indeed solvable and determine when a suitable solution is reached. This means that the changes in normal science will be “cumulative” in the sense that they are merely further elaborations of accepted theories, as new puzzles will be solved with “conceptual and instrumental techniques close to those already in existence” (Kuhn, 1970a:96).

As in the normal phase of science the changes continue to share the premises of the paradigm and add to the collective achievements of the scientific community, they are viewed (by the particular scientific community) as constituting progress (Kuhn, 1970a:162-163). However, Kuhn (1970a:163) in quoting Max Planck, states that in the end, progress in normal science is “simply in the eye of the beholder”. It is important to note, of course, that this “beholder” is not simply an individual scientist, but rather a community of scientists reaching consensus.

According to Kuhn (1970b:247), normal science progresses because the community of scientists can take an accepted theory for granted (rather than criticize it) and can explore it to almost “esoteric depth and detail otherwise unimaginable”. Because this in-depth exploration is bound to uncover anomalies, normal science will ultimately take a critical turn into what Kuhn terms “revolutionary science”. A brief look at this fundamental phase of Kuhnian science is necessary.

In revolutionary science, changes occur in terms of replacing one paradigm with another, after “nature itself” has undermined the professional security and has problematized the prior achievements of the scientific community (Kuhn, 1970a:169). The alternative (i.e. new) paradigm will only be embraced by the community if it has the potential to resolve generally recognized problems and if it preserves a large part of the concrete puzzle-solving ability of the old paradigm (Kuhn, 1970a:169).

Despite its improved puzzle-solving ability, the new paradigm is not a better representation of what nature is really like (Kuhn, 1970a:206). Contrary to Popper, this means that successive paradigms do not increasingly approach the truth (Kuhn, 1970a:170).⁴ This lack of an ultimate goal in scientific revolutions, has led Kuhn to waffle between revolution and evolution, in his choice of terms, to describe the nature of paradigm changes. According to Kuhn:

“The net result of a sequence of such *revolutionary selections*, separated by periods of normal research, is the wonderfully *adapted* set of instruments we call modern scientific knowledge. Successive stages in that developmental process are marked by an increase in articulation and *specialization*. And the entire process may have occurred, as we now suppose biological *evolution* did, without benefit of a set goal, a permanent fixed scientific truth, of which each stage in the *development* of scientific knowledge is a better exemplar” (Kuhn, 1970a:172-173, italics R.A.L.)

⁴ For Kuhn, “truth” in this case refers to the ontological match between the postulated entities and that which is really out there and since there is no theory-independent way to understand what is out there, the idea of truth as such (for Kuhn) becomes “illusory in principle” (Kuhn, 1970a:206).

Furthermore, because paradigm changes do not imply directed ontological development, scientific revolutions are “non-cumulative” (Kuhn, 1970a:92). These characteristics of paradigm changes could easily be interpreted in a manner that would make change rather unconstrained.

4.2 Evaluation of Kuhn’s views

According to Lakatos (1970:178-180; cf. 140 fn. 3) the Kuhnian view of scientific change implies that there are very few logical reasons for revolutions, but many psychological ones. When a Kuhnian paradigm comes into “crisis”, this denotes (for Lakatos, 1970:178) a psychological state of “contagious panic”. Furthermore, the new paradigm will be incommensurable with the previous one (each containing its own standards) and there will be no supra-paradigmatic rational standards with which to compare them (Lakatos, 1970:178).

Kuhn’s insistence on the role of the scientific community in paradigm-choice, has further led Lakatos to describe Kuhnian paradigm change as causing a “bandwagon effect” which will eventually become a “mob rule” as individual scientists imitate the great scientists by submission to the collective wisdom of the community (Lakatos, 1970:178-179). I agree with Lakatos’ interpretation: Kuhnian revolutions may eventually be the result of propaganda or rhetorical persuasion.⁵

For Kuhn (1970a:94) the circular argument (presupposing a paradigm whilst arguing for its defence) is indeed an effective form of persuasion in a scientific community, leading to a form of assent that is rhetorical (and therefore not logically or even probabilistically given).

To summarize: Kuhn clearly has two different sides to his conceptions of change in scientific frameworks: considering revolutionary science, paradigm changes are rather unconstrained. But, we also have periods of normal science, during which changes in frameworks are “linear”, “additive” or “cumulative” (Kuhn, 1970:52-53; 96. Cf. 1970b:250). Therefore, Kuhn may be seen as holding a rather moderate position amongst authors who consider changes to be rather free and unconstrained. Although Kuhn regards it as incorrect to describe his position as a form of relativism, he leaves the door open for partial relativism.⁶ One of the most prominent figures to step through this open door was Paul Feyerabend.

4.3 Paul Feyerabend and methodological anarchy

For Feyerabend, the dynamics of scientific change are the result of the interplay of two principles, namely “proliferation and tenacity” (Feyerabend, 1970:210). Scientists must be allowed to “introduce new ideas even when popular views should appear to be fully justified and without blemish” and at the same time have the right to “retain ideas in the face of difficulties” (Feyerabend, 1970:210).

⁵ In partial defence of Kuhn, it should be noted that he does not simply propose that might makes right in the sciences and that scientists are the victims of a history rewritten by the powers that be, since the special nature of scientific communities qualifies them for arbitration of professional matters (Kuhn, 1970a:167).

⁶ Kuhn (1970b:264-266) states: “In one sense of the term I may be a relativist, in a more essential one I am not.” In the first sense Kuhn refers to his view of scientific development as being fundamentally evolving, unidirectional and irreversible, which results in some scientific theories being considered better than others. In the second sense, Kuhn refers to his view that truth is a term with only intra-theoretic applications, which results in certain scientific theories being no better than others in representing what is really “out there” in nature.

Noteworthy are the undertows of subjectivism and relativism⁷ in Feyerabend's understanding of the principles.

With regards to "proliferation", Feyerabend (1970:210) seems to support relativism by stating that people should be able to follow their inclinations and that "there is no need to suppress even the most outlandish product of the human brain". With his view of "tenacity", Feyerabend subscribes to a form of subjectivism, where "one is encouraged not just to follow one's inclinations, but to develop them further" and to employ criticism (in the form of comparison with existing alternatives) in order to strengthen one's own views (Feyerabend, 1970:210). According to Feyerabend (1970:210) however, both proliferation and tenacity support the ultimate aim of science: "...*happiness and the full development of an individual human being is now as ever the highest possible value*" (italics A.L.).

To reach this highest possible aim, Feyerabend (1975:29-32) advises us to proceed in a counter-inductive manner. Without "chaos", no knowledge and no progressive change will be possible (Feyerabend, 1975:179). The reason for this approach is that any fixed method rests on a too limited view of the complexity of the human condition (Feyerabend, 1975:27). The freedom of the individual is elevated to a point where it is to be fully unconstrained. The scientist is therefore free (like the sophists of antiquity) to defend different ideas in different circumstances, to hold no idea and all at the same time. According to Feyerabend (1975:189) the scientist may change his views "as a result of argument, or of boredom, or of a conversion experience, or to impress a mistress, and so on". In the end, the only principle for epistemic change that Feyerabend (1975:28) is willing to defend, is "anything goes".

For Feyerabend, changes in scientific frameworks are therefore not guided by well-defined programmes (because the anarchistic method contains the conditions for the realization of all possible programmes) change is rather guided by "vague urges" or "passion" (Feyerabend, 1975:26). In the wake of Feyerabend (though in a more moderate spirit) more authors seem to agree that changes in frameworks occur in a manner that is rather free and random.

4.4 Change after Feyerabend

Although it is certainly not the only trend after Feyerabend, some authors do continue in the vein of unpredictability of change (though in a more moderate spirit). For Lyotard science, as a kind of "language game", cannot yield certain knowledge (Lyotard, 1984:38-39). In this language game, scientific knowledge is constantly reduplicated, that is, "citing its own statements in a second-level discourse (autonymy) that functions to legitimate them"⁸ (Lyotard, 1984:38). According to Lyotard (1984:39) the need for legitimation itself causes a process of delegitimation: "*There is an erosion at*

⁷ Subjectivism and relativism are not always equated to each other (as in Bernstein, 1985). According to Van der Walt (2008:66-67) the tendency to emphasize the human subject (subjectivism) as well as the cultural situation and historical change in terms of worldviews, can lead to the more radical view of "so many views so many worlds" (relativism). Relativism can thus be regarded as a possible consequence of subjectivism.

⁸ The problem of "legitimation" is borrowed from Habermas (e.g. 1976) and remains prominent in recent philosophy (cf. Coletto, 2007) for example in Lyotard. The quest for legitimation can be regarded as an attempt at identifying an authoritative foundation for politics, ethics or (*in casu*) science (the three spheres distinguished by Kant and accepted by Habermas). Lyotard rejects legitimation by meta-narrative (e.g. Habermas' "emancipation") and argues that *petit recits* (small narratives) are all one can rely on.

work inside the speculative game [of science], and by loosening the weave of the encyclopedic net in which each science has to find its place, it eventually sets them free” (Lyotard, 1984:39) (italics A.L.).

This “internal erosion of the legitimacy principle of knowledge” has the result of creating a “constant flux” of areas of enquiry (Lyotard, 1984:39). This causes a crisis in scientific knowledge. Apart from not being able to legitimize itself, the game of science has no special authority over any other game, because (although each kind of game has its own set of rules) all games are on par with the others (Lyotard, 1984:40). In the end, for Lyotard (1984:41) only “language practice” and “communicational interaction” provide some legitimation. Postmodern science focuses on “undecidables”, on the limits of precise control, on catastrophes, paradoxes and other related subjects, and this causes evolution in science to be “non-rectifiable” and “paradoxical” (Lyotard, 1984:60).

Richard Rorty seems to agree that truth is “a property of linguistic entities” and that these languages are made by us, rather than found in the world (Rorty, 1990:7). This means that the world cannot tell us what language game to play (Rorty, 1990:7). However, Rorty does not simply substitute objective criteria for the choice of language game with subjective criteria (Rorty, 1990:7). For Rorty, changes in language games are not the result of conscious decisions, but rather the result of the loss or acquisition of “habits” in using certain words. It would seem as if, in Rorty’s model, changes in scientific frameworks are the result of customs of vocabulary.

Further examples of authors who emphasize freedom of change in a postmodern climate could be included (e.g. Bloor, Barnes, Collins and other “social constructivists”), but I will have to stop here. This brings us to the end of this historical overview and in the next section I will propose a transcendental criticism of the polarization described in the previous sections.

5. At the roots of constrained and random change

5.1 A reformatioal hypothesis

We have seen that several authors regard changes in pre-scientific and scientific frameworks as being either free and random or quite constrained. In some cases, a synthesis of the two views is attempted. In most cases, however, the *integration* of constancy and change does not seem to emerge either clearly or sufficiently. This is obviously the case with the two opposite models, because either change or constancy is given the primacy. But even in the “middle positions”, change and constancy are juxtaposed or balanced, rather than integrated.

Should one attempt to penetrate into the deeper reasons behind this state of affairs? The following hypothesis can be advanced from a Dooyeweerdian point of view. Herman Dooyeweerd does not discuss the authors mentioned in this article, but he (1979:148-188) describes the consequences of certain pre-theoretical dynamics and mechanisms for culture in general. He (1979:15-16) recognizes a religious driving force at work in humanist culture, which he terms the “nature-freedom” ground motive. The nature-pole is rooted in the orderliness of concrete reality (conceived rather deterministically) whilst the freedom-pole is rooted in the unconstrained human personality. In *Roots of western culture*, he (1979:150) describes the modern humanist emphasis on the freedom of the human personality and the view of “nature” consequently adopted. Nature becomes:

“an expansive arena for the explorations of his (sic) free personality, as a field of infinite possibilities in which the sovereignty of human personality must be revealed by a complete *mastery* of the phenomena of nature” (Dooyeweerd, 1979:150).

By contrast, the “nature” pole of the ground motive (which prevailed until the 18th century) implied a mechanistic view of nature and the adoption of the natural-scientific method (with its faith in the power of reason and progress). This ideal of science tried to include all of reality in a chain of causes and effects inspired by physics and leading to the division of complex phenomena into their simplest “elements” (Dooyeweerd, 1979:183). This became the new scientific method, granting the elimination of prejudice and speculation. In this perspective, nothing can be accepted as “truly real if it does not fit into this chain of mechanical cause and effect” (Dooyeweerd, 1979:153). Ironically, however, it soon became apparent that this “chain” left no freedom for the human being itself (regarded as a part of nature and therefore also causally determined). Nature and freedom, therefore, threaten each other: either humans “abolish” nature, or nature abolishes humans. In between these extremes, there are recurring attempts at “reconciling” the two poles in a sort of middle position.

In the 19th century the shift to the freedom-pole inspired a new scientific method inclined to a “new universalism”, which led to an attempt at understanding the “peculiar place and function of the parts in terms of the whole” and focused on the individuality of phenomena (Dooyeweerd, 1979:182-183). This was particularly suited to the science of history and thus historicism was enthroned as the new scientific method (Dooyeweerd, 1979:184). Dooyeweerd closely associates historicism and relativism. In his (1979:151) opinion the historicism of the freedom pole did not permit scientific thought to recognize a given structural (i.e. creational) order⁹, thus causing the *locus* of order to be (mis)placed in the human knowing subject. One of the consequences was that the notion of scientific truth became rather relativized.¹⁰

Summing up, the two poles of the humanist ground motive move in two different directions. The one leads to a constrained, patterned, even determined world, the other leads towards a world of unconstrained freedom and unpredictable developments. As science and its developments are part of this world, they are (intuitively) regarded as constrained or un-constrained, depending on the pole attracting the scholar’s trust.

