2.3 Complex Systems Model Their Worlds

Complex adaptive systems build models containing assumptions about the world out there that aid them in understanding and anticipating events that influence their behaviour (Waldrop 1992: 146, 177). They have to be able to understand and use the information they get from the world through their sensors. Science as complex system continually and actively search for, and gather, new experience that are packaged as information. Experience must be able to enter the system through sensors. Sensors can be the human senses or methods, techniques, and instruments extending the senses. Characteristic of science is the multiplicity of sensors strengthening, amplifying, and complementing human senses.

Complex adaptive systems must order, classify, and systematise the new information they receive. Therefore, they must identify those regularities and patterns in information coming from their environments that are relevant to their purposes (cf. Holland 1995: 31–32). These regularities are condensed into models that enable action and behaviour in the world (cf. Gell-Mann 1994: 17). Models of relevant aspects of their environment must be modifiable so that they can be improved upon receiving new information. Models are continually tried out to determine whether the complex adaptive system can act successfully on their prescriptions and predictions (cf. Holland 1995: 33–34). The results of the action and behaviour must be monitored and fed back to modify the models, if necessary. In the light of experience, the models must be modified (Waldrop 1992: 179).

The results of modelling in the sciences through observation and interpretation of problems under investigation can be extremely diverse in content and style (cf. Ziman 1994: 179). Despite this diversity, contributions to scientific knowledge usually have a publicly shared, quasi-objective, and schematic form similar to those of maps (Ziman 1995: 72). These maps are attempts at modelling the world that are revised or rejected through critical examination
and testing. Amongst the diversity of maps provided by scientists are experimental measurements, logical analyses, observational data, theoretical calculations, mathematical models, new theories or hypotheses, instrumental techniques, textual analyses, critical surveys, and pictorial communications of pattern recognitions, such as diagrams, photographs, maps, and graphs (Ziman 1995: 71 and 1994: 179).

Gathering new experience, recognising patterns, modelling regularities, and modifying models after critical testing lies at the heart of the sciences. And theology? Theology gathers new experience of the languages, cultures, and lifestyles of the authors and first readers of the ancient sacred texts of the Bible through various subdisciplines such as archaeology, ancient near Eastern studies, and study of the Hebrew and Greek languages. Application of new methods of textual analyses supplies new information and evidence for use in exegesis of texts, while writing theologies of specific texts (Bible books) or collections of texts (Old and New Testaments, the whole Bible) aim at identifying patterns and regularities. Systematic theology produces models of doctrines and practical theology designs models to embody doctrine in church practice. The critical testing of these scientific activities of theology are severe, judged by theological debates in journals, books, and conferences.

2.4 Complex Systems Recombine, Rearrange, and Revise Themselves

Complex systems continually recombine and rearrange their building blocks and revise their structure and organisation (cf. Waldrop 1992: 145–146). Complex systems do this as a result of gaining new experience. Rearrangement of components, revision of structure, and recombination of building blocks are the fundamental mechanisms of adaptation, evolution, and learning, which become necessary as a result of experience (Waldrop 1992: 146). In the sciences rearrangement, recombination, and revision are common occurrences, despite the attitude of many scientists humorously
expressed in the "First Commandment of Academia: Thou shalt not transgress thy disciplinary boundary" (Kline 1995: 5).

This section does not focus on changes in science that result from developments within the boundaries of a specific science, but rather on the way that developments outside the boundaries of a scientific discipline can be used to modify scientific practice within those boundaries. Thus, the focus is not on the effect of new results and theories developed by a researcher of a particular science, but rather on the common phenomenon of rearrangements and recombinations that follow from appropriating new methods, techniques, theories, and results developed elsewhere, by other sciences. The ongoing integration and grafting of elements from other disciplines into one's own are driven by the hope of discovering things in other disciplines that can extend the limits of one's own discipline (Van Huyssteen 1997: 17, 32).

For many decades sciences have been influenced by intellectual developments occurring in other sciences. Obvious examples are the role of mathematical and statistical techniques used for analysis in an ever-growing variety of sciences. But are such influences restricted to borrowing and using these instruments and tools? Are other influences from one scientific discipline to another, such as the transfer of methods, theories, and results, excluded? Definitely not. The two examples of diverse scientific investigations in a previous section demonstrate how various sciences continually rearrange and recombine themselves through selective borrowing and integration of aspects of other disciplines. These recombinations and rearrangements point to the interdisciplinary nature of most sciences.

I want to argue that scientific investigation in one scientific discipline leads scientists to discover overlaps between their field of study and other fields of study. Selective borrowing occurs – without regard for academic frontiers (cf. Ziman 1995: 95) – of methods of investigation, techniques for observation
and analysis, tools for computing, results for background knowledge, and theories for explanation and prediction. The result is that several sciences share various aspects of their methods, techniques, and results with one another. For this reason many sciences have lots in common. For example, mathematics, statistics, and computer technology function as instruments for analysis in many sciences. Which aspects, the extent, and depth to which scientists use the tools provided by mathematics, statistics, and computer science vary considerably in widely differing sciences like botany, psychology, and economics. Similarly, theories and results are often shared in many sciences. For example, nuclear physics play an important role in different scientific disciplines, just as theories of interpretation are shared by a variety of human sciences.

