Source: Werner Ulrich: "Some difficulties of ecological thinking, considered from a critical systems perspective: a plea for critical holism." *Systems Practice,* Vol. 6, No. 6, 1993, pp. 583-611.

Some Difficulties of Ecological Thinking, Considered From a Critical Systems Perspective: A Plea for Critical Holism[1]

Werner Ulrich[2,3]

ABSTRACT

We probably have simplified matters too much. We tend to talk about systems thinking and practice as if we knew what they are. The fashionable call for "holistic" or "systems" thinking in ecological issues provides a major example. This much is certain: the quest for comprehensiveness, although it represents an epistemologically necessary idea, is not realizable. If we assume that it is realizable, the critical idea underlying the quest will be perverted into its opposite, i.e., into a false pretension to superior knowledge and understanding – a danger of which the environmental movement does not always appear to be sufficiently aware.

My question, therefore, is this: How can we deal critically with the fact that our thinking and hence, our knowledge, designs, and actions, cannot possibly be comprehensive, in the sense that we never "comprehend" all that ought to be understood before we pass to judgment and action? What consequences does this fact imply for a critical systems approach to ecological concerns, and ultimately, for our concepts of rationality in general?

KEY WORDS: ecological thinking; holism; critical holism; critical systems thinking; critical systems heuristics; boundary judgments.

---

[1] Revised version of an opening address presented to the "Aegean Seminar" of the University of the Aegean, a seminar held in Pythagorion on the Island of Samos, Greece, 30 September-4 October 1991, and dedicated to the topic of "Sustainable Development Through Systems Thinking and Design."

[2] Faculty of Philosophy, University of Fribourg, Switzerland.

[3] Email: Werner Ulrich.

1. SYSTEMS THINKING AND DESIGN . . . YES, BUT HOW?

According to a widely held understanding of the systems idea, systems thinking means an effort to "look at the whole" of an issue, e.g., to include the entire relevant problem environment in one's definition of a design problem. (I use **[||584]** the term "problem environment" not only in the sense of "ecological environment" but rather as referring to all those factors which influence the outcome of a design but are not controlled by the designers and decision makers involved.) This holistic notion of systems thinking is all right in itself, but it remains practically useless. Practically speaking, such an understanding of the systems idea requires us to go through a never-ending process of expanding the boundaries of our problem definition, to the point where it might encompass God and the World. The implication is that the best systems thinker is the one who works on the biggest problem.

Ecologists find themselves placed in a somewhat similar situation. Ecology, even if we understand it narrowly as a natural science only (an understanding that I do *not* mean to propose), distinguishes itself from economics through its comprehensive definition of the *oikos,* i.e., the household that is to be considered and the resources that are to be managed: ecological rationality has as its point of reference the biggest of all households, the household of nature. But then, nature's household has of course long since been influenced by man, so that *comprehensive thinking on ecological issues can find no natural boundaries.* For this reason, ecology – at least from a systems point of view – should not be taken to be a natural science only.

Ecological and systems thinking in this respect appear to be nearly congruent. This is so because the underlying epistemological difficulty of the two fields is really the same: their shared fundamental problem is the unsolved *problem of holism.* The problem consists in a dilemma, namely, that the holistic imperative of "considering everything relevant" is philosophically as inescapable as it is impracticable. Systems thinking, because it shares this dilemma with ecological rationality, can thus hardly be expected to be a remedy for the difficulties of ecological thinking.

Why, then, should we attempt to secure *sustainable development through systems thinking and design,* as this year's topic of the Aegean Seminar suggests? How can we escape the implication of the problem of holism, namely, that problems *either* are not adequately defined (in so far as they do not include the entire problem environment) *or* are too big and too complex to be solved? Considering this dilemma, it seems to me that something must be wrong with our contemporary understanding of holistic thinking as it

is embodied in both systems theory and ecology. If ecological and systems thinking ultimately imply that the best planner is the one who takes up the biggest problems or, to put it in a less sloppy way, that an action-oriented delimitation of problems amounts to a deficit of rationality, it should hardly surprise us that the practical relevance of the systems approach for securing ecologically rational decision making has remained limited.