5.2 The humanist ground motive and framework changes

From this point of view, the authors examined above (sections 2 to 4) can all be placed on a continuum between the two extremes of the nature-freedom ground motive. It should be noted that, historically speaking, we meet, firstly, the authors relying on “determined” change, secondly, the middle position and, thirdly, the option of unconstrained change emerges. Authors such as Holton may be considered closer to the nature-pole, whilst Popper and Lakatos, occupy positions that can be considered fairly centralized between the two extremes. Feyerabend, Lyotard and Rorty tend towards the freedom pole.

⁹ With “given creation order”, Dooyeweerd refers to the structure for reality (cf. fn. 1 above).

¹⁰ As Strauss (2005:225) points out, historicism taken to the extreme (“everything is history”) becomes unthinkable (“there is nothing left which can have a history”). More radical consequences of this cultural movement include nihilistic tendencies, for example, in the works of Nietzsche, Dilthey, Spengler and Schelling (Dooyeweerd, 1980:81; 111).

Kuhn also belongs to the latter group, but seems to be more moderate in his position. What all of these authors have in common, however, is that their positions all depend on a dialectical (pre-theoretical) starting point.

In the case of dialectical ground motives, two “spiritually charged” poles exist within a single ground motive (Dooyeweerd, 1979:12). The resulting dialectic is characterized by an absolutization of part of created reality, which necessarily calls forth the correlates of what has been absolutized (Dooyeweerd, 1979:13). Dooyeweerd explains that an absolutization of something which is relative will, in the long run, lead to an absolutization of its “opposite” or “counterpart”, because all parts of creation are necessarily related to each other. Such a religious dialectic can never be synthesized into a higher union, because no higher point than the absolute exists.

This dialectic generates a kind of “pendulum dynamic” driving theoretical thinking from one pole to the other in its attempt to rid itself of this correlativity. According to Dooyeweerd (1979:13) the effect of the pendulum dynamic is that priority or primacy is alternatively attributed to one of the two poles, whilst simultaneously depreciating its opposite. Attempts at synthesis are also performed and can be observed in authors who attempt to hold a middle position between the two extremes. As a result of the powerful dialectical dynamics at work, however, such attempts are usually short-lived, genuine integration cannot be achieved and the pendulum quickly moves to the next pole.

What has been presented here is a hypothesis aimed at understanding and penetrating to the roots of the three main positions concerning framework change presented in the previous sections. Some readers might consider that such a hypothesis would require substantiation by further evidence, taking into account the complex developments of each author’s philosophy. All this cannot be offered within a single article: here I can only indicate, as a modest contribution, a direction for further research. This hypothesis, however, is not indispensable or even necessary¹¹ to proceed to our next step, namely the search for a model in which change and constancy are better integrated. The main reason for this search is that the models already explored may not be regarded as fully satisfactory. In fact, change and constancy could not be properly integrated, even though in some cases they appear as somehow “balanced”.

As an alternative to this polarization, it may be worthwhile to consider authors who proceed from a non-dialectical starting point. A model may be regarded as non-dialectical when it is rooted in a ground motive which does not present dialectical traits (cf. Dooyeweerd, 1979:11-14). According to Dooyeweerd, the Christian-biblical ground motive of creation, fall and redemption should be regarded as non-dialectical. This is the basis on which Dooyeweerd’s work developed, and on which Marinus Stafleu (1987:153-157) has developed a model to account for the scientific enterprise.¹²

In the next section, it will be necessary to briefly explain Stafleu’s view of science a bit in general, before moving to the more specific question concerning the nature of change in scientific frameworks.

¹¹ The Dooyeweerdian hypothesis is also not the only one that could be employed for the aim of exploring the dialectical conflict discussed above. Similar conclusions might be reached for example by referring to Bernstein’s (1985) conflict (“agon”) between objectivism and relativism or by utilizing Visagie’s (1996) “macromotives” and the type of “emotive logic” that they generate.

¹² A detailed discussion of the connections between the Christian-biblical ground motive and the concrete proposals and tenets of reformational philosophy would be too complex to be (re)proposed here. For an introduction to this topic see for example Hart (1984:325-370).

6. Marinus Stafleu

6.1 A multidimensional model for framework changes

In Stafleu's model the notion of *law* is prominent. The aim of the scientific enterprise is defined as: "the opening up of the law-side of nature" and the "discovery and development of law-conformity in reality" (Stafleu, 1987:152). Furthermore, his definition of objectivity reads as follows: "not conformity of theory to fact, but law-conformity" (Stafleu, 1987:241). This has a normative consequence: "investigation of the lawfulness of the creation is conducted by respect for the laws, or rather for the law-giver, the Sovereign of heaven and earth" and further "it means the subordination of human thought to divine law" (Stafleu, 1987:241). The laws are not merely "descriptive", but also "prescriptive" (Stafleu, 1987:153). This is an attempt at escaping the subject-object dilemma described above by introducing a dimension (the law, and the structural order) which was often recommended by Van Riessen (1992:54-55) as the most suitable "anchorage" for scientific research.

Stafleu's model outlines three basic dimensions (or coordinates) which show that research is not a linear process, but is multidimensional:

- (1) the distinction between the "law-side" and the "subject-side" (all of which is subjected to the law)¹³ of nature,
- (2) the distinction between "universal" and "typical" modes of being or experience
- (3) the distinction between the various (irreducible) aspects of human experience¹⁴ (Stafleu, 1987:153-154).

Regarding the scientific inquiry, each of the three dimensions is connected with two pairs of directions of research (Stafleu, 1987:154). In the case of (1) we can note that induction is directed toward the law-side whilst deduction is directed towards the subject-side. For (2) the search for unity is directed to the universal, whilst the search for structure is directed to the typical. Lastly, with regards to (3) the search for applications is determined by anticipations, whilst the search for objectivity is determined by retroceptions (Stafleu, 1987:154-156).

According to Stafleu (1979:15ff) this manifests as a certain pattern in the history of science: a field of science becomes "isolated" from other fields and subsequently it becomes possible to "develop" the field, for example to "design a mathematical framework", to "relate" it to other fields or to "apply" it to technical problems.

Stafleu (1979:15ff) recognizes that this process occurs in various phases:

- (1) An orientation stage characterized by more or less uncoordinated observations and speculative explanations (roughly corresponding to Kuhn's pre-paradigm phase).
- (2) A period of "isolation", during which the specific concepts and problems of the field are distinguished from those of other fields. Although there is no generally accepted theory (as Kuhn would argue) authoritative scientific works appear, summarizing the properties and phenomena characterizing a

¹³ Stafleu regards as subjected to the law both the (knowing human) subject and the object of knowledge. Simply stated, "all things, events and relations are subjected to laws" (Stafleu, 1987:153).

¹⁴ For a list of the "aspects" of human experience, cf. fn. 1 above. According to Stafleu (1987:154) the aspects are related to each other because: (1) "they show a linear order" which can be indicated as referring forward (anticipations) or backward (retroceptions) and (2) each aspect refers to the other aspects.

certain field (Stafleu, 1979: 15ff).¹⁵ (This phase roughly corresponds to what Kuhn would regard as the acquisition of the first paradigm).

(3) Furthermore, what Kuhn would call paradigm-shifts are explained by Stafleu as the discovery of both retrocipatory and anticipatory analogies. This happened for example during the phase of “mathematization” of physics, when the numerical modal aspect shed light on physical phenomena.

The model can therefore be used to explain what happens when changes occur in scientific frameworks. In what follows the term “multi-dimensional”, which I proposed, is enriched by the connotation of “multi-modal”.

6.2 Constancy and change in framework changes

Stafleu argues that during the opening-up process (phase 3 above) meaning is both deepened and relativized (Stafleu, 1980:26). (In the latter case, especially, the discoveries can be truly spectacular). This means that framework changes are not only “revolutionary”, but also follow persistent “themes” (to use Holton’s language). In fact, the modal aspect in question remains the same (as a fundamental and irreducible mode of explanation), but at the same time is not exactly the same anymore, as it is “opened up” by modal analogies (Stafleu, 1980:26). Change and constancy are therefore deeply integrated. From this point of view, the fact that both revolutionary change and persistent “themes” were discovered in the history of science becomes quite understandable (Stafleu, 1980:27). For Stafleu, the recognition of modal analogies is one among many conditions for scientific advance.

This model also implies that changes in epistemic frameworks occur according to a pattern, neither completely random nor rigidly constrained, which results in change being dynamic but not arbitrary. Because the model is based on a non-dialectical motive, change and constancy are more integrated and coherent, in a way that is not always possible even in the most “centralized” positions examined above. For example, Kuhn has change especially in one (the revolutionary) phase of science and constancy in another (normal science). Popper and Lakatos may be regarded as having a more integrated approach and this may be appreciated. However, if the (reformational) hypothesis that they are attempting an unlikely synthesis is plausible, one would expect that their attempt would be rapidly followed by more polarized positions (in this case in the historicist direction). Historically speaking, this is precisely what happened.

Stafleu’s model deals particularly with changes in special-scientific frameworks. Regarding the pre-theoretical frameworks, other authors in the reformational tradition have developed some valuable perspectives. As already mentioned, Dooyeweerd (1979:11-14) describes a “pendulum” dynamic between opposing poles of a religious ground motive, giving some structure to changes (cf. section 5.2 above), whilst with philosophy the problem-historical method of Vollenhoven (2005:113; 114) suggests some interaction between “types” and “time currents” in a way that “types” are changed by each new time period. An explication of the latter method is beyond the scope of the current article, but is well worth investigating (cf. Vollenhoven, 2005:95ff).

¹⁵ Stafleu (1979:15ff) demonstrates this pattern in the history of science, in dialogue with Kuhn, by using examples from studies of electricity and magnetism: William Gilbert gave a summary of magnetism in 1600, separating the two fields from each other and in 1733 Charles Du Fay developed a defining summary for studies of electricity (Stafleu, 1979:15ff).

7. Conclusion

Since the recognition of the existence and role of pre-scientific epistemic frameworks in philosophy of science, three main approaches to framework-change have been detected. The first approach regards changes in frameworks as occurring in a way that is rather constrained, predictable and even according to a pre-determined pattern. The second approach seems to argue that changes in frameworks occur in a way that is more random or unpredictable and free from constraints. In between these two views, a middle position is found that attempts a kind of synthesis between constancy and change.

The reformational approach sketched above would acknowledge the importance of the structural order for reality (in terms of the modal aspects) influencing changes in epistemic frameworks. By referring to both the irreducibility and cohesion of modal aspects, I have argued, it is possible to explain framework changes both in terms of continuity and revolutions, which result in changes being dynamic but also deeply integrated with constancy.

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Article 3: Factors shaping scientific framework change

Through the history of philosophy of science, several different change factors are proposed as crucial for scientific framework change: the logical and psychological factors (e.g. the positivist tradition), the physical and logical (e.g. Popper), the logical, social and psychological (e.g. Kuhn), the social and political (e.g. neo-Marxism), the social and linguistic (e.g. Rorty) and the certitudinal and psychological factors (e.g. Feyerabend). The relationship between the different change factors becomes particularly problematic when some of the aspects are absolutized, often simultaneously reducing the others. The aim of this article is to discern the factors shaping framework change. The article suggests a pattern in which changes in epistemic frameworks occur as the result of many aspects, some of which are qualifying aspects for science, so that these should play a more regulative role. The latter position does not reduce some aspects to sub-aspects of the absolutized one(s) and suggests a normative direction for framework change. A few hypothetical questions on the role of non-qualifying aspects (and related functions) conclude the article.

Faktore wat raamwerk verandering vorm

Deur die geskiedenis van wetenskapsfilosofie word verskeie veranderingsfaktore voorgestel vir wetenskaplike raamwerk verandering: die logiese en psigologiese faktore (bv. die positivistiese tradisie), die fisiese en logiese (bv. Popper), die logiese, sosiale en psigologiese (bv. Kuhn), die sosiale en ekonomiese (bv. neo-Marxisme), die sosiale en linguistiese (bv. Rorty) en die pistiese en psigologiese faktore (bv. Feyerabend). Die verhouding tussen die verskillende veranderingsfaktore word besonder problematies wanneer sommige van die aspekte verabsoluteer word, dikwels met gelyktydige redusering van die ander. Hierdie artikel het ten doel om die faktore wat raamwerk verandering vorm, te onderskei. Die artikel stel 'n patroon voor waarin veranderinge in epistemiese raamwerke plaasvind as gevolg van menige aspekte, waarvan sommige kwalifiserende aspekte vir wetenskap is, sodat hierdie aspekte 'n meer regulatiewe rol behoort te speel. Die laasgenoemde posisie reduseer nie sommige aspekte na sub-aspekte van die verabsoluteerde(s) nie en stel 'n normatiewe rigting vir raamwerk verandering voor. Enkele hipotetiese vrae aangaande die rol van nie-kwalifiserende aspekte (en verwante funksies) konkludeer die artikel.