Some sciences are reconstructed through new discoveries, theoretical insights, or new linkages between previously distant disciplines (Ziman 1994: 20, 22). Though scientific disciplines evolve to become more specialised and frequently differentiate and split apart as result, they just as often recombine to form intricate and overlapping connections with one another. Connections are made at theoretical and instrumental levels, boundaries between theories and disciplines are revised, and intellectual mergers between theories and disciplines take place (Ziman 1995: 84). Ziman describes the complexities of these processes as beyond ordinary human understanding (Ziman 1994: 71). Linking previously unrelated information is a typical creative scientific contribution. These recombinations of sciences is a redrawing of the cognitive maps of disciplines and forms a central theme in the developmental history of the sciences (Ziman 1994: 63).

The sharing and borrowing of methods, techniques, results, and theories suggest that there are more similarities between individual scientific disciplines than thus far suggested. An intermediate conception of science can account for these overlaps and similarities. Such a conception aims to give a
description of the nature of science at the level of clusters of individual sciences that are temporarily grouped together through shared interests. The meshing of a few simple rules with the specific subject matter investigated by a scientific discipline does not create sciences that necessarily develop in totally different directions. Shared interests between scientific disciplines abound, as several sciences are closely related. Close relations result from studying similar objects or phenomena, or from using similar methods, techniques, results, and theories. The similarities and overlaps between sciences are not permanent or fixed, as new relationships and overlaps are constantly forged based on new developments in diverse sciences. Nevertheless, individual sciences cluster together on the basis of shared interests in subject matter, methods, techniques, theories, and results.

Theology itself is a good example of integrating the methods, techniques, and results from other sciences. The scientific study of languages and the practice of philosophy are some of the earliest intellectual disciplines that have played a major role in theology. Today theology makes large-scale use of the results, methods, and techniques of a diversity of sciences (Eybers 1982: 24–26). Literary analysis provides methods and techniques for use in the interpretation of ancient sacred texts (Hays 1996: 298), while history and archaeology provide research results for understanding the context of ancient sacred texts better. The similarities between literary analysis in the study of modern and ancient languages and theological interpretation of ancient sacred texts are numerous.

Different clusters of sciences might have little more in common with one another than the few basic rules specified above. Sometimes the detailed interpretation of what the few basic rules require with respect to the subject matter under investigation can lead to further distance between sciences, creating a feeling of fragmented discourses that are virtually incomprehensible for people not conversant with its esoteric language (cf. Lyotard 1979).
This often observed inability of communication between scientists from different fields of study can be explained through a maximal conception of science. This conception deals with science on a third level beyond the minimal conception based on basic shared rules and the intermediate conception dealing with overlapping sciences grouped into clusters. This third level of analysis requires an explanation of the ability of complex adaptive systems to self-organise.

2.5 Science as a Complex System Self-Organises

As the number of scientists involved in a particular field of study grow, the scientific discipline starts to become complex. This happens through the ability of complex adaptive systems to self-organise.

Complex adaptive systems have the ability to change and develop their structures with the aim to better adapt to, cope with, or manipulate their environment. They thus continually transform their structures and organisation as a result of rich interactions between components of the system, as well as between the system and its environment. Interaction with the environment is complex, as many parts of the environment are also evolving. One could thus refer to co-evolution, as individuals try to adapt to their evolving environment (cf. Holland 1995: 10; Waldrop 1992: 259).

Self-organisation does not result from a central controller, as complex systems usually have no central controller with complete control over it. The dynamics of these systems allow a great deal of autonomy, although there might be some tendencies toward central control. The absence of rigid central control results in systems with robust, adaptive, flexible, and innovative organisation (Brockman, 1995: 349; Casti 1994: 272).

Self-organisation clearly plays a major role in science. Science is institutionally embodied in universities, research institutes, and industries. At universi-
ties the sciences often organise themselves into faculties such as Medicine, Economics, Law, Theology, and so on, who cluster together related sciences organised into departments. Some sciences, like particle physics, have become collectivised because research facilities have become extremely sophisticated and expensive. For these reasons they have to be funded by governments and shared by scientists from many different countries, like CERN in Europe (cf. Ziman 1994 and 1995: 364). Not only are these facilities shared, but some experiments involve teams of a hundred scientists and more. Many scientific projects require the input of scientists with various specialised skills drawn from different sciences (Ziman 1994: 60). Similar patterns of collectivisation in other sciences are marked by a large increase in the number of multiply co-authored articles in the last few decades (Ziman 1995: 289).

Through regional and national organisations scientists group together for promoting their disciplinary interests, especially through conferences and the publication of journals. Within organisations specialised interest groups arise who share information and exchange ideas. Even smaller formal or informal research groups are formed that collaborate on projects on various levels. Through publications, i.e., journals and books, important forms of self-organisation take place through the selection of editors, editorial boards, and referees. Funding agencies also appoint referees for advice on suitable candidates or proposals for research funding.