It appears to me that *the call for "holistic" or "systems" thinking*, popular as it has become through the writings of authors such as Fritjof Capra (1982) **[||585]** and Frederic Vester (1983, 1988; also Vester/Hesler, 1980), *is really too simple:* the problem of sustainable development resides much deeper than in, say, the willingness of planners and decision makers to become more holistic in their ways of thinking. The deeper problem for me lies in the *concept of rationality* that underlies most of contemporary systems theory and systems methodologies. Its roots are largely the same as those of the conventional analytical-reductionist model of science; they are to be found in Kant's ideal of a rationality that would be so comprehensive as to become transparent to itself and to justify the conditions of its own possibility in an absolute, because complete, fashion – for the totality of conditions, according to a famous remark by Kant (1787, p. B379), is itself unconditioned. Hence it is clear that appealing to the willingness of planners and decision makers to think comprehensively, begs the question – namely, of how under normal conditions of imperfect rationality we (and "they") can be arguably "rational." So long as this question remains unanswered, systems thinking and design must remain vague, if not mystical, in regard to its claims for a superior kind of rationality, and all efforts of systems methodologies to develop methodological rigor will be built on sand.

Paradoxically, it is not the systems approach but the analytical-reductionist model of science which in the past has dealt with the problem of holism with remarkable success and rigor. In science, Kant's holistic concept of rationality has led to the ideal type of the controlled laboratory experiment, in which the inseparability of problems from their environments can at least temporarily be suspended. The experimental sciences rely on the fact that in purely theoretical-instrumental issues, the ideal of complete rationality can be approximated by the best possible control of external interferences. Within the limits of the experimental conditions under control, the laboratory setting renders comprehensive instrumental rationality practicable.

My conclusion from this short excursion to the laboratory may come as a surprise but may help us to understand some of the difficulties invoked by the systems idea: reductionism is a consequence of the same concept of rationality as is the quest for

comprehensiveness. The two notions of rationality – the model of science and the systems approach – find common ground in their striving for unconditional justification. This may explain why the abstract concept of systems has won so much popularity; the systems approach has in fact become a part of the very scientistic culture that it originally set out to overcome. Scientism is impoverished in that it identifies the limits of rationality with the model of science, i.e., with instrumental rationality. I find it certainly symptomatic that a majority of systems thinkers today understand themselves as "systems scientists." The systems idea has been tamed and has become "*systems science"* or, at best, *"soft systems thinking." The necessary break-through to the other, practically normative dimension of rationality has not as yet been accomplished.*

Systems science has indeed remained as similarly one-eyed as conventional **[||586]** science with respect to the two-dimensionality of reason. I have elsewhere (Ulrich, 1988a, pp. 140ff) discussed this two-dimensionality of reason in some detail and thus can limit myself here to recalling one major implication for systems practice: namely, that the conventional "monological," instrumental and functional (often utilitarian) concept of rationality needs to be complemented by the "dialogical" (communicative) and normative (ethical) dimension of rational practice. And since in practice the two dimensions of rationality will frequently be in conflict with each other, it is not sufficient to "welcome" the idea of communicative in addition to functional rationalization of systems. It is indispensable to demonstrate exactly how practical reason can be practiced *without* simply presupposing that everybody involved is willing and able to be perfectly rational. It will thus not be enough to merely open again the closed second eye and to acknowledge the existence of the normative dimension; nor will some occasional decisionistic appeals to the moral responsibility of systems planners do. It is not only at the level of personal awareness but at the level of methodological tools that the normative dimension needs to be incorporated, so that it can become an intrinsic part of rational argumentation.

The contemporary deficit not only of *awareness* but of *methodology* with respect to the normative dimension of rationality is probably the most serious consequence of scientism. Moral judgment has been eliminated from our concepts of rationality as far as they are actually built into existent scientific and systems methodologies. And yet it is the very task of ethics – more so than of any other kind of reflection and argumentation – to strive for a comprehensive justification of good and "right" actions.

The underlying difficulty, I think, is this. In ethics, the quest for comprehensiveness does not allow us to retreat to the laboratory but rather requires us to "sweep in"

(Churchman) the whole environment of the problem at issue. The reductionistic principles of experimental control are replaced by the *principle of universalization*, a principle that is known to all of us through Kant's (1786, 1788) *categorical imperative.* Unfortunately, this other consequence of holistic thinking leaves us no possibility to suspend experimentally the interconnections of the real world. Rather, it confronts us with the really ideal, i.e., inexorably counterfactual, nature of systems rationality. *The paradoxical consequence of conventional holism is ethical skepticism.*

It is thus in ethics (as well as in ecology) that the holistic ideal really shows both its truly indispensable character with regard to the justification of applied inquiry and its impracticability with respect to methodology. If we are to find a way out of this dilemma, a different understanding of holism is in order – one that would do justice to the critical intent of Kant's philosophy without sacrificing practicability. **[||587]**

2. THE NEED FOR A CRITICALLY HEURISTIC TURN – TOWARD CRITICAL HOLISM

My conclusion from the preceding reflections on the problem of holism is a *plea for critical holism.* Let me try to circumscribe my understanding of critical holism by means of four basic concerns:

1. The central issue of concern to critical holism is the question of how a *concept of systemic rationality* could at the same time be critically tenable *and* practicable (cf. Ulrich, 1981a, pp. 26-34; 1983; 1990b; 1992).