1. Orientation

Scientific frameworks have some kind of plasticity or capacity for change and through the history of philosophy, different conceptions of how this change supposedly occurs have been proposed. In previous articles (Loubser, 2012a, 2012b) I have explored different models of framework change and found that epistemic frameworks change according to a pattern referring to the irreducibility of coherents, where change and constancy exist in cohesion. Intuitively, however, changes in frameworks are also influenced by various factors. These change factors, of *theoretical* epistemic frameworks in particular, are the focus of my current article.

Traditionally, the change factors have been categorized as being either internal or external to science. For example, Kuhn (1970:ix-x) states that his main focus in *The structure of scientific revolutions*, is the influence of internal (i.e. epistemic) factors on scientific development. Although the external factors

(e.g. social pressures for reform) are not his focus, Kuhn (1970:69) admits that they are “immensely important” and “principally significant” in determining the timing of revolutions, the ease of acceptance of changes and the areas of mature sciences which are first affected.

Feyerabend (1975:68) argues that, for the sake of scientific development, scientists need to contrast scientific ideas with other incompatible ideas, without excluding those external to science. Notably, he claims that it is necessary to “step outside the circle”, and to import a new system “from outside science, from religion, from mythology, from the ideas of incompetents or from the ramblings of madmen” Feyerabend, 1975:68).

In these examples, one gets the impression that what is defined as “internal” to science differs markedly from author to author, to the extent that whatever is identified as crucial for determining scientific change (by each specific author) is considered “internal” while all the other influencing factors are regarded as “external”. Also what is (or is not) included in the external factors can differ radically (from Kuhn’s “technological advances” (1970:x) to Feyerabend’s “mythology”).

The problematic nature of the traditional internal-external distinction, leads me to the adoption of a different classification scheme. In this article, change factors are classified along the lines of the different aspects of reality, as distinguished by Dooyeweerd (e.g. 1979:40-41). These aspects are the numerical, spatial, kinematic, physical, biotic, psychical, logical, historical, lingual, social, economical, aesthetic, judicial, ethical and certitudinal.

In the literature of contemporary¹ philosophy of science, several change factors are proposed as the most important for science: the logical and psychological factors (e.g. the positivist tradition), the physical and logical (e.g. Popper), the logical, social and psychological (e.g. Kuhn), the social and political (e.g. neo-Marxism, cf. Habermas, 1971:198; 308-314), the social and linguistic (e.g. Rorty) and the certitudinal and psychological factors (e.g. Feyerabend). Since some of the aspects are often absolutized while others are simultaneously reduced², the relationship between the change factors becomes problematic. The problem statement of this article can be formulated as follows: which factors are crucial to shaping science and (i.e. which factors have a regulative role?) Furthermore, which factors should *legitimately* have a shaping influence? Are there factors which should not have such influence on theory change (e.g. economic or political factors)?

The hypothesis of this article is that a wide variety of factors influences changes in frameworks but that some of these factors have a regulative function, pointing towards a normative element in scientific changes. Support for the hypothesis is provided through the following plan: I investigate contemporary literature in philosophy of science and explore approaches which indicate different key-factors for

¹ My usage of the adjective “contemporary” refers to the period circa the Second World War, characterized by the emergence of a solid anti-positivist approach (e.g. in authors such as Popper), as well as its subsequent elaborations (e.g. in authors such as Kuhn, Polanyi, Feyerabend, Dooyeweerd). The humanist thinkers considered here are discussed because they are among the most influential contemporary philosophers of science and the reformational philosophers are included because they contribute valuable insights towards a solution of the problems explored here.

² *Absolutization* occurs when all of reality is viewed through one or a few of its aspects, so that all the other aspects become sub-aspects of the absolutized one(s) and in that sense *reduced*. In the reformational tradition one can find attempts at serious analysis of this issue. For example, Clouser (1996:77-78 fn. 23) distinguishes between “strong reduction” (referring to either “meaning replacement” or “factual identity”) and “weak reduction” (manifesting as “causal dependency” or “epiphenomenalism”).

change in frameworks. By concentrating especially on theoretical frameworks, I evaluate the different approaches, pointing out some problems.

I propose an alternative “pattern” following the reformational theory of qualifying functions. According to this perspective science is qualified by certain functions, which are supposed to play a more regulative role in scientific change. However, a variety of factors shaping science exists and since all the aspects of reality are necessarily related to each other, they should not be ignored. Before concluding, a few hypotheses in the form of questions are formulated on this issue, as a possible contribution to open up new avenues for research. Let us start the exploration by considering the physical and biological change factors identified by the positivist tradition.

2. Logical and psychological change factors

Frederick Suppe (1974:12) regards the Received View of science as occupying a central place in logical positivism. According to him the original version of the Received View can be formulated as follows: a scientific theory is to be axiomatized in mathematical logic (Suppe, 1974:12). This axiomatization consists of: (1) logical and mathematical terms, (2) theoretical terms and (3) observational terms given phenomenal or observational interpretation (Suppe, 1974:12). Furthermore, the Received View analogously characterizes the way in which science develops. According to Suppe (1974:13) science initially consists of empirical generalizations formulated using (3) above. This is later followed by the introduction of theoretical terms and theoretical laws or by the formulation of the generalizations by theoretical terms (Suppe, 1974:13).

I am of the opinion that, in this approach, some change factors are over emphasized, whilst others are reduced, or even disregarded. One of the most important change factors emphasized in this manner is the logical. Logical positivism proceeded from mathematical statements of scientific laws and definitions of theoretical terms given in the form of mathematical logic (Suppe, 1974:13). Secondly, since logical positivism assumes epistemological assertions to be empirically verifiable through sensory perception, the psychological factors are emphasized as well. In fact, according to Suppe (1974:15) the sensory verification of physical assertions was taken as “non-problematic”.

Unfortunately, the emphasis placed on the logical and psychological change factors by the logical positivist tradition can be problematic at least in two senses. Firstly, it seems that the absolutization of the psychological factors caused other factors to be reduced. For example, the members of the positivist tradition were opposed to the introduction of metaphysical concepts in scientific frameworks, since such concepts could not be empirically verified (Suppe, 1974:13). This means that, for example, the influence of certitudinal change factors (e.g. beliefs, expectations *et cetera*) on the development of science was rejected. Secondly, absolutization of some factors can cause other factors to become distorted. In the positivist tradition, some struggled with reducing physics to sense perceptions (observations) and logic. This means that the linguistic change factors become subjected to the norms of the psychological and logical aspects.

In the subsequent sections of this article we will see more examples of different change factors which have been emphasized in philosophy of science. Let us proceed with the physical and logical factors in the next section.

3. Physical and logical change factors

For Karl Popper, the purpose of science is the testing of universal laws (1961:144). These laws are “the laws of nature” equivalent for him to physical laws and representing immutable regularities throughout space and time (Popper, 1961:5). Popper regards scientific theories as seeking correspondence to the immutable physical laws (1963:224;229) and changes in theories are the result of increasing approximation to the physical facts (1963:231-233; 1970:57). In this way, Popper gives fundamental importance to physical change factors. This also implies that, when it comes to scientific certainty, Popper locates it in the object of study rather than the human subject³. It should be noted, however, that Popper does not subscribe to a form of unmitigated objectivism. Popper holds a rather moderate position, where the human subject does play a limited role in grounding scientific certainty.

For Popper, the role of the subject is not to be found in the individual scientist, but rather in “social institutions”. He states that “science, and more especially scientific progress, are the results not of isolated efforts but of the free competition of thought” (Popper, 1961:154-155). Competing scientific hypotheses need personal representation, but the latter must be institutionally organized if it is to be effective (Popper, 1961:155). It is in these institutions that scientific knowledge progresses through conjectures and refutations. According to Popper (1979:261) hypotheses which survive criticism better than their competitors, are to be accepted tentatively as part of scientific knowledge. Furthermore, scientific institutions have to be protected politically, so as to insure democracy and freedom of thought.

The implication is that social and political factors shape science *indirectly* by creating the space for the logical change factors to function. For Popper, however, the combination of logical factors (rational criticism of competing hypotheses through conjecture and refutations) and physical factors (the physical universal laws) is the key to scientific change. According to Stafleu (1987:204, 253) Popper absolutizes these two aspects (cf. also Coletto, 2007:33, 72-73).

In the next section we will explore the work of Thomas Kuhn who adds social and psychological factors to the list.

4. Logical, social and psychological change factors

In *The structure of scientific revolutions* (1970), Thomas Kuhn mainly focuses on what he regards as the internal factors that influence the development of science, but he states that an analysis of the external factors, e.g. technological advance or social, economic and intellectual factors, will add an important dimension for understanding scientific advance (Kuhn, 1970:ix-x). According to Kuhn (1970:ix-x) the “conditions outside the sciences” may influence the range of revolutionary alternatives available to end a scientific crisis, although an explicit consideration of them would not alter his main thesis that scientific change is primarily dependent on internal (epistemological) and therefore logical change factors. Nevertheless, social and psychological factors play a relevant role as well.

For him (1970:169) the unit for scientific progress is the solved puzzle. However, because the scientists adopt a certain paradigm and try to apply it to new areas of research, they will only be open

³ In *Normal science and its dangers*, Popper (1970:57) states that scientific knowledge may be regarded as subjectless.

for alternatives once nature has problematized their previous answers (Kuhn, 1970:169). Even after reality itself has “kicked back” and forced the existing paradigm into crisis, the role of the human subject enters Kuhn’s equation again. During the revolutionary phase of science, the group of scientists decides which of the proposed alternative paradigms to embrace. Their decision (according to Kuhn, 1970:169) will be based on important conditions: (1) the new paradigm must promise to solve well-known and previously unassailable problems and (2) must preserve a large part of the concrete puzzle-solving ability of preceding paradigms.

This means that, when it comes to explaining scientific change, Kuhn holds a moderate position between emphasizing the role of nature and the role of the knowing subject, however, ultimately leaning more towards the role of the subject. It is important to note that Kuhn does not regard the individual scientist (on a personal level) as influencing changes, but rather a community of individuals (Kuhn, 1970:168). The scientific community must have a certain composition of members, namely individuals who share specialized training and experience. This makes the scientific community the “sole possessors of the rules of the game” capable of unequivocal judgments (Kuhn, 1970:168). In this way, Kuhn emphasizes the social change factors for science.

Kuhn’s emphasis on the role of the scientific community has lead authors like Lakatos (1970:140 fn.3) to believe that (for Kuhn) the history of science cannot be fully understood without taking psychological change factors into account. According to Lakatos (1970:178) there can be (in Kuhn’s view) no logic, but rather the psychology of scientific discovery. In Kuhn’s conception anomalies are always found in science, but during the phase of normal science, the dominant paradigm secures a pattern of growth which eventually gets overthrown by a “crisis” (Lakatos, 1970:178). There seems to be no stringent rational cause for the appearance of a paradigm “crisis” and Lakatos (1970:178) perceives the crisis to be of a rather psychological nature, akin to a “contagious panic”.

Furthermore, in Kuhnian revolutionary science, there seems to be no super-paradigmatic standards to compare old paradigms with new paradigms, since the latter bring in a totally new rationality and are perceived to be incommensurable (Lakatos, 1970:178). Lakatos proceeds to noticing the crucial role of the psychological factors by stating that, in Kuhn’s philosophy, scientific change becomes a “bandwagon effect” which resembles an “irrational” matter of “mob psychology” (Lakatos, 1970:178). Kuhn (1970b:260-263), however, does not regard his philosophy as over-emphasizing the psychological change factors, since standards for theory choice (e.g. accuracy, scope, simplicity, fruitfulness, etc.) continue to exist.

This view of science as being social, i.e. subject-dependent and non-neutral, is shared by authors in the neo Marxist tradition (e.g. Habermas) who emphasize social and political change factors (critically ignored by Kuhn). Let us proceed to an investigation of such factors in the next section.

5. Social and political change factors

Neo-Marxism considers theoretical science to be intimately related to practice and to historically-bound human interests. As such, the purpose of science is not merely description of the facts, but social change. Jürgen Habermas can be regarded as supporting this thesis.

For Habermas (1971:308-311) science can be categorized into three different types, each characterized by specific interests: (1) the empirical-analytic sciences characterized by the “cognitive interest in technical control over objectified processes”, (2) the historical-hermeneutic sciences characterized by a “constitutive interest in the preservation and expansion of the intersubjectivity of possible action-orienting mutual understanding” and (3) the systematic sciences of social action (i.e. economics, sociology, political science) determined by an “emancipatory cognitive interest”. Of the three different types of interests, the emancipatory interest is the most important, since it shapes our understanding of the other two interests (Habermas, 1971:198). This means that for Habermas, scientific change is influenced by the scientist’s perception of and reaction against existing social repressions and exploitation. In this way, Habermas emphasizes the social and also political change factors in science.

The list of change factors mentioned in the previous sections does not exhaust all the factors proposed in the history of philosophy of science. In the next section we will see that linguistic factors can also be regarded as crucial for shaping scientific theorizing.