Self-organisation in science results from the absence of central control. Control over what is accepted as science, is widely dispersed throughout the scientific community (cf. Waldrop 1992: 145). Referees, editorial boards, and editors of thousands of journals and publishers share decisions about what is good science and ought to be published. Committees of countless scientific institutions, composed of experts, determine appointments, promotions, funding, and prizes. Individual scientists involved in research make deci-
sions, gather information, and develop arguments for judging existing research and presenting new findings. Individual scientists often have informal networks of contacts with fellow scientists that are kept up through mail, telephone, guest lectures, and conferences.

The richness of the multiple interactions between scientists demonstrates why self-organisation is possible within the sciences through widely dispersed decision-making powers. As a result the nature, contents, and processes of science are continually adapted to fit better with the environment – whether environment here means the objects of study, fellow scientists, or the current state of the art research findings, methods, and techniques setting the agenda for future research.

The result of the comprehensive ability of the sciences to self-organise through widely dispersed control over what qualifies as good science underlies the third conception of science. The maximalist conception of science analyses science at a third level, viz. that of the community of scientists in a particular field of study. This community of scientists determines the nature, standards, accepted findings, and workable theories of their discipline on a continual basis. As community they decide what kind of research is do-able, what the current state of the art is, and what is well-established in the discipline (Ziman 1995: 273).

The critical scrutiny of experts in a discipline temporarily resolves disagreements – a characteristic feature of science – only to be disrupted again (Van Huyssteen 1997: 250). This never-ending redefinition of what science is by leaders in their fields of study is all we have. These judgements come from within a discipline where scientists know well enough how to distinguish ways of proceeding, whether they are justified or not, fruitful or fruitless, reasoned or not. Hilary Putnam's advice (1990) is that scientists should not abandon these knowledgeable judgements that they as doers, practitioners,
and agents of a specific scientific discipline make in favour of judgements from outside their discipline imposing standards of science on them.

Competent judgements within a scientific discipline are possible because scientists can learn from history and experience. Through comparison of new theories, methods, and findings with what has gone before they can judge the significance of new proposals and decide whether they are better estimates of how the world really is (Van Huyssteen 1997: 253). The acceptance of new contributions results in reinterpretation of existing information to determine its correspondence and coherence with what has been judged to be the new standard-bearers of significance. As a result selective forgetting takes place, as lost significance implies the death of scientific work and death means being forgotten.

Theology self-organises just as these processes above describe. Theology itself consists of various disciplines and subdisciplines with their own experts, journals, conferences, and organisations. The sociological functioning of theology is fully in line with the other sciences.

Different maximalist versions of individual sciences are in interaction with one another and are commonly aggregated under the collective name of science. Clustering together are typical behaviour of complex adaptive systems. When similar complex systems are in interaction, they have a tendency to generate other more sophisticated complex systems on a higher level of organisation. Such a complex system of complex systems evolves through the efforts of the complex agents to survive or improve their positions. Such a collective of complex systems are beneficial to the individual complex systems.

Unitary conceptions of science claim to give a reconstructed model of how science, in the sense of complex system of complex systems, works and
ought to work. Thus, what they are doing is to interpret one specific science, usually physics, and generalise those findings to science as the aggregation of complex systems. This generalisation is without grounds. Science as complex system of complex systems is not a single unified and monolithic enterprise, but resembles a "rather ramshackle structure with little coherence among its various parts" (Kuhn 1970: 49). The various sciences cohere on a minimal conception of science, based on a few basic rules, and some sciences cluster together on the basis of shared interests. However, one prescriptive model developed by philosophers of science that applies to all sciences seems out of the question.

2.6 Science at the Edge Between Order and Chaos

The processes through which scientists judge the results of new and existing scientific research can be elucidated by another aspect of complex adaptive systems, viz., the fact that they are poised between the edge of chaos and order. The interplays between order and disorder, stability and fluidity, chaos and regularity, and predictability and unpredictability that complex adaptive systems exhibit are regarded as one of their most striking features (cf. Stein 1989: xiv).

Commonly called the edge of chaos, this expression refers to that part of a complex adaptive system where its components never quite lock into place, yet never quite dissolve into turbulence either. The edge of chaos is described in different ways. Some regard it as the constantly shifting battle zone between stagnation and anarchy (Waldrop 1992: 12), while others interpret it as the tension between regulation through feedbacks and creative response to new conditions. The edge of chaos is described as the zone where complex systems can be spontaneous and adaptive, or where new ideas can nibble away at the status quo (cf. Waldrop 1992: 12).
The edge between order and chaos in science lies at the frontiers of new research where research traditions manifest their dynamism in a never-ending dialectic of continuity and change (Van Huyssteen 1997: 33). In most scientific disciplines opinions simultaneously converge and differ on what are established theories, results, methods, and techniques (cf. Rouse 1990). Scientists have sufficiently overlapping convictions about which important developments have shaped their discipline thus far to enable communication about the significance of new contributions. The shared overlapping convictions enable scientists to discuss differences and to make creative contributions. Yet the overlapping convictions are in continual tension with new contributions that threaten the coherence of the shared convictions of scientists about what scientific results, methods, theories, and techniques are significant and dominate their field.

