Paper Title: Relating Science to Religion / Theology: Which Approach?
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Abstract:
The often used relations (i) conflict, (ii) independence, (iii) dialogue, and (iv) integration are based on binary logic. Excluding that one domain is a subset of the other, (i) to (iv) represent the only possibilities within that logical restriction.

But why should the use of binary logic be the guiding principle? It does not work for Christian doctrines (Holy Trinity, Two Natures of Christ …) nor for important life decisions (choice of a profession, a partner …). For one, binary logic only deals with "atomic", unchanging entities, *not* with entangled or changing ones.

This paper argues for the use of a context-sensitive trivalent logic as incorporated in relational and contextual reasoning (RCR – Reich, 1995a, 2002). Before discussing actual relations between science and religion / theology, the particular context has to be established. For instance, regarding Christianity, the relation was not the same in the Middle Ages (when religion was hardly in dispute), in the Renaissance (when human self-affirmation grew considerably), and in the Enlightenment era (when "rationality" was the reigning Goddess).

Furthermore, relating science to religion / theology *per se* is too general to be really helpful. For instance, inorganic chemistry and religion have markedly less to do with each other than evolutionary biology and religion. A more meaningful discussion deals with circumscribed themes to which both science and religion / theology can contribute. An example would be the origin and the becoming of our universe and humanity's position and role within it.

Looking at the issue from a different perspective, namely that of anthropology, it is recalled that a human being can "simultaneously" be an object of scientific research, a sense-making subject, and a unique personality formed by his or her character and biography. Also, the complex pathways from gene to brain to cognition to spiritual activities and on to behaviour cannot be dealt with by simple two-valued relationships. Dealing with these givens as far as science and religion / theology are concerned, requires to keep the different aspects apart yet study their entanglement and the mutually enabling, restricting, or whatever relations.

Finally, once more, binary logic cannot deal well with emergence-based becoming such as the arising of consciousness (e.g., Clayton, 2004).

The application of RCR is explicated for two cases, "Genesis" and "Anthropology".

Biography:
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cognitive and religious development. He also has an interest in science and religion. He has published numerous papers and several books (www.helmutreich.ch), prominently "Developing the Horizons of Mind". In 1997 Reich received the *William James Award* (USA) from APA Division 36 for his contributions to the psychology of religion; he was elected *Academic Fellow* of the Institute on Religion in an Age of Science in 2002.

Paper text:

Introduction

This conference fosters viewing science and religion from a global perspective, even from global perspectives. I take it that science as understood here is largely the *same* the world over but there are many *different* religions. Basically, then, the conference objective can be achieved at least in three ways (a) authors take into account many religions, compare and contrast their particular relation with science; (b) participants deal with the theme from a global perspective but concentrate on their own religion / cultural region; (c) participants from many different traditions present their own (local) view from that perspective only, and as the mosaic of these many views develops, a global perspective comes into sight. Approach (a) by its nature is limited to a few experts, approach (c), while easier for authors, may make the appearance of the global perspective difficult because of reader's possible unfamiliarity with a particular religion and the authors' limitations in regard to using a vocabulary and a style comprehensible to outsiders.

For these reasons I have chosen approach (b) – but unwittingly in parts may still fall into (c). I am aware of differences (i) between Western and Islamic scientific ways, at least in psychotherapy (Murken & Schah, 2002), (ii) in the use of binary logic by Westerners and Asians (who have not been "corrupted" by Aristotle) and (iii) I am conscious of the fact that human understanding and insight can successfully travel the route of analysis (and be published in Paris when a Tunisian) or the route of narration (published in Cairo when a Tunisian).

My main argument in this paper is that approaching science and religion on the basis of the rules of binary logic is too restricted. It is not fully adequate as seen from the point of view of the structure of the problem. For best results, the form of the thought applied should match the problem structure. As this statement in my experience resonates with few persons. I shall go into it shortly. Before that, I lay open my metaphysical, ontological and epistemological presuppositions. I then discuss different thought forms, explicate the difference between various logics, deal with the usual typology (i) conflict, (ii) independence, (iii) dialogue, and (iv) integration, develop Relational and Contextual Reasoning (RCR), demonstrate the difference of applying RCR over against binary logic makes when dealing with (a) science & religion and (b) anthropology, and finally come to some conclusions. In doing so, I draw in various ways on Reich (2002) by kind permission of Cambridge University Press and on Reich (2004b).

Metaphysical, ontological and epistemological presuppositions

The present considerations imply certain choices in metaphysics and ontology that is, it makes assumptions about the nature of reality. It also involves epistemological assumptions, having to do with the process of gaining knowledge in the cases concerned. Therefore, I begin with assumptions adopted here from the relevant philosophy (largely adapted from Reich, 2004b, pp. 13-18, itself based on Reich, 2002, pp. 35-41).

Why is this discussion of the philosophical foundations useful? Throughout this study, some kind of reality is assumed to exist "out there." That is not undisputed, and

needs clarification and justification. I first deal with science, and then with religion / theology.

In view of the importance of the assumptive base for one's research (Case, 1998, pp. 747-753; Fahrenberg & Cheetham, 2000; Overton & Reese, 1972; Putnam 1999; Reese & Overton, 1970; Werner, 1948/1973, 1957), I make my position explicit (more extensively in Reich, 1995c, 2000, 2002). Rather than recalling the history of the philosophy of knowledge (e.g., Overton, 1998, pp. 127-163), I first situate in their contexts my three choices concerning basic metaphysical orientations and philosophical presuppositions, and then formulate them explicitly and justify them by contrasting them, when helpful, with other conceivable choices.