6. Social and linguistic change factors

In *Contingency, irony, and solidarity*, Richard Rorty states that, with regards to knowledge, we need to distinguish between our claims that “the world is out there” and “truth is out there” (Rorty, 1990:4-5). Truth, for Rorty is equated to our *descriptions* of the world (supplied via sentences or language) and cannot exist “out there” independently of the human mind. What is important is that even though the world itself is out there, the world does not make one particular “language game” better at corresponding to reality, i.e. the world does not help us “decide” between alternative theories (Rorty, 1990:5). According to Rorty (1990:6) this does not mean that our choices between alternative languages are arbitrary, or even the expression of something deep within us. Furthermore, it does not follow that objective criteria for choice of vocabulary are to become subjective, it rather means that the notion of “choice” is no longer the issue (Rorty, 1990:6). For Rorty, changes are the result of habits of vocabulary and therefore he emphasizes linguistic change factors.

Of course, these habits of vocabulary are made, rather than found and our holding of certain habits is the result of “other human beings” allowing us to do so (Rorty, 1990:6-7). This means that social factors, as well, play a crucial role in scientific change.⁴

From the way the survey has been progressing since Kuhn, one can see the increasing importance of the role of the human subject (either as an individual or a community) in influencing scientific change,

⁴ More recently, social factors for scientific change are radically emphasized by authors representing the Edinburgh school of the sociology of knowledge, cf. Collins (1992); Barnes, Bloor and Henry (1995). Space constraints do not allow an exploration of this very interesting trend in philosophy of science. It can only be mentioned that, for Bloor and others, the scientific community becomes the norm and means for framework change.

through the emphasis on psychological, social and linguistic change factors. In the next section, we will see this progression towards the subject become even more pronounced, with Paul Feyerabend insisting on the role of certitudinal⁵ change factors.

7. Certitudinal and psychological change factors

For Feyerabend, scientific change is shaped by the decisions and needs of the free individual (1970:210). The individual's freedom of choice allows for worldviewish beliefs to influence the direction of scientific research, even if the beliefs are counter-inductive with respect to contemporary theorizing and experience (Feyerabend, 1975:26). Beliefs stemming from the subject's whims, passions, emotions, wishes etc. are all causes of the proliferation of ideas, which together with tenacity, form the two cornerstones of Feyerabend's explanation of scientific progress (1970:210). Scientists must be allowed to "retain ideas in the face of difficulties" and "introduce new ideas even if popular views appear to be fully justified and without blemish" if science is to prosper as a critical activity (Feyerabend, 1970:210). Because new ideas stem from personal worldviews and beliefs, this means that Feyerabend emphasizes the certitudinal change factors.

Although Feyerabend regards certitudinal factors as important, the desires of the individual seem to be even more crucial. For Feyerabend (1970:209) the most important question remains: to what extent has scientific progress increased the happiness and freedom of individual human beings? For Feyerabend, the certitudinal factors are also shaped by hedonistic inclinations, preferences and conveniences of individuals or groups. He demonstrates this by analyzing the change from the geocentric view to Copernicanism. According to Feyerabend (1970:141) Galileo, writing in Italian, "appeals to people who are temperamentally opposed to the old ideas and standards of learning connected to them" and so becomes preferable to Aristotle. The new classes emerging in society want a "new world" and therefore instinctively side with Galileo. Although Feyerabend gives a normative element to guide scientific framework change (the desires of the free individual/group) it is not clear how this element should qualify science as opposed to non-science. At this point, it is time for an evaluation.

8. Evaluative reflections

Through the history of contemporary philosophy of science, there seems to be an endless search for the factors shaping science. A gradual movement from lower aspects (such as the physical) to the higher aspects (logical, social, economical, linguistic and certitudinal) can be detected. This movement seems to correspond to the increasing role attributed to the human subject in science.

In fact the first (or lower) aspects qualify the objects of study of the natural sciences, while in the later (higher) aspects only the subject of knowledge functions actively. It should be granted, however, that the distinction between the object and subject can never be mutually exclusive, since the lower and higher aspects exist in cohesion. The physical, biotic *et cetera*, are also aspects of the human subject and to an extent they can qualify the objects of study of the humanities. Although it will be difficult to

⁵ I follow Olthuis (1985:21-40) in using the term "certitudinal" to refer to the aspect originally designated by Dooyeweerd as the pistic (or faith-) aspect.

determine a precise system, it seems as if the order in which the change factors were chosen through history, is not completely random. The broad variety of proposals examined above shows that whatever modality is identified as crucial for revealing the factors shaping science seems “to make sense” for the purpose, as it is possible to observe everything in reality via any modal aspect. The impression is created that each aspect can be regarded as the key aspect qualifying the factors shaping science. In the end, however, the key aspect remains elusive. What more can we gather from the choice of change factors in history? The issue of absolutization and reduction emerges as well.

It is through studying practical examples of absolutizations in the philosophy of science that one becomes aware of the consequential under-appreciations of other aspects. One such example is the seminal work done by Kurt Lewin in the field of change management. Although this is a relatively old example, it demonstrates the point quite clearly. In *Field theory in social science* (1951) Lewin describes social change in terms of physical forces (1951:199-212). Lewin uses a theoretical device known as the “phase space” to describe certain aspects of social dynamics. For Lewin, the phase space is a system of coordinates, each corresponding to different amounts of intensities of one “property” (1951:201). This means that a social group’s tendency to change (or remain constant, i.e. resisting change) can be measured (mathematically) as the result of opposing physical forces, namely (1) those forces striving to maintain the *status quo* and (2) those forces pushing for change (Cummings & Worley, 2001:22). Initially, the social group’s behavior is in a state of “quasi-stationary equilibrium” where both sets of forces are about equal (Cummings & Worley, 2001:22). Change can then be brought about by increasing the forces pushing for change, or decreasing the forces maintaining the *status quo* (2001:23).

Interestingly, the phase space represents, through graphs or equations, the quantitative relation between a *few* aspects of the field (Lewin, 1951:201). This means that the mathematical and physical aspects of change in social groups are absolutized. My dissatisfaction with Lewin’s proposal lies with the concomitant under-appreciation of the other aspects of social change. Lewin states that the phase space “does not intend to represent the layout of a field composed of groups, individuals, and their ecological setting, but concentrates on one or a few factors” (Lewin, 1951:201). This means that the theory of social change in groups will tend to neglect (or only peripherally deal with), for instance, the human psychological aspect of groups dynamics.

It may perhaps be noted that even Lewin admits the “representation by way of a phase space takes into account only certain aspects of the actual processes in the social field” (Lewin, 1951:211) and that, in the end, one must “finally refer back to the actual social field” (1951:202). Even after this realization, however, Lewin seems unable to escape the physicalistic metaphor describing the social aspect as a (physical) force field. Further examples of how the absolutization of certain aspects in science tends to reduce other aspects, can be found in the discussions of Ponti Venter on how scientific developments (and the nature of the university) are determined by economic and utilitarian interests (cf. Venter, 2006:275-318).

A further problem with the proposals by authors such as Feyerabend, is that “the way that science is” becomes a sort of normative statement, so that it is also “the way that science is supposed to be”. This means that, in these authors, the difference between “which change factors are crucial” (*de facto*) and “which change factors should legitimately be crucial” (*de jure*) is not always clear. In the next section, I am investigating an alternative view towards a possible solution to these problems.

9. Leading and foundational functions

9.1 Revisiting the theory

An answer to the question of which factors should legitimately shape science, may come from the theory of qualifying functions, developed in reformational philosophy. According to Kalsbeek (1975:352) a “guiding function” qualifies a thing in the sense of characterizing it (plants are qualified by the biotic, the state by the judicial, etc.) The guiding (or leading) function is “the highest subject function of a structural whole (e.g. state, animal, business enterprise, or state)”. It “leads” or “guides” the substrate functions of the structural whole, e.g. the guiding function of a plant is the biotic and the “physical function of a plant is different from physical functioning elsewhere, since it is guided by the biotic” (Kalsbeek, 1975:348).

The leading function can also be called the “function of destination” (Kalsbeek, 1975:348). It is one of two qualifying functions of (e.g.) a social institution, the second (modally lower) is called the “founding function”, e.g. the state has its function of destination in the judicial, while its founding function is historical. However, things are qualified by only one modal function, which we can call the qualifying function.

Deeper insight into the nature of leading and foundational functions is given by Roy Clouser in *The myth of religious neutrality* (2005). According to Clouser (2005:260) the qualifying aspect of a thing is “the aspect whose laws regulate the internal organization of the thing taken as a whole”. The qualifying aspect is also the highest aspect in which a thing functions “actively” and the fact that the thing only functions “passively” in the successive aspects is partly the reason why things are seen intuitively as having a typical nature (Clouser, 2005:260-261). This striking correspondence between the intuitive grasp of a thing’s highest active function and its qualifying function leads Clouser to give the following definition of the qualifying function:

“that aspect whose laws govern the overriding internal structure and development of a thing considered as a whole, and which is the highest in the sequential order of aspects in which the thing functions actively. This deliberately includes both the pre-theoretical intuitive recognition of a thing’s nature as centered in the last aspect in which it functions actively, and the theoretical reasons for identifying which kind of laws have overriding governance of the internal structure of a thing taken as a whole” (Clouser, 2005:261).

What is important is that the concept of the qualifying function provides us with a way to account for the nature of things in a manner that is both “non-reductionist and subject to empirical confirmation” (Clouser, 1991:261). Clouser’s discussion of artifacts deserves special attention.⁶

Artifacts differ from natural things because their leading function is an actualized passive function rather than an active function (Clouser, 2005:266). Since human beings make artifacts in accordance to a preconceived plan, the modal qualification of human artifacts consists of three elements. According to Clouser (2005:264) in addition to (1) the qualification of the kind of natural material used and (2) the process of transformation (of the natural materials) there is also (3) the qualification of the plan by which the process was guided. Of the three elements, the aspectual qualification of the plan can be seen as the artifact’s leading function, while the other two elements are regarded as foundational

⁶ Due to our focus on science I leave aside Clouser’s interesting discussion of animal artifacts.

functions (in the sense that they provide the means for the accomplishment of the plan) (Clouser, 2005:264). Since all of the aspects are interrelated to each other, none of the aspects can be neglected.⁷ How do we apply the theory of qualifying functions to scientific changes?

9.2 Reformational discussions

In order to determine which aspects should be qualifying for science, it is necessary to decide whether science should be regarded as a thing, an artifact or an activity. For Stafleu (1981; 1982) theories are “logically qualified artifacts”. Nevertheless, “science is not a set of statements or theories or an amount of knowledge, but an activity, something people do” (Stafleu, 1987:102). According to Dooyeweerd (2003:15) activities function in all aspects and are qualified by the aspect whose laws govern the internal organization or event taken as a whole. Thus, formulated more precisely, science refers to a collection of activities or events which aim at the production of artifacts (such as theories) where both activities/events and artifacts can be qualified (Clouser, 2012). On this point I agree with Clouser and Stafleu.

On the issue of which aspects in particular qualify the activities of science, the opinions do not coincide fully. Authors such as Botha (1984) seem to suggest that scientific activity is qualified by the (logical or) linguistic aspect, while other authors, for example Strauss (2011) regards it as logically qualified and Stafleu (1987) seem to emphasize the historical aspect.⁸

For Botha (1984:63) the growth of scientific knowledge is dependent on lingual devices (such as metaphors) and occurs as a result of “constant modification and accommodation of theories as lingual or semantic networks”. For her, the critical question regarding the qualifying aspects for scientific activities, is whether a closer approximation of the structure of reality can take place without lingual means (such as conceptual frames of reference or semantic networks) and whether new discoveries in science (as a result of new ways of viewing the world) are possible without support by lingual means (Botha, 1984:63). Theory-constitutive metaphors (as well as theories derived from them) aim at understanding the world through a logical act, which is nevertheless supported by lingual means (Botha, 1984:64). The theory-constitutive metaphors are, in turn, rooted in a metaphor which provides the overall view of reality and which functions as a pre-theoretical perspective (Botha, 1984:63-64). This means, that (for Botha) although the logical aspect is important for the activities of science, the most fundamentally qualifying aspect seems to be the linguistic. A different proposal is developed by Strauss, who seems to regard the logical aspect as the one qualifying the activities of science.

For Strauss (2011:18) all language (including metaphorical language) is based on the ability of “lingual identification” and “lingual distinction” which presupposes the original logical-analytical meaning of identification and distinction. This means that the logical aspect precedes the sign mode (or lingual aspect) and that, viewed from the perspective of the interrelatedness of the aspects of reality, language

⁷ A brief but interesting “synopsis” of reformational positions (Dooyeweerd, Hart, Chaplin) concerning the qualifying functions of artifacts and social institutions is supplied by Geertsema (2004:58 ff.).

⁸ One should note that their discussions are not always framed in the context of the qualifying functions for the activities of science, but are “collected” from various contexts.

use is built on the basis of logical skills (Strauss, 2011:17-18). The activities of science are therefore logically qualified. A third suggestion for the qualifying aspect of science is provided by Stafleu.