The edge between order and chaos in science has the stability of some shared convictions about significant work to enable scientists to judge the value of new contributions that threaten to undermine the temporarily established shared convictions of significance. But significance in science means exactly that – to change, modify, or add to the preceding history of significant contributions. Rouse thinks that scientists live within various ongoing stories, all aiming to push the story line in diverging directions. The coherence of the narrative, documenting significant contributions to the development of the discipline, is under continuous pressure to unravel due to new contributions challenging the current state of the art. However, a reasonably coherent narrative is needed that encourages and yet controls controversy (cf. Ziman 1995: 82). By keeping criticism and imagination in continuous tension differences within a discipline can be kept intelligible and a space exists within which creative work can be done (Rouse 1990).

Through significant contributions modifying the existing cognitive landscape of a discipline (cf. Ziman 1995: 275), scientists redefine what the field is
about and provide new opportunities for research. Solutions to important problems in a scientific discipline necessitate that every scientist must reconsider the contents, methods, and aims of their research programs (Ziman 1995: 279). Scientists read new contributions – published in books or journals – with the aim of discovering new advances at the frontiers of their discipline. Such advances include results they must take account of, research opportunities that they could usefully follow up, or methods and techniques that they might employ (Rouse 1990).

The contents of a scientific discipline currently accepted as significant, and thus dominating research activities in the discipline, are constantly exposed to problems, pressures, and challenges (cf. Popper 1981). Theories are examined for their internal coherence, their coherence with established theories and results, and for their fit with available evidence. New findings are under pressure to withstand critical examination of the methods used for data-gathering and whether these methods were consistently and impartially applied. Further pressure comes from investigations determining whether the techniques of analysis were appropriately applied and skilfully handled.

One result of stringent critical examination and rigorous testing of existing scientific contributions is the presentation of imaginative, new scientific theories, results, methods, and techniques. These new proposals aim to correct problems, deal with challenges, and alleviate pressures on existing accepted scientific results. In the process, new contributions proliferate and tend to create a chaotic field of new ideas to be sorted out. Again this leads to creative tension between already accepted scientific results and the newly proposed contributions whose significance are constantly being determined through academic debates, critical scrutiny, and rigorous testing. When significant contributions become accepted part of the body of established knowledge, no state of equilibrium follows. The result rather changes the environment in which scientific research is conducted. The changed envi-
ronment results in new pressures, problems, and challenges that must be dealt with through similar processes as described above.

The nature of the edge of chaos in science as complex system draws attention to another characteristic of complex systems, viz. components of complex systems co-evolve with their environments. In this case, the components of science can refer to the theories, results, methods, techniques, and the conceptions scientists have of their disciplines, albeit often tacitly. Complex systems are characterised by multiple independent agents that interact with one another in many ways. Each agent are constantly reacting and adapting to what the other agents are doing (cf. Waldrop 1992: 145). For this reason the environment of an agent is not fixed, but constantly evolving. Individual agents must change and improve themselves relative to the evolving changes implemented by other agents.

Successful changes thus depend upon what other agents are around, the success of those agents' adaptation, learning, and evolution, the niche an agent fills, the agent's ability to adapt and learn, and sometimes even the past history of an agent. Fitness, in the sense of either successful adaptation to the environment, or appropriate learning from experience, arises "from the dance of co-evolution" (Waldrop 1992: 259). Science is such a system of co-evolving components. Ziman (1994: 78) calls the scientific enterprise a system with closely linked components that are continually evolving. The components — scientists, theories, methods, results, or even disciplines — grow and change in relation to one another.

There is no doubt that theology also fits the description of the edge of chaos. New theologies emerge that undermine currently accepted ones and aim to redefine the narrative of developments in the discipline thus far. Endless critical scrutiny of theologies leads to the development of new alternatives. Theologians must continually co-evolve with new developments in their
fields, as well as new developments in related fields, such as literary analysis, philosophy, or sociology.

The complexity scientists use the concept of the edge of chaos in conjunction with the idea of self-organised criticality. When combined these two ideas suggest that complex systems can tune themselves toward optimum sensitivity to external inputs. In such a state of sensitivity even minor events can start a chain reaction that affects large numbers of elements in the system (cf. Waldrop 1992: 304–305). Such a chain reaction can lead to breakdowns of all sizes ripping through the system and rearranging it. Complex systems in a state of self-organised criticality can be identified if they show waves of changes and upheaval on all scales (Waldrop 1992: 308).