To the question, "What can we know about reality" a broad answer is given by the various shades of realism (e.g., Putnam, 1988). Classical ("naïve") realism assumes (i) that there is a reality independent of human ideas and theories; (ii) scientific theories and the theoretical entities contained in them purport to refer to those [real] entities, processes, or structures existing independently of the theories; (iii) hence scientific theories can be judged to be true or false in some sense larger than "they allow one to describe, predict, and organise the experimental data." Thus, the scientific theories assumed by classical realism involve *ontic* truth (R. S. Kitchener, 1988, p. 17), not just the *epistemic* truth of theories "merely" aimed at describing, predicting and organising empirical data.

Foundationalism follows from the purported ontic truth of scientific theories. Laudan (1990, p. 134) enumerates the resulting (foundational) epistemological programme as "(1) a search for incorrigible givens from which the rest of knowledge could be derived; (2) a commitment to giving advice about how to improve knowledge; and (3) the identification of criteria for recognising when one had a *bona fide* claim."

According to most contemporary philosophers of knowledge, foundationalism can no longer be justified (e.g., Laudan, 1990). Indeed, by now it has become clear that (a) all observations are "theory-laden" (influenced by pre-knowledge); (b) scientific theories are underdetermined by facts (several theories may explain "equally well" a given data set); (c) "verification" / "falsification" of a theory is more complex than thought previously (the *experimentum crucis* is an exceptional occurrence); and (d) the (unwittingly chosen) underlying assumptive framework provides an influential hermeneutic context for one's research (cf. Lakoff & Johnson, 1999, pp. 74-81).

First choice made: On account of such arguments, I opt for a conjectural / hypothetical, sceptical and qualified, critical realism (cf. Putnam, 1999, especially part 1). According to this view, we are engaging with realities that may be referred to and pointed at, but which are beyond the range of any completely literal description; these realities include thoughts, virtual quantum "particles", and so on. To refer to them, we most appropriately employ metaphorical language and describe a given reality in terms of models, which models may eventually be combined into theories.

Franz Brentano and his successors broke with the idea of "uncertainty" about coming to grips with the outside world. They posited instead that all contents of mental acts are to be taken as *immanently objective,* whether or not they have an external referent (cf. Baron-Cohen, 1995; Vande Kemp, 1996, pp. 166-167; Yates, 1985). In other words, for the very large majority of persons, his or her ideas and representations usually spring from a sense of utter reality, regardless of what exists externally – theirs is a first-person ontology. Thus, as mentioned above, no person will doubt that colours are attributes of the external world unless he or she has learned certain scientific facts about our visual apparatus (cf. Ramachandran & Blakeslee, 1998, pp. 72-80, passim). Why do all Indo-European languages include some saying such as "knowing is seeing" (= seeing

something becomes eventually knowing it) if no confirming experiences underlie this saying? Furthermore, turning from the outer world to the inner world: why should the vocabularies of nearly all languages, even those spoken on remote islands and in "inaccessible" mountain valleys, have terms for the basic colours (e.g., Hardin & Maffi, 1997), unless those colours have the quality of "immanent objectivity"? However, this is no warrant for a *naive* realism.

Faced with the loss of foundationalism and the resulting weakening of the correspondence theory of truth, what can one say about the truthfulness of a given scientific theory? The answer is "little". But from Laudan's (1990, pp. 19, 59, 85, 103) discussion one gathers that under the assumptions adopted here (all observations are "theory-laden"; scientific theories are underdetermined by facts; "verification"/ "falsification" of a theory is more complex than thought previously), it remains possible to *compare* rival approaches rationally and rank them.

Second choice: From the perspective of the critical realist approach we are discussing, the task of science is to come to some (tentative) conclusions concerning "order" or "patterns" with respect to the object of study, to explain them by elucidating the variables involved and demonstrating relationships between them, and finally to understand the underlying mechanisms in depth, whenever possible in terms of a coherent theory. Any such order or pattern and its understanding is neither simply discovered as objectively given, nor constructed purely socially, without any "objective" constraints. Not infrequently, theories evolve by iterative bootstrapping analyses of ever more appropriate data gathered in the light of ever better hypotheses, possibly aided in this by better empirical methods and research instrumentation, and improved reasoning using more appropriate tools of thought.

Religion / theology. The methods used for collecting "data" are different (Reich, 1995c, pp. 394-395; 2002, footnote 6.5, pp. 107-108). *Scientific* standards require (a) the complete and precise indication of the conditions under which an experiment / experience occurred, (b) willed repeatability, (c) testability by *any* (competent) third person, (d) generalisable significance. Theologians, apart from pointing out that such standards are inapplicable to contemplative, aesthetic, and similar experiences, explain that (a) to (d) are inappropriately maximised requirements as far as religious experiences are concerned (cf. Watts & Williams, 1988, especially ch. 9). However, weaker forms are maintained. In particular, appropriate testimony of witnesses from both earlier and present times is considered epistemologically adequate as justification for the veridicality of "data", even if not everybody has had or will in all likelihood ever have the witness' experiences. Religious learning from experience is based less on the robustness of single facts and more on an ensemble of experiences, accumulated across situations and events with time. This poses the question of an "absolute" third-person versus a "restricted" third-person ontology on the one hand, and a third-person ontology vs. a first-person ontology on the other. How many witnesses and with which characteristics are needed to turn their witnessing into credible evidence? Among other things, the answer probably also depends on the specific knowledge domain concerned (e.g., JCS, 2003, 2004).