2. From previous holistic philosophies (e.g., Smuts, 1926; Haldane, 1931; Meyer-Abich, 1948) – philosophies that prepared the ground for the rise of systems theory in biology and for today's "ecological paradigm" – critical holism distinguishes itself by its goal of breaking through the limitations of theoretical reason to the *practical dimension of reason.* Critical holism is grounded in practical philosophy.

3. Against the Kantian ideal of unconditional (complete, objective) justification contained in the holistic quest for comprehensiveness, critical holism posits an alternative "*ethos of justification"* (Ulrich, 1984, p. 328). It says that the rationality of applied inquiry and design is to be measured not by the (impossible) avoidance of justification deficits but by the degree to which it deals with such deficits in a transparent, self-critical, and self-limiting way.

4. *Critically holistic thinking is, of necessity, critically normative thinking.* I call a methodology *"critically normative"* if it fulfills the following two conditions.

   (a) It offers methodical help in identifying the *normative content,* i.e., the value-laden premises and life-practical implications, of the propositions it helps to find; it thereby guides the process of formulating and understanding problems of inquiry or design by systematically tracing the normative content of alternative ways to define and solve the problems in question.

   (b) It understands the question of the *normative validity* of its propositions as an intrinsic part of its concept of rationality; that is, it does not refer the normative content of propositions to an extrarational domain of merely subjective acts of faith but instead provides operational tools for critical reflection and cogent argumentation on disputed normative validity claims.

   In one phrase, a methodology is critically normative if it always serves as a tool of instrumental *and practical* reason at the same time, but never one-dimensionally of instrumental reason only; for the latter possibility **[||588]** would mean that it excludes the normative content of instrumental rationality from its concept of rationality in operation. Accordingly, only those *systems* methodologies will be critically normative methodologies which do not restrict their employment of the systems idea to its merely instrumental (or functionalistic) interpretation but rather employ it as a tool of practical reason. The failure of contemporary systems approaches to employ the systems idea in such a critically normative manner is apparent. (I have sought to demonstrate this from various viewpoints, e.g., in Ulrich, 1977, pp. 1100ff; 1980; 1981a; 1981b; 1983, pp. 21ff, 222ff, 326ff and passim; 1988a, pp. 143ff; 1989; 1990a; 1990b.)

The question then poses itself of how these four basic postulates of critical holism might be translated into an operational, critically normative approach to dealing with deficits of systems (ecological) rationality. This is the question to which I have dedicated my "critical systems heuristics."

Critical systems heuristics, or simply critical heuristics, understands itself as a new approach both to practical philosophy and to systems thinking. By unifying the two fields within an epistemologically well-defined framework, critical heuristics aims to provide *first* a theoretical foundation and *second* a practicable heuristic operationalization of critically normative systems thinking. It can also serve us as a framework for developing the principles of a new, critical, holism.

3. THEORETICAL FOUNDATION: A "THIRD WAY" IN EPISTEMOLOGY

The theoretical (epistemological) underpinnings of critical systems heuristics have not always been well understood by its commentators. Perhaps it is useful to state briefly its different orientation as compared to the two dominating "schools" in the philosophy of (applied) science. This will help us to understand the difference that the practical tools of critical heuristics are to make. For a full discussion, I must, however, refer the reader to the original source (Ulrich, 1983).