The idea of a state of self-organised criticality in science functions at the level of comprehensive theories. Thomas Kuhn's (1970) concept of scientific revolutions illustrates self-organised criticality at work in major theoretical changes that occur in some sciences. Normal science — in Kuhnian terms — and anomalies prepare the ground for a state of criticality. The research agenda for normal science are defined by comprehensive theoretical frameworks called paradigms. Normal science consists of "puzzle solving," as intricate instrumental, conceptual, mathematical, and empirical problems left unresolved by a new paradigm must be solved. The challenge of fitting all the right pieces of the puzzle functions as an important driving force in scientific research.

Growing specialisation through normal science makes a paradigm more precise, accurate, and complicated. Besides strengthening the existing paradigm, growth through normal science also leads to the gradual disintegration of a paradigm. According to Kuhn, "the more precise and far-reaching that paradigm is, the more sensitive an indicator it provides of anomaly and hence of an occasion for paradigm change" (Kuhn 1970: 65)
Anomalies disturb normal science and threaten paradigms. Anomalies are new, unknown phenomena that defy easy explanation in terms of the existing paradigm. Normal scientists first try to explain anomalies. If explanations fail, scientists modify the existing paradigm. They try to resist anomalies that can overturn the existing paradigm as far as possible. A paradigm whose explanatory power has diminished as a result of accumulating anomalies leads a scientific discipline into a state of self-organised criticality.

A scientific revolution occurs when a new paradigm replaces the existing one. This revolution happens when the new paradigm explains both known facts and anomalies. To reject the existing paradigm is simultaneously a decision to accept the new. The old and the new paradigms cannot co-exist, the older one must make way for the new. Paradigms specify the standards for normal science, therefore a scientific revolution changes the way science is practised. Scientific revolutions destroy the weak parts of existing paradigms and incorporate their explanatory successes.

The relatively minor event of the acceptance of a new comprehensive theory or paradigm starts a chain reaction that affects large numbers of scientists, often in more than one discipline. Breakdowns of all sizes can rip through scientific disciplines and subdisciplines and rearrange how science is done. Kuhn is clear that revolutions of different sizes could occur and that the effects of some revolutions vary on members of different disciplines as a result of the phenomenon that a paradigm can be important for many scientific disciplines, though "it is not the same paradigm for all" (Kuhn 1970: 50).

The influence of an important scientific result can work its way across the conventional boundaries of various disciplines and fields like an epidemic, where "new foci of infection appear unexpectedly at points that are far away from previously affected regions" (Ziman 1995: 94). Galison lists some of the
metaphors that have recently been employed for depicting these modifications of current scientific practice. Instead of gradual accumulation, philosophers of science are now referring to epistemic ruptures or fissures, gestalt shifts, sociological disruptions between generations, or ontological rifts tearing like geological faults between theories (Galison 1988: 204).

The role of paradigms in theology is disputed. Nevertheless, there are theologians convinced of the important role of paradigms in theology. Willem Vorster (1988: 34) describes the role of a paradigm in New Testament studies as follows.

"There can be little doubt about the importance of the historic-critical approach and the application of historico-critical methods, especially during the past century, as the dominant disciplinary matrix in New Testament science. It was within this paradigm that solutions for problems were looked for. Those problems deemed worthy for investigation were determined by this frame of reference. In short, historical criticism as applied by biblical scholars dominated the activities of New Testament scholars and in certain circles it is still regarded as the only way in which any New Testament problem can be solved. This does not mean that there were no other paradigms. I am just arguing that the historico-critical paradigm was dominant, and also that it influenced other paradigms directly or indirectly."

Other theologians also accept the idea of paradigms in theology and claim that conflicting paradigms often co-exist, because old paradigms are not replaced by new ones, but rather live on (Bosch 1991: 186). Bosch argues that an individual accepting a new paradigm does not necessarily abandon all aspects of the old one. A complex fusion of different paradigms often occur in the case of individual theologians (Bosch 1991: 186). Changes in paradigms have often affected theology drastically, as the Protestant Reforma-
tion demonstrates. Theology are also often influenced by paradigm changes in other sciences, like literary analysis. New methods for textual analysis have required almost continuous "retoolings" in theology in the past couple of decades.

2.7 The Rationality of Theology as Science

In most respects discussed above, theology qualifies as a science similar to most other sciences. Theology as science works as a complex system and thus functions in practically all respects just as the other sciences do. The similarities between theology and the other sciences can be explained in terms of the fact that all the sciences use the rich resources of our shared human rationality (cf. Van Huyssteen 1999). Humans employ rationality in all domains of their lives as ways of coping with their lives and their world. Rationality enables humans to make the worlds around them and in them intelligible so as to optimally understand them (Van Huyssteen 1999: 2, 7, 114). Included in these worlds are the questions of theology, like those dealing with meaning and suffering in life and the origin and purpose of humans and their world (Van Huyssteen 1999: 7).