Summing up, I espouse a critical realist ontology and a nonfoundational epistemology involving a *transverse rationality*. The latter permits one to build bridges also between disciplines considered incompatible, incommensurable, etc., by some protagonists.

Contrasting the first two choices made with other options (cf. Hefner, 1997). Postmodernism. According to Donald Carson (2002), Nancey Murphy (1997), Pauline Marie Rosenau (1992), and others, (deconstructive) postmodernism has usefully alerted

us to the cultural and social influences on constructing the foundations and methods of epistemology in modernity, and hence on the resulting knowledge. However, Carson (2002), David Ray Griffin and Huston Smith (1989), Murphy (1997), Rosenau (1992), and John Taylor (2002) among others also observe that pushing this argument too far is likely to lead to a weakening of the idea of truth (as correspondence) as a goal of rational enquiry, of the striving for epistemical rigour, for *total* coherence of our knowledge, and so on. Given the senses, capacity of reflection, and traditions (standing on the shoulders of giants) of human beings, we can know truth at least partially, even if it is often difficult to express in a culture-transcending way, and even if, in our global village, fickle public moods are apt to change rapidly when exposed to a torrent of trendiness. Given the progress made in modernity, the aim should be to transcend modernity, for instance by admitting nonsensory perception (e.g., Hall, 2003), not to reject it lock, stock, and barrel. As far as the present work is concerned, certain warnings of postmodernism are heeded but it is not espoused as metaphysical orientation.

Relativism. It is a truism that even knowledgeable intelligent persons of good will may differ in their judgement of complex states of affairs. And that each judgement has to be respected and considered unbiasedly according to its merits.

But this is not equivalent to accepting the relativistic principle that one person's view is just as valid as another person's view (except to some extent in matters of taste). Or, to put it more abstractly, it is not equivalent to denying that a particular standpoint is privileged over others. The earlier considerations concerning postmodernism apply *mutatis mutandis* to relativism.

Constructivism. According to Jean Piaget's (1970/1983) theory of logico-mathematical thinking, from a *psychological* perspective we are all constructivists. In other words, from the perceptual awakening in the uterus onward, human beings order and class their perceptions, reflect on them, construct and revise their view of the world, of their human surroundings, and of themselves. Thomas Aquinas (S. th. I, q. 75, a. 5) already formulated it this way, "Omne quod recipitur in aliquo, recipitur in eo per modem recipientis" [Whatever is received into something is received according to the condition of the recipient – Aquinas, 1259-1264/2003].

However, radical constructivism as an *epistemic* enterprise in the areas of cognition and knowledge goes further (e.g., von Glasersfeld, 1995). The declared epistemic basis of radical constructivism is one's personal (everyday) experience (epistemic solipsism); the criterion for proceeding with the (personal) construction is *coherence*. Thus, no claim is made about any correspondence of the knowledge thus gained with a "reality" that exists independently from humans. At best there could be some functional analogy.

Whereas constructivism shares some of the positive aspects of postmodernism and relativism, the reason that it has not been adopted here is as follows. When one considers, for instance, the performances of (manned) space flights and the achievements of science in general, does one not suspect (notwithstanding radical constructivists' affirmation to the contrary) that we can know more about "reality" than the radical constructivists aim at?

Instrumentalism. Instrumentalism holds that scientific theories and models of the universe are valid only in the sense that they are useful in predicting events and explaining data consistently (saving the appearances), while at the same time making no claim that anything they describe actually exists.

Instrumentalism thus shares some aspects with radical constructivism. What is the difference? It seems that radical constructivism is more individualistic than instrumentalism. Constructivism comes to shared views via lengthy "negotiations" with others – if

at all –, for instrumentalism that seems to be a more matter-of-course, a built-in procedure. Instrumentalism is accepted here as a minimal epistemic approach.

Methodological framework adopted
Third choice: The following methodological stipulations are considered vitally important: First, convergence of evidence from as many sources as possible is to be striven for (e.g., Brink, 1995). Second, empirical generalisations over the widest possible range of phenomena are aimed at (Lakoff & Johnson, 1999, pp. 79-80). Third, the triadic network of justification is adopted: (i) research aims and theories should normally harmonise, (ii) theories justify methods and are in turn justified by them, (iii) methods exhibit the realisability of the research and are justified by the aims (Laudan, 1984, pp. 62-66).

Table 1. Main differences of (1) Piagetian operations, (2) cognitively complex thinking, (3) dialectical thinking, (4) analogical thinking. and (5) Relational & Contextual Reasoning (RCR). A, B, C, D are the "variables", "dimensions" or characteristic "aspects" concerned.
(Source: Reich, 1999, p. 139; reproduced in Reich, 2002, p. 89).