Stafleu (1987:159) admits that “language has an important hermeneutic function in science” but maintains that this does not mean that science (as a collection of activities) is linguistically qualified. For Stafleu (1987:151; 159) science, instead, has a definite aim in the sense of “the progressive opening up of the lawful character of reality”. This means that (for Stafleu) the leading function of the activities of science is historical (cf. 1987:98-107, 151-157). The aim of science “characterizes science” (1987:102) and Stafleu can say that “science is history” (1987:103). Stafleu also characterizes theoretical thought as “opened up by the historical aspect” (1982:166). I would argue that the historical (i.e. cultural) aspect is the foundational function of science. However, although Stafleu emphasizes the historical aspect of science, he (2008:154-169) recently rejected the existence of the historical aspect and it is possible that he may reformulate his views.

Although these proposals differ from each other the general approach of determining the qualifying aspects for science, whilst not diminishing the other aspects, provides some ground for the solution of the problems examined in this article. While the discussion is continuing, in my opinion the most accurate proposal is that the activities of science are historically founded and logically qualified (cf. Clouser, 2012).

At this point, allow me to suggest a hypothesis in the form of orientating questions with regards to the relationship between the logically (and historically) qualified factors of influence and the “secondary” factors. Could the anticipations and retroceptions of the qualifying function perhaps provide a clue about the relationships that should exist between the influencing factors, so that the secondary factors are recognized but placed in a kind of “subordination” to the qualifying one? If this is so, might this perhaps also lead to establishing a difference in importance between the anticipations and retroceptions? Another consideration may be whether the modal point(s) of entry of each science should also indicate legitimate and particularly relevant shaping influences for that science. I will conclude the article here.

10. Conclusion

Through the history of philosophy of science, many authors have emphasized certain factors as crucial for scientific change, while simultaneously reducing others. This has induced a lack of normativity. Authors seem to *describe* the change factors which they regard as relevant, often with no *prescription* concerning the legitimacy of such factors. The implication of the lack of normativity is that scientific change can become reduced to aspects by which it is not qualified, for example economic factors (Habermas) and power struggles (Foucault). I have proposed an alternative approach where the anticipations and retroceptions of the qualifying function suggest a relationship, so that the qualifying function remains crucial, while influences from the other factors are recognized in a “secondary” capacity. This places me in (partial) agreement with some of the authors examined above and provides a starting point for argumentation about the legitimacy of the factors influencing change in scientific theorizing. I would like to call attention to the fact that there remains fertile ground for future research on this topic.

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Article 4: An ontological exploration of change and constancy

The history of philosophy presents a variety of viewpoints regarding the ontological primacy of either change or constancy. Some views regard change as foundational, to the point where constancy is denied (e.g. Heraclitus). Other views regard constancy as so important, that change becomes unthinkable (e.g. Parmenides). The apparent dialectical tension between the different conceptions demands an ontological clarification of these issues. This study illustrates and evaluates the relationship between change and constancy in the viewpoints of various philosophers and scientists throughout history. This is done by referring to a reformatory insight that change and constancy exist in cohesion. The study finds that the relationship between change and constancy is not dialectical, but rather one of integration, seated in irreducible primitive domains (modalities). The purpose of the article is twofold: (a) to show that change and constancy cannot be reduced to one another but can only exist in a relationship of coherence and (b) to contribute a systematic clarification of framework change in terms of the relationship between change and constancy on the ontological level.

‘n Ontologiese eksplorasië van verandering en konstantheid

Die geskiedenis van filosofie vertoon ‘n verskeidenheid van standpunte aangaande die ontologiese voorrang van óf verandering óf konstantheid. Sommige beskouings aanvaar verandering as fundamenteel, tot die punt waar konstantheid ontken word (bv. Heraklitus). Ander beskouings aanvaar konstantheid as so belangrik, dat verandering ondenkbaar word (bv. Parmenides). Die oënskynlike dialektiese spanning tussen die verskillende konsepsies vereis ‘n ontologiese uitklaring van die kwessies. Hierdie studie illustreer en evalueer die verhouding tussen verandering en konstantheid in die standpunte van verskeie wetenskapsfilosowe deur die geskiedenis. Dit word gedoen deur te verwys na ‘n reformatoriese insig dat verandering en konstantheid in ‘n kohesie bestaan. Die studie vind dat die verhouding tussen verandering en konstantheid nie dialekties is nie, maar eerder een van integrasie, gesetel in onreduseerbare primitiewe domeine (modaliteite). Die doel van die artikel is tweeledig: (a) om te toon dat verandering en konstantheid nie tot mekaar gereduseer kan word nie, maar in ‘n verhouding van koherensie bestaan en (b) om ‘n sistematiese uitklaring van raamwerkverandering, in terme van die verhouding tussen verandering en konstantheid op die ontologiese vlak, by te dra.

1. Orientation

Change and constancy can be related to epistemic frameworks according to a pattern referring to the irreducibility of coherents, where change and constancy exist in cohesion. As a result, change can never be completely random or absolute.

This central theoretical assumption underlies a research project discerning a level of consensus regarding the characteristics and functions of epistemic frameworks (Loubser, 2012a), as well as the factors shaping framework change and the relationship between these factors (Loubser, 2012b). A further part of this project tries to achieve clarity on how framework changes occur (Loubser, 2012c).

Framework changes can, for instance be conceptualized as being constrained, predictable and even pre-determined, or random, unpredictable and free from constraints. Some conceptions attempt a synthesis between the more radical positions. At an earlier phase of the research project the need for an ontological exploration of change and constancy and substantiation of the main thesis (cf. Loubser, 2012c) was announced.

In recent philosophy, some conceptions seem to regard change as foundational, to the point where change becomes the only constant. The conceptions where change is everything and constancy denied, can be traced from antiquity (Heraclitus, Fr. 12, 49a)¹ and are also popular in postmodernity. They do however harbor some problematic internal incoherence. In order for change to be recognized, some kind of constancy must be present (Strauss, 2005:225) and the idea that change itself becomes the only constant is therefore rather paradoxical. Other conceptions regard constancy as fundamental to the point where change becomes unthinkable (Parmenides, Fr. 2, 6, 7, 8). The apparent dialectical tension between these different conceptions of change and constancy plunges its roots in Antiquity and demands an ontological clarification of these issues.

This brings us to the problem statement of the current article: What is the ontological relationship between change and constancy?

The present investigation proceeds by evaluating a few different ontological conceptions of the relationship between change and constancy in antiquity. Since the issue appears to be still problematic in philosophy, a few modern and postmodern conceptions are considered in addition to the more ancient examples. This article does not attempt to provide a complete history of the idea, but merely shows that some problems do not die off easily and that some basic trends seem to repeat themselves.

I will argue (with Strauss) for a position where change and constancy go hand in hand, because they are both rooted in primitive domains (modalities) which are irreducible. Change is based on the physical aspect of reality and constancy is rooted in the kinematic aspect (Strauss, 2009:164-167). Should we relate this ontological principle to epistemic frameworks, it would appear that they do not change absolutely or arbitrarily, but rather have some kind of plasticity (Loubser 2012c).

In the following sections I will explore the relationship between change and constancy in Greek philosophy, while also paying some attention to the theme of unity and diversity, to sketch a broader picture and to show how all these issues are interrelated.

2. Change and constancy in antiquity

2.1 Thales

According to Allen (1966:1) every history of philosophy begins with Thales. This article happens to begin with the opinions of Thales as well, since his philosophy serves as the framework of beliefs which gave rise to ancient thought about the nature of change and constancy.

Thales' pronouncement that the source of all things is water, means that (1) all things must have a source and (2) that this source is singular (i.e. one thing) (Allen, 1966:1-2). From these two assumptions, it follows that "the universe is bound to a single principle, the primordial water, by a single relation, that

¹ The numbering of the fragments is in accordance with the notation in Diels & Kranz (1959-1960).

of derivation” and that “nature is one whole, with unchanging ways of its own, to be accounted for in terms of a unitary principle of explanation” (Allen, 1966:2). For Thales, therefore, the nature of the world is singular, holistic and *constant*. Although the primordial water was “alive” and therefore “capable of spontaneous movement”, so that it becomes the “source of movement” in the world (Allen, 1966:2) Thales does not give an explanation as to how this singular source could *change* to give rise to diversity in the world. The question about change was first posed by Anaximander: “How is the qualitative diversity of the world to be reconciled with the primordial unity of its source?”

2.2 Anaximander

In order to address this question, Anaximander raises an important objection to Thales. For Thales, the primordial element is simultaneously unbounded and water. Water (the wet) stands in relation of opposition to other entities that embody the dry. If water were to be unbounded, its opposite would cease to exist (Allen, 1966:2)².

Anaximander proposes that the primordial principle (the Unbounded) is not to be associated with any sensible opposite, nor does it have any characteristics that can be found in the world of sensory experience. The Unbounded is internally undifferentiated (Allen, 1966:2-3).

Furthermore, Aristotle³ interprets Anaximander’s Boundless to be a mixture of all the sensible opposites (water, air, fire and earth) so that “the opposites fuse in it” and “it is itself of no determinate sort, a thing which is no kind because it is all kinds” (Allen, 1966:3). According to Anaximander, the Non-limited is “everlasting and ageless” (Fr. 2) as well as “immortal and indestructible” (Fr. 3; cf. Freeman, 1971:19) and therefore it is *constant*.

Anaximander’s answer to the question about *change* is that the different elements (or opposites) separate from the original material and that these opposing elements then “war” upon one another (cf. Fr. 1). This enmity between the opposites causes a pendulum dynamic (where one opposite, encroaching the domain of the other, is turned into the other, and *vice versa*). This cycle is kept in balance by Time, so that the world is in equilibrium (Fr. 1; cf. Allen, 1966:3). In this way, although constancy still prevails in his philosophy, Anaximander tries to account for change.

Anaximander is not the only philosopher to propose an answer to the question about change and a different conception can be found in the thought of Anaximenes.

2.3 Anaximenes

For Anaximenes, the primordial unity is to be identified with a substance (air, mist or breath) and everything else is made out of this material (Fr. 2). Diversity in the world occurs when this primary substance undergoes *change* of a quantitative nature. This means that qualitative diversity is dependent on quantitative variation (thickening and thinning, condensation and rarefaction) of the primary substance (Allen, 1966:4). According to Anaximenes, air (when made finer) becomes fire, or

² Anaximander’s objection to Thales is reported by Aristotle, *Physics* 204b 24.

³ Aristotle, *Physics* 187a 12, cf. Allen, 1966:31.

(when made thicker) wind. When air is made thicker still, it progressively becomes cloud, water, then earth, stones and everything else (Freeman, 1971:33).

Anaximenes believes, like Thales, that the primary substance is ensouled and this is the cause of motion in the world (Allen, 1966:4). Interestingly, for Anaximenes, motion is eternal, but change comes about through it. The primary substance (air) is revealed by motion and is always in motion, for “things that change do not change unless there be movement” (Freeman, 1971:33-34). I will come back to change and constancy in relation to energy and movement later (cf. section 4.3) since it appears that in Modernity, movement is associated with constancy rather than change.

2.4 Heraclitus

Like Anaximander, Heraclitus has a principle of isonomy that maintains balance in the world process. In the case of Heraclitus, this principle is called “logos” and is identified with a sensible element, namely fire (Fr. 30; cf. Allen, 1966:10). As the first principle of knowledge, the “logos” has connotations of proportion, measure and pattern. For Heraclitus, however, the “logos” also represents the first principle of existence: it is the “unity of the world that sustains it as a process” (Fr. 1; cf. Allen, 1966:10). The “logos” maintains the balance between diverse and conflicting opposites in “strife”. This balance differs from the equilibrium brought about by Time in Anaximander. According to Allen (1966:10) Anaximander’s Time produces equilibrium in a cyclical alteration of excess, while the “logos” in Heraclitus maintains the balance at every given moment. Since the balance is continuous, the opposites being drawn apart are drawn back together at the same time and thus they are being maintained, constantly, in equal measures (Allen, 1966:10)⁴. This means that the world process, for Heraclitus, is a circle and that movement in any direction around the circle is continually balanced by movement in the opposite direction (i.e. the way up and the way down happen simultaneously cf. Fr. 60). The opposites then, become in a sense the same (Fr. 88; cf. Allen, 1966:10-11).

Vollenhoven (2005a:35) emphasizes the point further: the two processes do not follow one another, but rather happen simultaneously, so that the continuation in the world is a matter of “the continual running into each other of two simultaneous streams”⁵. In the first place, this type of thinking is contradictory. Because the world is self-contradictory, “the knowledge that describes this world cannot acknowledge as norm a principle that would exclude contradictions in thinking” (Vollenhoven, 2005a:35). Secondly, because the origin of all things is eternally active fire, Heraclitus is a monist. This leads Vollenhoven (2005a:35; cf. 2005b:92) to describe Heraclitus’ thought as form of contradictory monism.

Although the “logos” itself is *constant* (Allen, 1966:11), the emphasis in Heraclitus’ world is very much on *change* (Fr. 91). Both Plato and Aristotle describe this as the doctrine of *perpetual flux* where “all things change and nothing remain at rest”⁶. The first reaction against this doctrine is provided by Parmenides.

⁴ Heraclitus uses the metaphor of the bow (or lyre) to describe this back-stretched connection (Fr. 51; cf. Allen, 1966:10).

⁵ For Vollenhoven (2005a:35), the term “*coincidentia oppositorum*” is eminently suited to this concept.

⁶ Cf. Heraclitus Fr. 12, Plato, *Cratylus* 402a & Aristotle, *Physics* 253b 9).