What are the contents of rationality in this context? To be rational can be explained in terms of the four fundamental rules of science mentioned earlier. Rationality enables scientists to define problems and find solutions as part of the quest for intelligibility and optimal understanding of our worlds. Provisional findings and tentative hypotheses need to be justified by giving an account of them and providing them with a rationale (Van Huyssteen 1999: 128). This is done through the ability for critical judgement, that help scientists determine the best available reasons based on appropriate evidence suitable to a specific context (Van Huyssteen 1999: 2, 5, 128, 132, 143). These reasons are determined against the background of responsible decisions about the value of earlier work and with the aim of convincing one's peers in a discipline. Scientists want to convince their community of
inquirers why their theories or findings are well-supported. They also want to convince their community that they have gathered, linked, and united interpreted experience into coherent hypotheses or theories (Van Huyssteen 1999: 128, 210).

This community of inquirers consists of individuals with sufficient expertise to be competent judges (Van Huyssteen 1999: 171). Through intersubjective examination, critical scrutiny, and continuing evaluation these inquirers help or challenge one another by confirming, rejecting, criticising, or modifying proposals. They are required to present good reasons for their evaluative comments (Van Huyssteen 1999: 171). Failure to rationally undermine any proposal or hypothesis qualifies it as provisionally acceptable in a scientific discipline, pending further inquiry (Van Huyssteen 1999: 26).

As a result of shared rational resources, theology can engage in “cross-contextual, cross-disciplinary conversation” (Van Huyssteen 1998: 214). Rationality makes it possible that humans from diverse backgrounds can communicate through conversation, deliberation, and evaluation whilst busy collectively assessing something (Van Huyssteen 1999: 267). As rationality is operative in different spheres of human knowledge, it provides links between different scientific disciplines and between the strategies of reasoning employed in them (Van Huyssteen 1999: 5). These links enable scientists to communicate across disciplinary boundaries, despite the heterogeneous language games embodied in different scientific disciplines. Not only does rationality enable theology to engage in academic debates with their colleagues from other scientific disciplines, but public, political debates through rational argumentation about the social value and role of theological values become a reality.

Unfortunately, though, the full picture of the status of theology as science cannot be determined only by the similarities between theology and the
other sciences. Although theology shares many similarities with other sciences, its fundamental differences with those sciences must be respected as well (Van Huyssteen 1999: 263). Theology has an Achilles heel that disqualifies it as science in many people’s eyes, despite so many similarities between theology and the other sciences.

3. The Achilles Heel of Theology as Science

If theology resembles other sciences in so many respects, why the persistent suspicions about its intellectual quality and scientific status? The reason for constant doubts about theology as science comes from its Achilles heel as science. Theology – perhaps one should say, conservative Christian theology – demands that its practitioners commit themselves to faith in God and belief in the divine origin and truth of the ancient sacred texts of the Bible (cf. Van Huyssteen 1986: 152, 154, 204, 210). Several reasons are advanced for this requirement. One reason is that large parts of the Christian Church judge the ancient sacred texts of the Bible as the only access to the reality of God – supposedly the focal point of theology as science (Van Huyssteen 1986: 210).

Another reason for theology’s Achilles heel is that the Christian Church accepts the ancient sacred texts of the Bible as the norma normans of its collective life and of individual conscience. Norma normans means that these texts are the fundamental values that determine any other values that might be used by the Christian church or in the lives of individual Christian believers. All other values drawn from whichever source become norma normata, that is, norms that are accepted in so far as they are in agreement with the Biblical texts. The decisive role of the values embodied in the ancient sacred texts of the Bible is thus required as the working assumption of Christian theology.
To accept the dominance of the ancient sacred texts of the Bible in the life of the Christian church implies that theologians are called upon to submit themselves to the moral and religious authority of those texts. Submission to these texts must result in a changed life, as the experience of being transformed by those texts is an important way of understanding the meaning of the text. This requirement asks theologians to accept in faith that God has revealed Himself through the ancient sacred texts of the Bible and that He claims complete obedience from believers to all His commands expressed in these texts.

If theologians comply with these requirements of faith, they can become "faithful interpreters" who have the virtue of "listening patiently" to the ancient sacred texts of the Bible. If they present "fresh, imaginative links" between these texts and our contemporary lives, the credit must go to God's Holy Spirit for these new interpretations of the texts. Without faith not even the best methods and techniques of exegesis can enable theologians to discern the core message of the ancient sacred texts of the Bible. As Biblical texts witness and testify to the faith of their authors, theologians ought to be tuned into a similar faith to gain a genuine understanding of their meanings. The Bible itself seems to subscribe to such a view. Spiritual truth given by the Holy Spirit, it claims, can only be understood by people filled with God's Spirit (1 Cor. 2: 13–15).