No.	Nature of aspects A, B, (C, D)	Relationships between A, B, (C, D)
1	A, B, (C ...) are part of the same conceptual system; are intrinsically independent from each other; they can variously be "linked externally" with each other. Piagetian tasks often involve the elucidation of such relationships within a given closed system, for instance in the case of the pendulum task or the balance scale task.	In agreement with (time independent) formal binary logic (*tertium non datur*) transitivity, associativity, distributivity, commutativity, reversibility (the negation of a negation leads exactly back to the origin) pertain. Logical contradiction is not to be tolerated; the overall system is of a static and synchronous nature.
2	Not defined; a large variety pertains like in the case of human relationships. That large variety invites wide-ranging exploration (differentiation and integration).	Experience of human life, recognition of protagonists' motivations, of their objectives, of personality variables, etc. are more helpful for insights than "logics".
3	Within an open system, A and B belong to different subsystems; they determine each other as do "being" and "non-being", "as such" and "for us", "assimilation" and "accommodation".	Relationships are dynamic and have to do with change and development. The negation of a negation leads to something new: Through becoming, non-being turns into new being and being into non-being.
4	A, B are part of one reference system, C, D of another system. Properties / functions of A and B correspond to analogous properties / functions of C, D: In the case of linked traffic lights, a car driver "surfs" along like a surfer on the ocean waves.	In order for the analogy to work (enlarged search space, better understanding), the similarities of the properties / functions need to be sufficiently strong and evident. Nevertheless, almost by definition there will always also be marked differences.

5	A, B, (C ...) belong to different categories within the frame of a given explanandum; they are "permanently" linked intrinsically, "completely understandable" in their own context; all needed for a genuine insight.	Negations = an iterative refocusing from A onto B and so on, with ideally each time a gain in understanding of their relationship – based on a logic of non-compatibility (which is not incompatibility).

Form of the thought applied and problem structure

Forms of thought considered: (i) (Piagetian) binary operations, (ii) cognitive complex thought (differentiating, integrating – Baker-Brown et al., 1992), (iii) dialectical thinking, (iv) thinking in analogies, (v) relational and contextual reasoning (RCR – trivalent logic; Reich, 1995a, 2002). The main distinguishing characteristics are presented in Table 1.

   Problem structure: Examples of differing structures are (1) cross-word puzzle, (2) settling a clash of interests between differing persons, (3) negotiating better conditions at work, (4) explaining /understanding by reference to something known, (5) explaining the nature of light (Feynman, 1988) in everyday language. The claim is that thought forms (i) to (v) best deal with problems (1) to (5) that is (i) with (1) etc. (see justification in Reich, 2002, pp. 92-97).

   If *matching the thought form to the problem structure* remains difficult to grasp, one may, by way of an analogy, think of a different field: a mathematical representation of a law of nature or the design of a feedback system. Clearly, for acceptable results, the mathematical function (linear or non-linear, continuous or noncontinuous, etc.) has to match the pattern found in nature, respectively the feedback characteristics desired. Another way to look at the issue under discussion is to compare it with the activity of composers of music. They always work with sounds, rhythms, harmonies, tempi, levels of sound volume etc. but at least for quite a number of kinds of music all these have to be adapted to the objective: lullaby, march, waltz, lied, etc. Again, comparable considerations concern various classes of writers: they all work with words mostly arranged in sentences but what differences in word choice, composition of sentences, etc. depending on whether a poem, a comedy, a tragedy, a thriller or a factual report is at issue! To change once more the field, take testing a medical drug: The procedure is quite different when short-term effects, medium-term or long-term effects are studied.

Logics

As one of aims of this paper is to bring out the difference between applying formal binary logic and the trivalent logic anderlying RCR, these logics are briefly discussed. Table 2 shows 16 operations in *binary* logic, representing all logical posibilities with four variables. Many of our electronic gadgets use these operations, for instance no. 2, a disjunction, an OR gate, or no. 4 a conjunction, an AND gate.

   Which are the main characteristics of formal binary (symbolic) logic? It deals with atomic (intrinsically independent) entities, is independent of time and context, is valid in any conceivable universe, and the results of applying it are necessarily so, not contingently. Also, binary operations are strictly reversible (Figure 1).

Table 2. The sixteen binary operations. p, ¬p, q, ¬q = independent variables; x = dependent variable. T = true; F = false. Explanation in text. (From Reich, 2002, p. 80).

x if	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
p & q	T	T	T	T	F	T	T	F	T	F	T	F	F	F	F	F
¬p & q	T	T	T	F	F	T	F	T	F	T	F	T	F	T	F	F
p & ¬q	T	T	F	F	F	F	T	T	T	T	F	F	T	F	T	F
¬p & ¬q	T	F	F	F	F	T	T	T	F	F	T	T	T	F	F	T

The three transformations R (reciprocal transformation: transforms p into nonp and *vice versa*, etc.), C (correlative transformation: transforms a disjunction into a conjunction and *vice versa*), N (negation: combines a R and a C transformation) can be carried out in various combinations and sequences, yet it is always possible to return to the starting point with 100% precision. This is easy to see in Figure 1 by way of looking at the respective Venn-type diagrams. In contrast, in dialectic logic, a double negation does not lead back to the origin but to something new.