2.5 Parmenides

In Parmenides' view, the belief in the reality of the physical world (of plurality and change) is unsatisfactory and is to be substituted by the belief in One Being. The latter is unchanging, ungenerated, indestructible and spherical (Fr. 7, 8; cf. Allen, 1966:12). His justification for belief in the One Being is demonstrated in the poem the *Way of Truth* by reference to a disjunction, which can be reduced to "It is or It is not". The first disjunct is the "way of true inquiry", while the second is the "unthinkable, unknowable, not to be uttered" and since thinking and being share the same ontological status (for Parmenides), the second disjunct is to be wholly rejected (Fr. 2; cf. Allen, 1966:11).

In contrast to the "way of true inquiry", Parmenides (Fr. 6) also refers to the "way of mortal opinion". The latter supposes the world of nature as having contents which "come to be and cease to be" and thus can be reduced to "It is and is not". For Parmenides, the "way of mortal opinion" is also to be rejected, again on the grounds of the original disjunction (Fr. 8; cf. Allen, 1966:12). This means that Parmenides draws a distinction between appearance and reality, as well as between knowledge and opinion. In the end, plurality and *change* are rejected in favor of *constancy*.

It would appear as though, in the beginning of the fifth century, Greek opinions regarding the relationship between change and constancy are rather polarized. On the one hand Heraclitus emphasizes change, while, on the other, Parmenides argues that constancy has ontological primacy. It is not surprising then, that the reaction to this situation included attempts at synthesis of the two opposing positions. According to Allen (1966:14-15), the main challenge after Parmenides was to reconcile the sensible world (of plurality and change) with criteria for reality that it cannot satisfy. These criteria include that the world should be intelligible and therefore free from generation and destruction (i.e. change).

2.6 Empedocles: an attempt at integration?

The proposal from Empedocles rests on the notion that certain elements are *constant* (satisfying the criteria of reality) and that *change* occurs when these elements are re-arranged (Allen, 1966:14-15). Like Parmenides, Empedocles denies the possibility of generation and destruction and accepts the existence of a holistic "Sphere of Being". Contrary to Parmenides, however, Empedocles conceives the Sphere as full of sensible opposites (the hot, the cold, the wet and the dry). *Change* occurs when these *constant* qualities re-arrange within the Sphere (Fr. 17; cf. Allen, 1966:15). The arrangement of the qualities occurs continually under the compulsion of the cosmic forces of Love and Strife. This means that the various compounds (complex substances of the world) come to be and pass away, but simultaneously the primary qualities constituting the substances, remain the same (Fr. 17; cf. Allen, 1966:15). Vollenhoven, however, does not regard Empedocles' philosophy of change and constancy as an attempt at integration. He (2005a:35; 2005b:127-128) classifies Empedocles as a dualist and a structuralist,⁷ inclined to constancy (cf. Olthuis & De Graaf, 1978:20-21).

⁷ Philosophers in a "structuralist" mode of thinking tend to emphasize constancy, whilst philosophers in a "geneticist" mode emphasize change, development and becoming (Olthuis & De Graaf, 1978:20-21).

2.7 Evaluation

The natural philosophers can broadly be divided into two groups. The first group proceeds from an original unity (monism). Duality and plurality are still recognized, but must be explained in terms of the original unity and is therefore seen as secondary (Vollenhoven, 2005a:33). In this group, we may place, for instance, Thales, Anaximander, Anaximenes and Heraclitus. The second group begins with more than one origin (dualism). Here, two or more equally original (and correlative) causes need to come together in order to give a secondary explanation for unity (Vollenhoven, 2005a:33). Parmenides and Empedocles may be placed in this group.

Vollenhoven neatly distinguishes the issue of unity and multiplicity (monism and dualism) from the issue of change and constancy. In fact, both monists and dualists can be inclined to cosmogonic or structuralist thought. One should grant that monists are more often inclined to cosmogonic philosophy, while dualists and pluralists are inclined to structuralism. The reason for this seems to be a search for “balance” (cf. Olthuis & De Graaf, 1978:21-22). Yet there are monists who are structuralists and dualists who choose cosmogonic thinking.

With regard to the main problem statement of the article, ancient thought seems to be polarized into positions giving ontological primacy either (1) to constancy, or (2) to change. Between these two poles there also seems to exist a third position (3) attempting an integration of positions (1) and (2). According to the classification of Vollenhoven (2005a:35) this does not amount to a true integration, and in his method he keeps using only two categories: structuralist and cosmogonic philosophies.

Members of group (1) include Thales, Anaximander, Anaximenes and Parmenides. For Thales, nature is constant and no explanation of how this singular substance could change is given. Anaximander regards the primary principle as everlasting and indestructible (and therefore as constant) and defines change as the “separation” of different opposites from this original material. The primary substance for Anaximenes remains constant, so that change is only understood in terms of qualitative variation (thickening and thinning, condensation and rarefaction) of the primary substance. However, in the case of Parmenides, group (1) acquires its most radical proponent. Parmenides rejects change for belief in the One Being, which is absolutely unchanging.

With regard to position (2), the thought of Heraclitus places the emphasis very much on change. For Heraclitus, the first principle (“logos”) maintains a balance between diverse and conflicting opposites. This means that the world process is in continuous flux.

In the next section, we find the continuation of some of these issues in modernity and postmodernity.

3. Change and constancy in modernity and postmodernity

3.1 An introductory overview

In the previous section, we have seen various ancient conceptions giving ontological primacy to either change or constancy. Debates on these dilemmas seem to be perennial in the history of philosophy and of course continued through the Middle Ages. This article, however, forms part of a research project (cf. Loubser, 2012a, 2012b, 2012c) investigating more contemporary trends and does therefore not provide a complete historical overview.

Focusing on more recent examples, we again find conceptions emphasizing change, to the point that it becomes the only constant (e.g. in Darwin, as well as some popular postmodern conceptions). Other conceptions may regard constancy as being fundamental to the point that change is denied. This can lead to positions that grant ontological primacy to constancy to the extent that change becomes unthinkable, for example in the viewpoints of Von Varga (1953:59-61). The apparent dialectical tension between the different conceptions of change and constancy has also given rise to contemporary attempts at finding “patterns” in changes. One such example can be found in the work of Gerald Holton.

Holton (1978:8) finds elements (“themata”) that function to constrain, motivate, guide and even polarize scientific research and scientists. This means that there are constant themes in scientific concepts, methods, problems and hypotheses. Even though the themata function on an epistemological, rather than the ontological level, we can infer that they tell us something about the world through their importance in science. Moreover, Holton (1978:10) finds that the amount of themata is limited (in fact, very small) with new themata being added only very rarely. This means that the themata are very persistent and that they fare very well in newly elaborated contexts.

In this project we have often dealt with the work of philosophers of science. However, the work of some scientists themselves also seems to contain a polarized notion of either change, or constancy. In the next two sections, we look at examples in the legacies of Charles Darwin and Albert Einstein.

3.2 The importance of change in the work of Darwin

In his work *On the origin of species* (1869) Charles Darwin defined Natural Selection (1869:92) as the “preservation of favorable variations, and the destruction of injurious variations”. According to Darwin (1869:92) variations that are inert, would not be affected by natural selection but would be “left as a fluctuating element, as perhaps we see in certain polymorphic species, or would ultimately become fixed, owing to the nature of the organism and the nature of the conditions”. Vollenhoven regards Darwin as a monist and a geneticist (2005b:96-97). With regard to change and constancy, Darwin seems to hold that the natural (biological) world is inherently changeful⁸ and that only the “fittest” survive. This has led neo-Darwinism to regard the action of two phenomena, that of *mutation* and *natural selection* to occur in tandem (Strauss, 2009:110). Since mutation normally occurs to the organism’s detriment, only when the aforementioned phenomena act in tandem, can the disadvantaged living entity emerge as the advantaged.

According to Strauss (2009:110-111) the role attributed to mutation and natural selection support the main thesis of neo-Darwinism, namely the assumption that the only reality within “living” nature is change. Strauss (2009:110-111) criticizes this assumption by stating that “only when mutation and natural selection are operating as a constant (conditioning) *law for* the existence of living entities, is it

⁸ Strauss (2009:111 fn.1) points out that this assumption greatly influences Darwin’s use of language. The terms “constancy” (2) or “persistence/persistently” (3) occurs in a total of five instances in his work (Darwin, 1869), while terms like “change” (268), “variation” (281) and “variations” (162) occur much more frequently (amounts indicated in brackets).

possible to account for the changefulness of the latter". His point is that the law-effect of mutation and natural selection is supposed to be constant and therefore not everything is changing in the bio-world.

It is not only in the world of biology where scientists think about change and constancy. In the next section we regard an example from the world of physics.

3.3 The importance of constancy in some physical theories

According to Strauss (2009:411) a proper elaboration of the insight that change presupposes constancy, can be found in Galileo's formulation of the law of inertia and in Einstein's theory of relativity. The core of Einstein's theory primarily emphasizes constancy (of the velocity of light in a vacuum). This means that whatever is in motion moves relatively to an element of constancy (Strauss, 2009:411). Furthermore, for Einstein, the distinction between the kinematic and physical aspects of reality is related to the difference between reversibility and irreversibility (Einstein, 1959: 43; cf. Strauss, 2011:6-7). This enables Einstein to reject the viewpoint that all physical processes are reversible and thus reducible to mechanistic movement (Strauss, 2011:7). Galileo's insights and formulation of the law of inertia is revisited in section 4.3. Before then, it is time to consider the nature of change and constancy as understood in the reformational tradition.

4. Attempts at integration: a reformational perspective

In the reformational tradition, two dimensions delimit what we can experience and therefore constitute the horizon of experience, namely *modal aspects* (so called functions, aspects or modalities) and concrete (natural and social) *entities* (Strauss, 2009:67). The dimensions cohere so that the modal aspects are "universal, constant, functional frameworks at the basis of all entitary functioning and thus co-conditions the occurrence of all kinds of events" (Strauss, 2009:67,68-71). Apart from the relationship between the two dimensions, the modal aspects themselves also cohere with one another. In order to understand this inter-modal coherence, we must first explore the structure of the modal aspects. If change and constancy are respectively seated in two of the modal aspects, this line of argumentation can lead to demonstrating that change and constancy also cohere. This is done by proposing a synopsis of the views of Dooyeweerd, Strauss and Hart in which the eventual differences between them are neglected, in the attempt to show my own position.

4.1 The nature of modal aspects

In Dooyeweerd's (1979: 40-41) ontology, created reality displays several modes (i.e. aspects or modalities) in the temporal order. Although the modes are irreducible to each other, they have analogical coherence. Dooyeweerd distinguishes between the numerical, spatial, kinematic, physical, biotic, psychical, logical, historical, lingual, social, economical, aesthetic, judicial, ethical and certitudinal modes of being. These modes of being can be understood as having the following nature:

- (1) Aspects have ontic status as universal functional modes of existence (belonging to a distinct dimension) and this means that aspects are neither functions, nor properties of things (Strauss,

2006: 64-69; Hart, 1984: 198-201). According to Hart (1984: 85-134) modal aspects cohere with the dimension of entities without being “dependent” upon those entities for their irreducible “dimensional” existence. This means that the dimension of modal aspects co-determines the existence of entities (and events) in the sense that the latter invariably function within them. Furthermore, whenever entities or events function within a particular modal aspect, the unqualified universal meaning of the aspect requires a specification that is “colored” by the entity-structure of the entity function within the mode (Strauss, 2009:143).

- (2) The difference between aspects and entities implies that there are two distinct kinds of laws: a) “laws for aspects” (universal modal laws) and b) “laws for entities” (type laws) (Strauss, 2009:25). In general, it can be said that modal laws hold for all possible classes of entities, whereas type laws hold for a limited class of entities only (Strauss, 2009:79).
- (3) According to Dooyeweerd (1955, 1:42-43) objective qualities that are ascribed to things in the logical and post-logical aspects are related to the subjective functions of human nature. They are related in such a way, that the typical structure of the individuality of the thing (which is characterized by a specific relation to its qualifying function) finds expression. Dooyeweerd (1955, 1:43) uses the example of a bird’s nest (characterized by a specific relation to animal life) which remains a bird’s nest with respect to its objective logical characteristics and even if it is a possible object of human culture, symbolic signification, or aesthetic appreciation (cf. Hart, 1984: 221-242).
- (4) As a result of (3) we can distinguish between the norm side and the factual side within each aspect of reality (Strauss, 2009:76).
- (5) The factual side of aspects comprises the subject-subject and subject-object relations, although, the first aspect is an exception to this, since it has only subject-subject relations (Strauss, 2009:76-77).
- (6) Every modal aspect is fitted into a cosmic time order (Hart, 1984: 149ff), while bringing to expression (in its own modal structure) a functionally “colored” manifestation of “cosmic time”. On the law side, it expresses itself as *time order* and on the factual side as *time duration* (Strauss, 2009:77). The duration remains constantly subjected to the time order, so that, for example in the aspect of organic life, one finds the temporal order of birth, maturing, adulthood, aging and dying in most higher organisms (Dooyeweerd, 1955, 1:28).
- (7) Each modal aspect has a core meaning (designated as its meaning nucleus or meaning kernel), which makes the modal aspect irreducible, indefinable and irreplaceable, since it founds the sphere sovereignty of every aspect (Strauss, 2009:74-75). For Dooyeweerd (1979:43) this principle of sphere sovereignty is a creational principle connected with the scriptural ground motive of the Christian religion.