These requirements for doing good theology boils down to accepting not only the existence of the Christian God, but also that a personal relationship with Him as prescribed in the Biblical texts ought to be established and lived. Even after twenty centuries there is still no rationally convincing arguments to persuade sceptics of the existence of God or the need for a Biblically prescribed and specified relationship with Him. The intellectual disciplines, like natural theology, philosophy of religion, and apologetics, intent on designing and presenting such arguments are at best marginal within the theological
sciences. That does not mean that the choice of Christianity is arbitrary. Adherents of Christianity could argue with ease that the collection of texts in the Bible provide the best available answers to the deep issues that theology deal with. A series of arguments are possible that show that intellectually satisfying interpretations of Biblical texts provide comprehensive frameworks of ideas within which the meaning of life, the existence of suffering, the nature of love, the beauty of creation, the devastation of natural and human forces, and the purpose of an individual’s life can be articulated and understood better than any other comprehensive moral or religious framework can provide. Nevertheless, such arguments are not conclusive to sceptics, like mathematical proofs or scientific observations are.

In the absence of rationally convincing arguments that will change the minds of sceptics, a leap of faith lies at the bottom of theology as science. This leap of faith requires a commitment to an immensely strong and comprehensive set of normative values and a demanding relationship to God that must transform a person’s life to become like God in many respects. What theology here requires from its practitioners is unique among all the sciences. To acquire a religious orientation and moral values as additional qualifications besides relevant intellectual knowledge and excellent research skills in order to practice science, is the Achilles heel of theology, leaving it vulnerable when attempting to defend its intellectual status as science. Van Huyssteen (1999: 115) acknowledges that the “high degree of personal involvement and commitment in religious faith ...present a very special challenge to any theory of rationality in theology.” How many sciences specify similar subjective, personal requirements as prerequisites for being researchers contributing to human knowledge?

The requirements of theology are so much more than other sciences expect from their researchers, the truth of Christian religion so controversial in pluralist societies, its moral orientation so biased, and the publicly available
evidence to support faith and belief so ambiguous, that the scientific status of theology is radically questioned. Can any intellectual discipline requiring this degree of personal commitment from its practitioners be called a science if it is not based on publicly accessible data available for inspection and rational evaluation by anyone?

The strong requirement that Christian theology asks of its practitioners, i.e., that they submit to the authority of the God that the ancient sacred texts of the Bible testify to, has profound implications for the moral and religious lives of theologians. They must live their whole lives, whilst doing theology and whilst not, according to the ethical guidelines embodied in the Scriptures. Few other sciences prescribe such stringent requirements on the lifestyles of their researchers. Nevertheless, some human sciences do prescribe certain attitudes and moral values to their researchers in order to be able to engage in reliable research. These prescriptions are found in cases where researchers themselves become measuring instruments through participant observation and interviews.

The prescriptions for researchers in the human sciences are limited to the practitioner’s role as researcher and do not necessarily extend beyond that role. Still, it is interesting to note the similarities. In the use of in depth interviews and field research in the social sciences, researchers are encouraged to accept research respondents unconditionally, treat them with respect, place their interests first, avoid any harm to them, listen to them attentively and with empathy, be authentic in order to win their trust, be honest and respect their confidentiality, be tolerant of lifestyles different from their own, avoid moral judgement of respondents, and become aware of their own assumptions and be willing to re-examine them in the light of new information and experiences. Theology demands similar attitudes and moral values towards the ancient sacred texts of the Bible, although the values of the texts must be sincerely assimilated into the life of the theologian as coming from a
Higher Being. Theology also requires its researchers to exhibit an attitude towards the ancient sacred texts similar to those human scientists in the literary sciences ought to exhibit towards the texts they study. Their attitudes must be to have respect for the integrity of the text, the assumption that the text has something meaningful to say, and judgement of the text within its own genre, period, and context.

Does theology’s commitment to the authority of the ancient sacred texts of the Bible, its Achilles heel, disqualify it as science? Not necessarily. Theology has many similarities to many sciences with secure scientific status. If one furthermore understands theology as akin to a critical social science, it gains more intellectual legitimacy. To identify critical social science only with the “Frankfurt School” or neo-Marxism, would deny the full, rich variety of scientific theories and results produced by critical social science (Fay 1987: 6). Critical social science shares with theology an explicit commitment to a science that is not “value-free.” It has a strong commitment to emancipation, that is, to free people from oppressive social conditions and to empower them to freely determine their own lives. The concern of critical social science is similar to that of religion, that is, that by offering the truth to people about their lives, they will be set free. This concern rests on the assumption that humans are unfree, but need not be, therefore they can be liberated through an increase in knowledge. This is a secular and humanist version of self-estrangement theory, of which theology is a religious version (Fay 1987).

Critical social science differs in important respects from theology. Critical social scientists are heirs of the Enlightenment who reject belief in God, while embracing the assumption that human reason can discover the good life for humans (Fay 1987). They are also convinced that humans can solve their own problems through their capacity to transform their lives. Science is a fundamental instrument in the process of emancipation as a result of its
transformatory power to understand and improve our situation (cf. Braybrooke 1987).

A comparison between critical social science and theology is instructive. Although it gives theology somewhat more scientific credibility for allowing the presence of values in a legitimate social science, it also reinforces the uniqueness of the Achilles heel of theology. Nevertheless, the acceptance of the power of human reason as designer of human values and solver of social problems appears to be as much an assumption that cannot be conclusively proven as the assumption that accepts the wisdom of the ancient sacred texts of the Bible as being relevant to our lives today. Perhaps dialogue on the value and limits of these two approaches and a possible combination can prove useful again today.