What about the trivalent RCR logic? Instead of true and false, there are three truth values, namely *compatible* ("entity" A and "entity" B can be simultaneously present or absent) *incompatible* (cannot be present or absent simultaneously) and *noncompatible* (in one context, in one condition A is much more in the limelight, in another B (Bedau & Oppenheim, 1961). A good illustration of noncompatible is the behaviour of light in the one-slit and the two-slit experiment. In the one-slit case, light behaves like particles, yet like waves in the two-slit case: The observed "nature" of light depends on the context. (see http://www.colorado.edu/physics/2000/schroedinger/two-slit2.html).
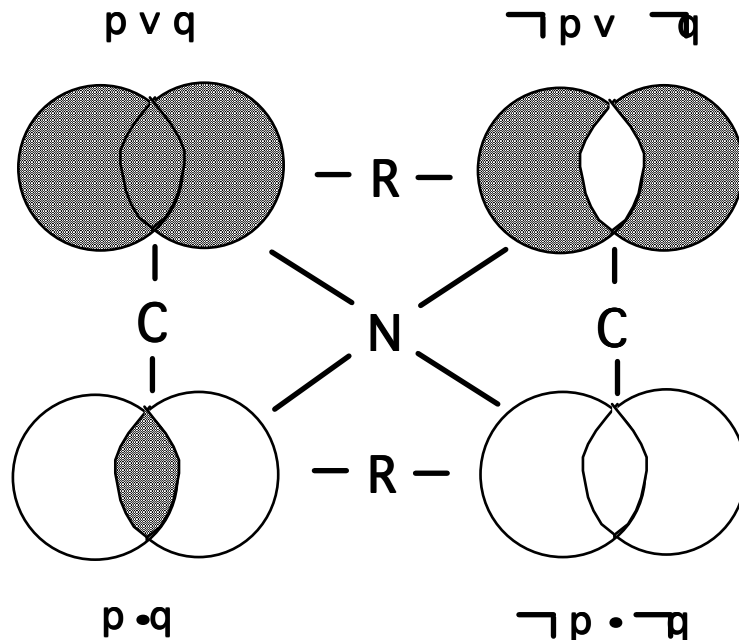

Figure 1. INCR group. I stands for identity transformation (resulting, e.g., from a double negation) N for negation, C for correlative transformation, and R for reciprocal transformation (explanation of transformations in text). (From Reich, 2002, p. 83).

Perhaps less convincingly but more simply, *noncompatible* can be illustrated by means of Figure 2. Upright, most persons see six 3D cubes, after rotating the figure through 180$^{\text{o}}$, most persons see seven.

Figure 3 illustrates the meaning of *noncompatible* by a predicate logical statement. It expesses both the state of affairs in the *One-slit and two-slit experiment*, and what one is supposed to perceive by way of looking at Figure 2 as indicated. Shortly, this logic will be applied to the relation between science and religion / theology, thereby creating a situation not covered by the "standard" typology.
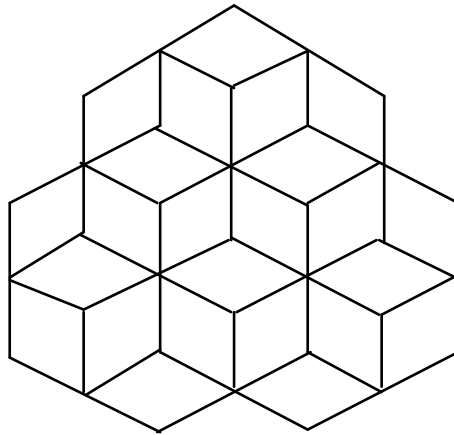

Figure 2. "Figure-ground" shift of the number of cubes (after rotation of the figure by 180$^{\text{o}}$) as an illustration for noncompatibility. (From Reich, 2002, p. 44).

$$(x)\,(\exists C')\,(\exists C'')\,(t)\left[\neg(C' = C'')\,\cdot\,\left\{(x\,\varepsilon\,nc) \supset \left[\left\{\text{Obs}\,(x,\,C',\,t) \supset [F'(x,\,t)\cdot\neg F''(x,\,t)]\right\}\,\cdot\,\left\{\text{Obs}\,(x,\,C'',\,t) \supset [F''(x,\,t)\cdot\neg F'(x,\,t)]\right\}\right]\right\}\right]$$

Figure 3. Noncompatibility according to Bedau and Oppenheim (1961, pp. 213-214). The statement in front of a bracket always refers to the entire content between those particular brackets. Explanation of symbols: x = explanandum, which has the noncompatible features F' and F''; $\exists$ = there exists; C', C'' = context-related conditions; t = time of observation; $\neg$ = not; $\cdot$ = and (conjunction); ε nc = belongs to the validity domain of noncompatibility; $\supset$ = implies; Obs (x, C', t) = observation of x under the condition C' at time t, bringing out F'; F'' = result of observation under condition C''. (From Reich, 2002, p. 45).