The above characteristics help us to understand the diversity between the aspects. According to Dooyeweerd (1955, 2:74) full justice ought to be done to the specific sphere-sovereignty of the modal law-spheres, because each of the law-spheres is a temporal, modal refraction of the religious fullness of meaning. This means that every aspect accesses the whole of temporal coherence of meaning in its own modal structure. However, although the aspects are diverse, they also cohere with one another (Hart, 1984: 164). In the next section, we will see how this is possible.

4.2 The interrelatedness of modal aspects

The coherence between the modal aspects can be explained as follows:

- (1) Aspects are analogically related through moments of coherence with other aspects reflected within the structure of the particular aspect (Strauss, 2009:75; Hart, 1984: 162-163). This means that the meaning of an aspect only comes into expression in this coherence. This feature is called the sphere universality of each aspect (Strauss, 2009:76).
- (2) There is an order of succession amongst the modal aspects (Hart, 1984: 190-198). This means that “the modal aspects are fitted into a cosmic order such that some are foundational to others” (Strauss, 2009:170). For example⁹, both the numerical and spatial aspects are pre-supposed within the structure of the kinematic aspect (2009:163). Hart (1984:151) designates the direction going through the modal order from lower to higher modes as the *founding direction* of the order. Here the lower level functions in a foundational way as support for the existence of the higher levels. In contrast, the *developmental direction* refers to the order in which lower functioning is enriched as a result of its being made serviceable to a higher order (Hart, 1984:152).
- (3) The moments of coherence between the modal aspects are referred to as analogies¹⁰, which embrace both retrocipations (backwards pointing toward coherence between an aspect and earlier aspects in the cosmic order of time) and anticipations (forward pointing coherence towards aspects later in the order) (Strauss, 2009:75).

Furthermore, regarding the relationship between the sphere sovereignty (diversity) and sphere universality (coherence) of the aspects, Dooyeweerd maintains the following:

- (4) Sphere sovereignty can only be maintained within the temporal inter-modal coherence of the different aspects if the modal meaning of each law-sphere has a structure: law-spheres must have a nucleus guaranteeing the sphere sovereignty of the entire aspect. This nucleus must be surrounded by a number of analogical modal moments which partly refer backwards to the nuclei of other aspects and partly refer forward to aspects that are later in the cosmic arrangement (Dooyeweerd, 1955, 2:75; cf. Hart, 1984: 162).

In order to understand the significance of the theory of modal aspects for the ontological relationship between change and constancy, we first have to determine where the latter (respectively) are seated in the modal aspects. This will be investigated in the next section.

⁹ According to Strauss (2009:163), Galileo used a thought experiment in 1638 where he contemplated the movement of a body on a path extended into infinity. I agree with Strauss, that here the terms “path” and “extended” designate the spatial foundation of the kinematic aspect, while the term “infinity” captures its numerical foundation.

¹⁰ Concrete examples of this can be found in composite expressions such as: emotional strength (sensitive and physical aspects), economic trust (economic and certitudinal aspects), aesthetic expression (aesthetic and lingual modes), etc.

4.3 Change and constancy as modal kernels of meaning

In defining the meaning nucleus of the kinematic aspect, Strauss (2009:89) once more refers to Galileo's experimental derivation of the law of inertia. The experiment rests on the hypothesis that whatever moves will continue its movement endlessly. This means that, whereas uniform motion does not need a cause, a change of motion requires an energy-input (physical cause) for both acceleration and deceleration. According to Strauss (2009:89) movement is something original in a functional sense and our immediate experiential awareness of uniform motion captures the meaning of movement as constancy. Therefore, we may adopt the synonym *constancy* when designating the meaning nucleus of the kinematic aspect.

When it comes to the term change, however, we need to look to the physical aspect of reality. According to Strauss (2009:89) energy in all its forms always causes physical changes. This means that energy-operation (the nucleus of the physical aspect) entails the cause-effect relation and forms the basis of causality in its original sense. Terms like change or dynamics are synonyms may then be used to designate the nuclear meaning of the physical mode.

4.4 Change and constancy are interrelated

In the previous section we saw that constancy is seated in the kinematic aspect, while change belongs to the physical aspect of reality. Since the kinematic and physical aspects are interrelated, it follows that constancy and change cohere as well.

The reason for this coherence is that change can only be established on the basis of something persistent and constant (Strauss, 2009:13). Without an awareness of persistence, the very notion of change becomes problematic in the sense of the question: what is it that undergoes change (Strauss, 2009:165)? Here, it may be helpful to refer back to point (1) in section 4.2: the meaning of an aspect (or its nucleus, for example *change*) only comes into expression in the coherence with other aspects (or their nuclei, in this case *constancy*) reflected within the structure of a particular aspect (the physical, in our current case).

To make the case more concrete, we may borrow yet another example from Strauss:

"Suppose an ageing person claims that she has changed a lot during the past two decades. This statement only has meaning on the basis of an implicit awareness of persistence, for there is a constant reference to the same person. The relationship between change and constancy is therefore an example of the 'coherence of irreducibles'" (Strauss, 2009:13).

Acknowledging the coherence of irreducibles between the kinematic and the physical aspects, opens up a new perspective in which constancy and change are no longer considered "opposites" (Strauss, 2009:166). An example from the natural sciences (Strauss, 2009:319) demonstrates the perspective. Let us consider the following statements:

- (1) The law of inertia assumes the constancy of motion if no physical forces interact with the movement under consideration.

- (2) The discovery of irreversible physical processes (e.g. radioactive decay) confirms the distinct and irreducible meaning of the physical aspect.
- (3) There exists an inter-modal connection between the kinematic and physical aspects.

Should the above statements be true, there seems to exist an analogical moment within the physical aspect, which reminds us of the functional meaning of the kinematic aspect. This makes it possible to arrive at a more precise description of the law of energy conservation: we find an analogy of the kinematic aspect on the law side of the physical aspect (Strauss, 2009:319).

5. Conclusion

An investigation and comparison between different philosophical traditions giving ontological primacy to change or constancy, shows that these conceptions cannot be regarded as satisfactory. Rather, change and constancy are coherent, irreducible dimensions of reality and therefore basic (primitive) ontological categories. Change refers to the physical aspect of reality, while constancy refers to the kinematic aspect. These two aspects cannot be reduced to one another, but can only exist in a relationship of coherence. This means that in epistemic frameworks, change and constancy go hand in hand, pointing towards the idea of plasticity. This can shed light on the discussions in previous articles, in particular in Loubser (2012c) where a clarification of this topic was announced, to illustrate better what was argued in that context.

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Conclusion

In this project I explored whether there are patterns in the changes of epistemic frameworks and in the way factors cause or stimulate such changes. In order to do a systematic analysis of the problem, I focused on four topics.

Firstly, I investigated whether there is any consensus on the role and nature of epistemic frameworks. This was indicated because the “received view” of science has been increasingly challenged by a growing emphasis on the role of the human subject in the generation of scientific knowledge. With this emphasis came a proliferation of terms indicating different epistemic frameworks (especially pre-theoretical) proposed to explain how the human subject comes to know. I have argued that, between the humanist and reformational traditions, some common ground exists notwithstanding the wide array of terms employed to describe such frameworks. This provided the necessary background for further discussions concerning frameworks and the ways in which they undergo change.

Secondly, I enquired whether changes in epistemic frameworks occur in a random or patterned manner. Three main approaches to framework-change could be detected. The first approach regards changes in frameworks as occurring in a way that is rather constrained, predictable and even according to a pre-determined pattern. The second approach seems to argue that changes in frameworks occur in a way that is more random or unpredictable and free from constraints. In between these two views, a middle position can also be found, attempting a kind of synthesis between constancy and change. I have argued that it is possible to explain framework changes both in terms of continuity and revolutions, so that changes are dynamic but also deeply integrated with constancy. This was made possible by referring to both the irreducibility and cohesion of modal aspects and thereby acknowledging the structural order for reality (in terms of the modal aspects).

Thirdly, I investigated which factors have a regulative role in shaping science (and which factors should legitimately have such an influence). Through the history of philosophy of science, different authors have emphasized numerous factors (whilst simultaneously reducing others). The problem with many approaches is an induced lack of normativity. Some authors seem to describe the change factors which they regard as the most relevant, often with no distinction between “de facto” and “de jure” influences on science. The implication is that changes in the activities of science are attributed to factors which (intuitively) should have little to do with science. I argued for an approach where the theory of qualifying functions helps us to grasp the “nature” of science and of the legitimate factors shaping its activities. Furthermore, anticipations and retrocipations of the qualifying function suggest a “model” in which (while the qualifying function remains crucial), other (i.e. differently qualified) factors are recognized in a “secondary” capacity. Although there remains fertile ground for further study of this issue, it appears that the activities of science are historically founded and logically qualified.

Fourthly, I explored the ontological relationship between change and constancy. An investigation of different philosophical positions giving ontological primacy to either change or constancy has led to the conclusion that both approaches are unsatisfactory. I have argued that change and constancy are coherent, irreducible dimensions of reality and therefore basic (primitive) ontological categories.

Change refers to the physical aspect of reality, while constancy refers to the kinematic aspect. These two aspects cannot be reduced to one another, but can only exist in a relationship of coherence. This insight has shed light on previous sections of this project (in particular on the third article).

In this research project, change and constancy were related to epistemic frameworks according to a pattern where they go hand in hand, so that change is never completely random, nor absolute. Furthermore, a broad variety of factors play a role in framework changes, so that a pattern can be discerned in the sense that some aspects play a regulative role so that change is dynamic but not arbitrary. As a future research perspective, further exploration of the theoretical frameworks could shed light on the interrelations between the pre-theoretical and theoretical frameworks and explain how they cohere with one another.

Appendix 1

APPENDIX 1: REQUIREMENTS OF DIFFERENT JOURNALS

APPENDIX 1.1: ACTA ACADEMICA

Instructions to authors

1. *Acta Academica* publishes articles in Afrikaans or English. The preferred length is about 7000 words; 4500 words is regarded as a minimum and 11 000 as a maximum.

2. Two printouts of the text as well as a file on computer disc, in MS-Word for Windows, should be submitted. Articles may also be submitted by e-mail to murray.bib@mail.uovs.ac.za.

3. Articles are to be submitted ready for the press: finally edited, stylistically polished and carefully proofread. Readability, fluency of style and clarity of exposition are essential. In the case of articles deemed by the editorial staff to require extensive language editing, the page fees payable by authors will be doubled.

4. The Editor reserves the right to make such alterations as he sees fit to accommodate the style and presentation of articles to the house style. Where major changes are necessary the text may be returned to the author for correction or approval. Copyright is transferred to *Acta Academica* on acceptance for publication.

5. Titles should be short and concise. Suitable headings and subheadings should be provided, with sections and subsections indicated by means of Arabic figures and full stops, i.e. 3. being followed by 3.1 and 3.1.1 (at most).

6. Source references in the text should be in the Harvard style, using the author's surname only, e.g.: (Coetzee 1986: 234-45).

7. Only genuine footnotes should be used, i.e. notes containing relevant elucidation of the text. Footnotes should be kept to a minimum. Numbered footnotes should appear at the bottom of the page. The position of the note should be indicated in the text in superscript Arabic figures without brackets.

8. A complete bibliography in the Harvard style must be provided, giving all relevant details. All sources must be listed alphabetically by authors' surnames, in the following format:

Coetzee H J
1977. Inflation in South Africa. *Acta Economica* 27(3): 17-36.

Snyman A L

1986. Human rights in political reform. Van Rensburg (ed) 1986: 1-34.

Van Rensburg C D (ed)

1986. *Human rights in South Africa*. 2nd ed. Pretoria: HAUM.

9. Abbreviations and acronyms should be avoided (except where an acronym, e.g. SABC, is current parlance).

10. Italics should not be over-used for emphasis. Latin phrases such as *per se* must be italicised. Words in languages other than that of the manuscript should be given in quotation marks.

11. Statistical and other tables should be labelled. Tables, as well as mathematical or similar symbols and expressions should be kept to a minimum.

12. Diagrams, sketches and graphs must be submitted in camera-ready copy on separate sheets of paper. Laser-printed computer graphics are also acceptable. Each diagram must have a short explanatory label.

13. If applicable, full details of the origin of the article must be provided (e.g. a paper delivered at a congress).

14. Two summaries of between 100 and 120 words, in English and Afrikaans, must be included.

15. Refereeing is always anonymous. Authors are invited to submit the names and addresses of up to three persons (from institutions other than their own) as referees. Where possible, at least one of them will be used.

16. Articles will only be refereed if accompanied by a declaration that the text has not been published or submitted for publication elsewhere.

17. The author of a published article will receive one free copy of the relevant issue of the journal and 10 reprints.

18. More detailed instructions and advice to authors are available from the Editor on application. If a specific field of study requires a style of reference other than the Harvard style, a special request may be addressed to the Editor.