Despite many criss-crossing overlaps between theology and many diverse sciences, theology will always suffer a lack of intellectual esteem as a result of its Achilles heel. The reason for this permanent scientific disability is the violation of fundamental scientific values, such as the idea of public access to a research domain and the notion that results should not be decisively influenced by personal values. Theology as prejudiced, engaged, committed, confessional science of ancient sacred texts that explores the value, worth, significance, and truth of those texts in the light of an assumption that they were inspired by God, will thus always struggle to be recognised as an intellectual equal in the world of the sciences.

There is however, some kind of check and balances built into theology as science that minimise the effect of the Achilles heel of theology. We have already looked at the rationality embodied in interpretation and the social functioning of theology as complex system. From these two matters emerged the important role of rational argumentation, the provision of good reasons, the use of empirical evidence comprised mainly of a textual, his-
torical, and archaeological nature, critical discussion, and peer evaluation. Although these factors cannot eliminate the Achilles heel, they might keep it somewhat in check.

4. Conclusion

The aim of this chapter was to justify the intellectual status of a science of ancient sacred texts. I used Anthony Flew’s challenge to theology as starting point to present my views on the status of theology as science. Having done so, how can Flew’s challenge be answered? I have selected two issues emanating from Flew’s challenge to respond to. One issue is the question to what extent theology is scientific, i.e., to what extent can the methods, conceptions, and criteria of science be applicable to theology. The other issue concerns Flew’s conclusion that theology dies a death of a thousand qualifications, suggesting that qualifying any religious assertion inevitably places Christians on a slippery slope towards vacuous, meaningless statements.

In this chapter I have argued that theology qualifies in many respects as scientific. Theology shares in many characteristics of science and frequently makes use of the results, methods, and techniques of other sciences. However, theology has a weak spot in its quest to be accepted as scientific by the other sciences. This Achilles heel is theology’s commitment to the truth of the ancient sacred texts of the Bible. Being a commitment based on reasons not entirely rationally convincing to sceptics, it implies something that theologians (and intellectual believers) have a strong preference for and that they refuse to easily substitute or trade for something else. For this reason contrary evidence to the meanings of ancient sacred texts will not be easily accepted, especially not evidence against simplifications of the complexities of those meanings.

Despite theology’s tainted status as science, it does not die a death of a thousand qualifications. Instead, theology comes alive through a thousand
qualities. All attempts by individual theologians to synthesise their interpretations of the diverse contents embodied in the ancient sacred texts of the Bible will lead to multiple qualifications. These texts have complex intertextual relationships aside from the inner complexities embodied in each individual text (Bible book). There is no way that definitive formulations of any doctrine can be given or any doctrine can be simplified into one sentence to be tested against empirical evidence. New interpretations constantly emerge as a result of modified research practices, different contexts, and changing circumstances of theologians. Also, constantly changing intellectual horizons and new societal problems focus theologians’ interests on often neglected parts of the set of ancient sacred texts.

Does this mean that no contrary evidence is allowed to count against theological statements? In a sense all theologies are mere provisional hypotheses to be tested, modified, or rejected in the light of new research results. However, this testing takes place within the safe environment of theology as committed, engaged science. Flew’s challenge rather concerns the issue whether thinking Christians would ever accept evidence that would prove the falsity of their beliefs. Some Christians do. In such cases the reasons might be different from the ones Flew wants them to take seriously. Not necessarily the intense suffering of children in general will be taken seriously, but acute personal suffering of one’s own child which disrupts the personal relationship with God can challenge faith in God.

Intellectual believers who become aware of the human origins of the New Testament and the similarities of its contents with other systems of thought of those times always seriously question the divinity and credibility of the ancient sacred texts. Part of the legacy of the Enlightenment also disrupts many believers in their faith. The value assigned to the freedom and autonomy of the individual to choose their own moral values makes intellectual believers sceptical to accept divinely revealed moral values that make radi-
cal demands. The spectacular, continuing success of the sciences has the effect that many people only accept ideas that are scientifically plausible. Whatever in Christianity does not seem to fit a scientific worldview is rejected as not possible and therefore unbelievable. In these cases it is not so much contrary evidence that leads believers to drastically modify or even reject their faith, but alternative sets of ideas that cohere more easily with the dominant thought systems of our times.

Furthermore, the emphasis in Christianity that believers must live the truth of the faith they confess suggests another kind of evidence that Christians will consider as counting against their faith. Lack of integrity and unwillingness to bear the consequences of the radical demands of Christian faith can negatively influence people’s faith. For this reason the influence of theology must not only stimulate Christians to be aware of the missionary dimension of their everyday conduct. Theology must cultivate the idea that an authentic Christian lifestyle is both an argument for the truth of Christianity to unbelievers and serves as encouragement to believers to persist on their pilgrim’s road to God’s new world (cf. Eybers 1982: 227–247).