"Standard" ways to relate science and religion

This is an ongoing debate (e.g., Clayton, 2005; Polkinghorne, 2005). An often used typology is (i) conflict, (ii) independence, (iii) dialogue, and (iv) integration (cf. Barbour, 1990, pp. 3-30). I assume that this approach is known well enough to obviate the need for explicating it *per se*. Let us just look at the logic involved. Figure 4 shows the Venn diagrams of possible relationships between two classes according to binary logic. Number 1 represents complete mixing, losing class autonomy and even a clear identity, representing relation (iv) integration. Dialogue (iii) is best represented by no. 3, the

classes overlap. No. 2a, b represent the situation where one class is a subset of the other. I can conceive a religion that, even today, considers science to be a subset of religion,. However, this is not so in most of Europe, and would hardly lead to a dialogue among equals. Diagram 4, looked at from "out-side", corresponds to (ii) independence. Looked at from "inside", the other class is ignored (at best) and we have (i) conflict.
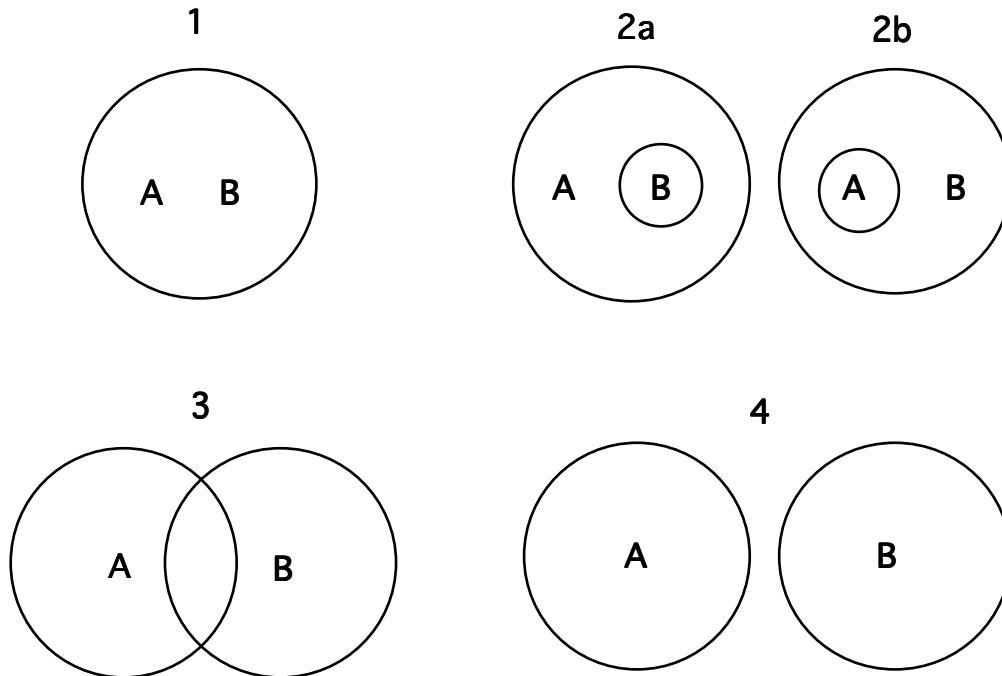

Figure 4. Venn diagrams of class sets (from Reich, 2002, p. 79).

Applying RCR

Relating science to religion *per se* is not an ideal case for demonstrating RCR at work. For one, it is too vast a case to be dealt with in any depth in the present context. However, the overriding advantage is that the "standard" we have been discussing exists to which the result of applying RCR can be compared. We proceed according to the eight formal steps of the RCR heuristic (Reich, 2002, pp. 103-104).

(1) (clarifying and defining, at least tentatively, the entity, the phenomenon, the event, the functionally coherent whole which constitutes the explanandum). The general procedure is to assume that the explanandum is suitable for study by RCR, and then to find out whether that is so by going through the next six steps. To begin with, *relating science and religion / theology* does not appear to be a proper explanandum, because it is not a *functionally coherent whole* (Reich, 1995b). There are quite a few areas where science is of little or no concern to theology (e.g., inorganic chemistry) and *vice versa*, in other issues science supports religion / theology (e.g., by demonstrating the beneficial effects of religious life – Gorsuch, 1995), in yet others it weakens it (e.g., heliocentrism versus Medieval Christian teaching). Also, historically, the relation has changed and still changes, as indicated earlier. Furthermore, there is not just one theology, but a diversity, even in Christianity (Fulljames & Stolberg, 2000). As a consequence, the explanandum has to be more restricted, better focused. The proposal is to concentrate on "Understanding the origin of the universe, its changes until today, and the resulting lessons for leading a human life" (which is still simplifying considerably the actual state of affairs, e.g., Reich, 1995c).

(2) (listing all descriptions / explanations / models / theories / interpretations A, B, C ... of the explanandum). The following convention will be used throughout this section (cf. Barbour, 1990, p. 3): A = science (empirical study of the order and patterns of nature); B = theology (critical reflection on the life and beliefs of the religious community); C = philosophy (analysis of the characteristics of inquiry and knowledge as well as analysis of the most general characteristics of reality). Regarding the explanandum under discussion, A involves cosmogony and cosmology, neo-Darwinian evolution, and biological / sociological anthropology; B refers to the theology of creation (in Christian terms, or to the equivalent in other religions), to that of divine providence, and to theological anthropology; C involves an analysis of methods admitted in A and B for gathering, analysing and interpreting evidence, a procedure for dealing with (perceived) transcendent reality (e.g., Reich, 2000), and philosophical anthropology.

(3) (ascertaining that A, B, C ..., are genuinely coextensive, that they refer to the identical explanandum). This is a much larger task than can be tackled here. At first glance one might say that individually A, B, C, will not have something to say to each and every aspect of the explanandum. That explanandum is clearly a weaker functional whole than, for instance, a single human being. However, this is probably not strong enough a reason to stop the application of RCR at this point.