19. Address for submissions: The Editor, *Acta Academica*, UFS-SASOL Library, P O Box 301, Bloemfontein 9300.

APPENDIX 1.2: KOERS: BULLETIN FOR CHRISTIAN SCHOLARSHIP

Voorskrifte aan skrywers / Style sheet

STYLE SHEET

Nature of articles submitted to *Koers*.

When submitting articles to *Koers*, authors should keep in mind that the Editorial Board of *Koers* prefers a certain kind of article as far as point of departure, the presentation of data, the conclusions arrived at, et cetera, are concerned.

- **Typical *Koers* articles should have an integrated worldview as foundation, and should be predominantly reflective in nature. Articles should thus not merely be the presentation of factual or empirical research, but be embedded within a wider (philosophical) framework – articles should reflect a definite underlying worldview – an aspect that could feature, for instance, in the author’s point of departure, the stance he/she takes, or the conclusions drawn.**
 - Relevant ethical, moral or philosophical issues related to the topic of discussion could be integrated into the line of argumentation.
 - The subtitle of *Koers* is “Bulletin for Christian Scholarship”. The basis of *Koers* articles is thus Christian – but room is left for justified differences in opinion.
 - *Koers* is an accredited interdisciplinary scholarly journal publishing articles from all fields of research. Articles should thus be directed to the reader public of a specific discipline, but should also be reader-friendly enough to accommodate a wider reader public, i.e. a reader public not necessarily conversant with the specific jargon and trends within a certain discipline. Articles should, however, still meet the required standards for scholarly articles published in an accredited journal.
1. **Agreement with authors:** Right of publication: The submission of an article entitles *Koers* to exclusive right of publication, both in printed and in electronic and other media.
 2. **Nature of articles:** *Koers* is an interdisciplinary journal. Articles from all fields of academic research are therefore welcomed, with the proviso that **articles should contain a statement or point of view based in principle** (that needs not necessarily coincide with that of the Editorial Board).

3. **Refereeing:** All articles will be refereed by at least two independent referees. Refereeing is done with complete anonymity and confidentiality. Identities of authors and referees are not divulged. Authors should **not identify themselves** by for instance inserting their initials, surnames or name of university in footnotes or in phrases between brackets.
4. **Formal requirements:**
- **Language medium:** Manuscripts can be submitted in either English, Afrikaans or Dutch.
 - **Manuscripts** should be in A4 format, in double spacing, with generous **margins** and printed on only one side of the paper. The manuscript has to be finally edited with regard to language and general finish.
 - **A computer copy** of the article should be submitted for the initial refereeing process. The electronic article can be sent to Susan.Lourens@nwu.ac.za (preferably as a Word document). If necessary the office staff will undertake to make copies of the article on behalf of the author. R0,25 per page will be charged – to be paid by the author.
 - The title page should have the following details: the author's initials and surname, department, university, personal e-mail address. Also supply a private postal address, a telephone (cell) and fax number.
 - **Once the refereeing process has been completed**, and the author has revised the article in accordance with suggestions, the revised manuscript and the **accompanying letter** of the author have to be submitted as an electronic copy.
 - **Length:** A length of 15 printed A4 pages (± 6 100 words) is set as general guideline.
 - **Facets of style**
 - The **title** should be as short and succinct as possible. Headings and subheadings should be **numbered** with Arabic numerals with full-stops in between, for example 3. is followed by 3.1, 3.1.1, et cetera (to a maximum of four numerals, thus 3.1.2.3).

- **Articles should preferably be divided into sub-paragraphs with suitable numbered headings.**
 - **Abbreviations** and lesser known acronyms are not acceptable in the body of the text. An acronym used very generally, such as SABC, is acceptable.
 - **Italics** should be used only as an indication of emphasis of a word or as an expression from another language.
 - **Graphs, sketches, tables and diagrams** can be created in any computer program, but must be saved in **jpeg** format.
 - ❖ **Graphs, et cetera should be integrated into the finalised document.**
 - ❖ These graphs, sketches and diagrams must be sent by e-mail – each graph with its own name stated clearly.
 - ❖ The font used in graphs, diagrams, et cetera should be in accordance with the font used in *Koers* (Arial) – preferable 12-pt size.
5. **Abstract:** All articles should be supplied with a language-edited abstract (summary in English) of about 200 words. Directly after the abstract: insert the **Afrikaans translation** of the abstract. Please indicate the title of the article in **English** (for the abstract) **and in Afrikaans** (for the *Opsomming*).
6. **Key concepts:** At the end of the article: insert 3-4 key concepts/very short phrases to be used for indexing purposes. Also supply the **Afrikaans translation** under *Kernbegrippe*.
7. **Page fees:** Upon submission of a research article authors of tertiary institutions undertake, should the article be approved for publication, to pay the prescribed publication fee (R100 per printed page). Authors can, however, usually have the page fees refunded from the Research Committee of their respective institutions.
8. **Co-authoring:** Authors submitting articles which originally formed part of dissertations/theses should consult their study leaders/promotors prior to the submission of the article.

9. **Preliminary proof:** A preliminary proof of the article will be supplied to the author to proofread. Please note that there is normally a period of 3-9 months between submission and publication. The proof will normally be sent electronically. Changes must be indicated on the electronic version in track changes or in **bold and red** and an additional list of changes, indicating page, paragraph and line numbers on which changes occur, must be sent as well.
10. **Method of reference:** The **abbreviated Harvard method** of reference should be used. References in the text are done as follows: Anderson (1982:305), or (Anderson, 1982:305). In referring to works by Classical or Medieval authors, the name of the author, the Latin/Greek title of the work (in italics) and the book, chapter, paragraph or line references (in Arabic figures with full-stops in between) should be provided, e.g.:

Vergilius (*Aeneis* 12.601); or
Cicero (*De Officiis* 1.13.2).

11. **Footnotes:** The **use of footnotes should be limited** as far as possible. Should it, however, be necessary to make use of footnotes, please indicate the footnote number on the relevant page in the text and give the text of the footnote at the bottom of each relevant page.

References in footnotes: the same as in the main text. **Bibliographical detail should not be included in footnotes**, but should be given in a bibliographical entry in the list of references.

12. **List of references**

Bibliographical details of references should be provided in the list of references and not by way of footnotes. **Only works referred to in the article** itself should be included in the list of references, and should be arranged alphabetically.

Please use the name of the author and the **initials/first names (authors' name)** as it is indicated on the titlepage of the book or in the article (journal).

Title: Nouns are not written with caps – only proper names of persons, places, et cetera.

Books:

ANDERSON, H.W. 1982. *Stylistics*. London: Macmillan.

ALFAU, F. 1988. *Locos: a comedy of gestures*. London: Viking.

The **place of publication and the publisher** should be stated.
Titles are not in italics.

Journals:

VAN NIEKERK, P.J. 1985. Capitalism or socialism: a spurious dilemma. *Koers*, 50(1):38-55.

Titles of journals are given in **italics**. No quotation marks are used with titles of articles in journals. Relevant page numbers should be stated.

Dissertations and doctoral theses:

COX, M.P. 2003. *Drinking among university students*. Pretoria: University of Pretoria. (M.A. dissertation.)

Chapter in a compendium:

MASSIMO, J.L. 1970. Psychology and the gymnast. (*In* George, G., ed. *The magic of gymnastics*. Santa Monica: Sundby Publications. p. 31-33.)

Contributions in collections (*Acta/compendia*): **the relevant page numbers should be stated.**

Use of internet:

NUNES, J. 1997. *Hypermedia as a learning tool*.
<http://www.shef.ac.uk/~is/lecturer/ircont.html> Date of access: 14 Oct. 1998.

Newspaper reports:

- Quotations from **anonymous newspaper reports**: reference is made under **Anon.**

Example (in the text of the article):

It was recently stressed that "only sensational elements from new novels are highlighted in newspapers: (Anon., 2005:12).

In the list of references:

ANON. 2005. Critics criticise media coverage. *Sunday times*: 12, 24 Feb.

- Newspaper reports – **name of author stated:**

Example (in the text of the article):

Parents angrily responded to media reports on language tuition in schools (Roberts, 2005:13).

In the list of references:

ROBERTS, S. 2005. First language always the best language! *Argus*: 13, 14 March.

13. Layout:

Title of article and subparagraphs in the text of the article: lower case, except where capitals are essential.

Headings of paragraphs: do not use capital letters.

- 14. Copyright and opinions:** Copyright remains vested in the journal. Opinions expressed in the articles are those of the author and are not necessarily subscribed to by the *Koers Society of South Africa*.

- 15. Subscription:** Subscription is R120/\$60 a year. Single numbers: R50. All contributions and correspondence to:

Koers
Bureau for Scholarly Journals
Staff Box 251
Private Bag X6001
POTCHEFSTROOM
2520

Phone: (018) 299 4081
Fax: 086 564 7983
E-mail address: Susan.Lourens@nwu.ac.za

APPENDIX 1.3: TYDSKRIF VIR CHRISTELIKE WETENSKAP

Journal for Christian Scholarship

An accredited journal of the Association for Christian Higher Education

The *Journal for Christian Scholarship* is an accredited publication of Die Vereniging vir Christelike Hoër Onderwys (The Association for Christian Higher Education) in South Africa. It serves to provide academics the opportunity for the publishing of articles with a Christian point of view. Such articles must contain a principal foundation or point of view (not necessarily in accordance with that of the Vereniging (Association)), however, but should (i) either make a contribution to the enhancement of Christian scholarship, or (ii) engage into discourse with the Christian scholarly tradition.

Contributions for Publication

1. The acceptance of contributions for publication is consistently being based on the philosophic and scientific disposition thereof. It is a prerequisite that an article should adhere to these premises in order to be considered. The significance of this prerequisite is therefore of a twofold nature: firstly the article's scientific composition should be supported by thorough research, and secondly, it is of importance that the compiler should be able to substantiate the outcome by means of research results. The evaluation is undertaken by external experts from tertiary institutions and it is thus expected that the content should comply to the same high standards.

2. ISSN: 1013 - 1116

3. The journal is being published twice a year, except for additional special editions from time to time.

4. The editorial staff includes academics of international stature who are regarded as experts with regard to a wide range of subject areas.

5. The members of the editorial staff are internationally recognised academics in their respective subject areas, which is substantiated by their own peer-reviewed research as contained in their publications and citations in various authoritative publications worldwide.

6. Every single article is subjected to external evaluation by an expert in the relevant subject.

7. The journal is being distributed to academic institutions, libraries and individuals locally, as well as in countries such as the USA, Canada, Australia, the Netherlands, Germany and Japan. Some of the institutions and libraries to which it is distributed include:

Westminster Theological Seminary of Pennsylvania;

Moore Theological College, Newton, Australia;

Pitts Theological Seminary, Atlanta, Georgia;

University Libraries of Thubingen Germany, Kwazulu-Natal (SA), Venda(SA) and Quaqua(SA), and Libraries in South Africa;

Schools in South Africa; and

individuals in the mentioned countries.

The *Journal for Christian Scholarship* can be viewed by using the SA ePublications address: Sabinet.

In general

The current editorial staff consist of the following internationally recognised academics:

Dr R. Clouser, 204 Bradley Avenue, Haddonfield: NJ 08033, USA

Prof W.J. Richards, Bloemfontein, South Africa

Prof A.W.G. Raath, University of the Free State, Bloemfontein

Prof D.F.M. Strauss, University of the Free State, Bloemfontein, who is the Editor-in- chief

It should be mentioned that since its inception in 1965, the journal has contributed on a large scale to the promotion of science and scholarship in virtually all of the various disciplines which have been embarked upon during these 40 plus years.

Furthermore, the journal has gained international status and relevance, being distributed to countries such as the United States of America, Australia, the Netherlands and Japan, where it is consumed by academics and students and being kept in several libraries.

Guidelines

1. Editorial privilege

It is a clear understanding with authors that the editorial privilege to bring about grammatic, stylistic and technical amendments deemed necessary for the publication of articles, is reserved by the editorial staff. If however, in the judgement of the editorial staff, intervention of a drastic nature is necessary, it will be done after deliberation with the author.

2. Author's particulars

Each article submitted must be accompanied by the author's particulars, such as title, name, address, contact number and professional affiliation, where applicable.

3. Format

An A4-format is required. The length of articles should rather be in the order of 25 typed folios, or about 10 000 words in Times Roman Font, a 12 pt lettering throughout the text and 1.5 line spacing.

A synopsis of each article in approximately not more than 250 words must be submitted simultaneously.

An electronic version of the article per e-mail dispatchment to the following address is required: vcho@mjvn.co.za.

4. Titles and headings

Titles of articles must be in Times Roman Font in 16 pt bold lettering. Articles must constitute divisions and sections, provided with headings and sub-headings, in 12 pt lettering, in Arabic numbering down to three levels only, and in bold.

5. Graphics

Graphical presentations, diagrams, etc. can be submitted and must be prepared in any one of the following formats: .pdf, .pcx, .bmp, .cdr, .egm or .tif.

6. Footnotes

The application of footnotes for necessary clarification and illustration is encouraged. Footnotes should be presented at the bottoms of pages in Arabic numerical consecutive order in Times Roman Font, 10 pt lettering.

7. Reference

The abbreviated Harvard method of reference is preferred.

8. Bibliography

A Bibliography in alphabetical order, according to the Harvard method, is required.

9. Page fees

Authors connected to academic institutions in South Africa will be liable for page fees.