(4) (establishing the circumstances, the context, under which A, B, C ... describe or explain particular aspects of the explanandum). Again, this is a lengthy study in itself. The suspicion is that A will provide the most relevant explanation of the actual changes of the universe and what it contains from the big bang until today, B on the lessons to be drawn, in particular regarding the inner life of humans (but will possibly also contribute to the presuppositions of A and C), and C on the validity of the "truth" claims of A and B, on the limits of their "legitimacy", and possibly on anthropology.

(5) (discovering and describing any [including unexpected] links between the respective attributes / features of A, B, C ..., as well as any coinherences). A furnishes B with detailed knowledge about the wonders of the universe and all it contains so that B can go on from there. Historically, B has supplied A with a world view which made research possible and attractive; if needed, B reminds A of its responsibility for the environment and human welfare. C furnishes to A and B a base for a rational discourse using consensual categories and procedures.

(6) (assessing the extent to which the [relative] explanatory power of A [B, C ...] depends on the current strength of B [A, C...], etc.). In the present case, the clearest case is probably the dependence of C, but also of B, on A (e.g., brain research). If B weakens, the lessons drawn by A (and perhaps by C) may be too one-sided. If C were to drop out, the quality of the dialogue might suffer.

(7) (developing a complete synopsis or theory that explains all features of the explanandum under differing contextual conditions). Given the difficulties evoked all along in this section, that task will take time. RCR proceeds by keeping A, B, C, distinct, and iterating the sequel from (1) to (7), feeding in each time any new insight gained.

(8) (explaining any shifts in the meaning of the concepts needed to explain the reference, A, B, C ..., and the new synopsis or theory). In the present case there is no obvious candidate for meeting point (8). One could possibly argue for writing science-and-theology(-and-philosophy) in order to emphasise the links found.

To sum up the result: Science-and-theology(-and-philosophy) "jointly" contribute to *Understanding the origin of the universe, its changes until today, and the resulting lessons for leading a human life.* While each discipline contributes something to most issues, science provides the most relevant explanation of the actual changes of the

universe and what it contains from the big bang until today, theology (potentially) contributes most to the lessons to be drawn, in particular regarding the inner life of humans (but possibly contributes also to the presuppositions of science and philosophy), and philosophy is most knowledgeable about the validity of the "truth" claims of science and theology, on the limits of their "legitimacy", and possibly on anthropology. While clearly distinct, on account of certain links each discipline can benefit from the others for flourishing optimally.

Actually, the forgoing result is more of a programme for further work than a complete achievement. However, it is sufficiently different from the above "standard" due to Barbour (1990) and others to warrant a discussion. What are the differences?

(a) The focus is narrowed. In an RCR approach, the entire field is carved up into appropriate domains (Reich, 1995b), and the exercise repeated until the entire field is covered. It is not clear whether an overall summary could then be made in the present case, but if so, it would be more differentiated than the "standard" approach.

(b) Applying RCR results in a single (idealised) relation, not four. From a developmental point of view, this relation is assumed to imply a stage of epistemic cognition, which is likely to be reached more widely in the future, given the existence of exemplars (e.g., John Templeton Foundation 1996; Richardson & Wildman, 1996; Southgate & contributors, 1999 – cf. Reich, 2002, p. 110).

(c) The context dependence of the explanatory power of science, theology, and philosophy is emphasised over against a universal context-independent assessment of their respective contributions / explanatory power.

(d) The links between science, theology and philosophy are made explicit.

(e) Overall, an attitude of mutual collaboration is fostered, given that neither side can *prove* the other side "wrong" as far as discipline-specific, (peer-reviewed) established findings are concerned.

Another example: Anthropology
Here, the central issue is a particular aspect of anthropology as viewed by (Christian) religious believers and by neurobiologists (e.g., Shermer, 1999, pp. 65-69).

Warren Brown and Malcolm Jeeves (1999, p. 139) put that issue as follows:

Proposition 1: Humans are physical beings who also have non-material souls. It is through our souls that we experience and relate to God.

Proposition 2: Humans are neurobiological beings whose mind (also soul, religious experience, etc.) can, in theory, be exhaustively explained by neurochemistry, and ultimately by physics.

Clearly, these propositions, representing traditional Christian theology (proposition 1) and (reductive) scientific physicalism (proposition 2) are dissonant. In particular, (1) intimates free will, and the possibility of eternal life, (2) holds that behaviour is determined (exclusively) by the laws of biology, chemistry and physics.

Applying the RCR heuristic (Reich, 2002, pp. 103-104) to that dissonance, the first task is to determine the explanandum. It shall be: *The nature of human beings and their capacity to relate to a perceived transcendent (God for the adherents to a monotheistic religion)*.

As to step two (listing all descriptions, explanations etc.), we already have proposition 1 above (= A) and proposition 2 (= B). I add a third (= C):

Humans are naked animals who share capacities with other animals, in particular with their nearest primate relatives. However, in humans some of these capacities are more enhanced, for instance *language*, a *theory of mind* (hypothesising what is going on in

another person's mind), *episodic memory*, *conscious top-down agency* (conscious mental control of behaviour), *future orientation* (mental scenarios of future implications of behaviour and events), and *emotional regulation* (cf. Brown & Jeeves, 1999, pp. 144-145). The enhanced capacities have enabled human culture to evolve; it co-determines human behaviour – as does the proximate human group.

Simplifying, A emphasises the spiritual aspect of human beings, B their biological aspect, and C the social aspects.

As the next step, (3), the question has to be answered whether A, B, C are coextensive. If the extension is given by C, then the co-extensionality of A and B with C seems debatable. C considers four explanatory levels: (i) the biological level, (ii) the individual psychological level, (iii) the social (group) level, (iv) the cultural (societal) level. A deals primarily with level (ii). It does not explicitly rule out the other levels (except the biological for the soul), but they remain hazy at best. B deals exclusively with the biological level; the other levels are declared epiphenomena (by implication). From this short comparison, a few questions arise, which would be put to the protagonists: to A, How does the soul communicate with the memory – and with the body? To B, How do social and cultural influences, and in particular those which go against the biological grain (e.g., devotion to visions, ideals) get into that neurochemical system? To C, Exactly at which level(s) are religion and religious experience located, and in particular the perceived transcendence? To do things properly, these questions should be answered before proceeding further. That cannot be done here, but we shall nevertheless continue.

As step 4, we look for circumstances, the context, under which A, B, C each explain best particular aspects of the explanandum. A opens the door to a spiritual life, possibly lasting beyond the death of the body. B makes a rudimentary "religion" of animals understandable such as the "religious" devotion of dogs to their masters, the sun "worship" of baboons, the "ritual dances" of anthropoids, and further animal ritualised behaviour (Wulff, 1997, pp. 146-155). C lets one get a sense of the multivariate nature of religion and religious experience.

Next (step 5), we look for links between respective attributes / features of A, B, and C. Even if A and B seem to be incomplete according to the foregoing considerations, there should nevertheless be links between one or more of their attributes / features and C, for instance concerning the psychosomatic nature of human beings.

Step 6 concerns the relative explanatory power of A in the functioning of (B) and *vice versa*, and so on. At this stage of the debate with the protagonists of (A) and (B), that question cannot be answered satisfactorily because (A) and (B) practically exclude each other as to explanatory claims. (C) could benefit from (B) regarding any biological roots of perceived transcendence.

Next, the penultimate step 7 involves a synopsis. To my mind that critical summing up has to be based on (C). The most difficult part is presumably to explain the relations / connections between the (neuro-)biological level and the individual psychological level, in particular as far as perceived transcendence is concerned (e.g., Zygon, 1999). One would have to go into the ergotropic and the trophotropic forms of arousal (Wulff, 1997, pp. 109-119), and into the latest results of brain research (e.g., Ashbrook & Albright, 1997; d'Aquili & Newberg, 1998, 1999; Joseph, 2002; Ramachandran & Blakeslee, 1998; Persinger, 1993; Reich, 2004a; Russell et al., 1999; Saver & Rabin 1997), being aware though of the speculative nature of some of this writing. Presumably, part of the arguments will centre on the issue as to whether a first-person ontology of the mental is acceptable, or whether only a third-person ontology makes the grade (e.g., JCS, 2003, 2004). As regards the important relations / connections between the individual psy-

chological level, the social level, and the cultural level, much material exists, given the longer history of the corresponding research. Thus at least a descriptive synopsis should be possible.

Finally, (8), any shift in meaning of the terms used should be explained, here primarily the *soul* (e.g. Brown, 1998). Brown and Jeeves (1999, p. 145) find attractive to view it as emerging from the experience of personal relatedness. I would say "relatedness to other people, to nature, and to what is transcendent as perceived by the person concerned." Such relatedness can be considered a core characteristics of spirituality (Reich, Oser, & Scarlett, 1999).

Once more, RCR's contribution was to determine the explanandum in terms of a functionally coherent whole, to add a further description / explanation, to uncover missing information, to discover links between A, B, C, and to thematise the context dependence of the respective explanatory power (cf. Sharpe, 2000, for an example of witnessing the RCR heuristic [tacitly] at work). Of course, the real work remains to be done by the experts in the various disciplines.

Conclusions

The application of RCR opens up an approach not accessible by binary logic. In my view at least, it better matches the nature of the science-and-religion relation (cf. Russell, 1989). Both disciplines are after "truth" in a universe that can be considered as a whole, yet needs to described and explained at various levels. Applying RCR ensures that (i) each discipline is dealt with in its own right, (ii) intrinsic links are searched for and clarified (usually not of the type cause-and-effect but more of mutual enabling and limiting, information flow, "kinship", etc.), (iii) the context dependence of the respective explanatory power is brought out, (iv) if all goes well, a more comprehensive, more satisfying overarching synopsis or even theory is developed.

If, finally, a speculative remark is permitted: In the psychotherapy of drug and alcohol addicts it appears that recovery involves healing "splits" that are root causes of the addiction (Blakeney, Blakeney & Reich, 2005). Examples for such splits are affect-logical splits (the individual "knows better" but continues nevertheless the cycle of misbehaviour) or interpersonal splits (imbalance regarding enmeshment with the context [over-accommodation to others] or detachment from context [over-assimilative ego-centrism]). This research brought out that recovered individuals had (unwittingly) applied RCR via spiritual development. Is it unreasonable to imagine that the health of the science-and-religion debate would improve if RCR were applied more widely?

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