Since the times of Aristotle and Plato, epistemological and methodological issues have been debated from the point of view of two seemingly irreconcilable positions, the "analytical" (originally: "realist") position and the "dialectical" (originally: "idealist") position. The first position, represented by analytical philosophy, logical empiricism, and critical rationalism, is dominating in the prevailing theory of knowledge; fundamental is Popper (1961; 1972; for extensive critical discussion see Ulrich, 1983, pp. 28-30 and 41-105). It declares **[||589]** practical reason to be impossible and, in effect, reduces practical to instrumental reason, while referring normative issues to an irrational domain of merely subjective acts of faith. The implication is scientism – the identification of rationality with the limits of science – and subsequently the immunization of scientific rationality and expertise against the critical efforts of practical reason. The second position is represented by the critical theory of Jürgen Habermas (e.g., 1964; 1971a; 1971b; 1973a; 1973b; 1984; I have likewise given an extensive critical discussion in Ulrich, 1983, pp. 30-34 and 106-173, esp. 152ff). It insists that practical reason must be possible and is in fact a necessary presupposition for the possibility of theoretical reason; but its holistic concept of practical reason is so ideal that its theoretical insights cannot be transposed into operational methodology. Its mobilization of practical philosophy against scientism for me is theoretically convincing, but practically speaking it is bound to remain a mere program.

Critical heuristics seeks to find a *"third way"* between these two unsatisfactory classical positions. Similarly to critical theory, this third way accepts the intrinsic complementarity and interdependence of theoretical and practical reason; unlike critical theory, its central concern is *practicability.* Similarly to critical rationalism, it seeks to achieve practicability by grounding its methodology not immediately on Kant's ideally holistic concept of rationality but on a practicable concept of rational argumentation; unlike critical rationalism, it achieves this purpose not by throwing the holistic idea overboard and, thereby, reducing practical to instrumental reason but, rather, in that it understands the

holistic idea – the systems idea – as having critical significance only; hence, it limits itself to the task of securing at least a *critical solution* to the problem of practical reason. A critical solution does not yield any "objective" justifications of normative validity claims; but it can at least make us competent in dealing critically with the normative content of applied inquiry and design, and in arguing *rationally* against false validity claims, e.g., on the part of those who have the expertise and power to decide.

This basic shift of orientation opens the way for developing a new degree of self-critical and emancipatory awareness of systems thinking with regard to issues of unequal or oppressive societal conditions under which "rational" design and argumentation take place. The rise of "critical systems thinking" in the last years testifies to this new awareness. It seems to me, though, that the new awareness – and the claims linked to it – are not always redeemed *methodologically*, that is, by showing how exactly such awareness translates into practicable tools of competent argumentation. Critical heuristics is concerned in this methodological issue.

In this context, I would like briefly to point out two intentions of critical heuristics that appear to have been misunderstood quite frequently. **[||590]**

(a) Apart from representing a specific technique mainly for "simple-coercive problem contexts," as Flood and Jackson (1991b, pp. 198-222, esp. 217f) ideal-typically classify it in their grid of systems methodologies, critical heuristics has worked out a number of methodological key ideas for turning *any* systems methodology into a critically normative methodology. This is quite different from what Flood and Jackson (1991a; 1991b, p. 219; similarly Jackson, 1985, p. 880; 1991b, p. 193) have noted, namely, that "Ulrich's criticisms of systems science and cybernetics seem somewhat overplayed and the important role that instrumental reason can offer when handled critically [sic!] in planning tends, therefore, to get neglected." The point is, indeed, that instrumental reason needs to be handled critically to provide useful orientation for action, and that systems science thus far has hardly developed the methodological competence required. I cannot see why this critique, the basis of which is a fundamental complementarism with regard to the relationship of instrumental and practical reason,[4] should be overplayed, or why the effort of critical heuristics to develop tools just for this task of "dealing critically with

[4] The critically-heuristic turn of systems thinking proposed in the author's original work (Ulrich, 1983) was explicitly based on a replacement of the usual dichotomy between theoretical and practical reason by a *complementary view;* compare Ulrich (1983, pp. 222, 274). Compare also my frequent references to the two-dimensionality of reason throughout my writings; more recently I have described the same complemetarism underlying critical heuristics in terms of "three complementary levels of rational systems practice" (three-level concept of rational systems practice; see Ulrich, 1988, pp. 146ff).

instrumental reason" should imply a neglect of the importance of instrumental rationality in planning.[5]

Regarding the need for other, more instrumentally oriented methods, critical heuristics does not of course pretend to be a self-sufficient technique of rational design. Conforming to its underlying complementarism, it aims to complement instrumental knowledge and expertise, as promoted by other methods, with critically normative competence. In particular, it aims to render thus competent not only those involved in **[||591]** the application of instrumental expertise (planners, experts, decision makers), but also ordinary citizens who may be affected by instrumental rationality. I briefly explain how critical heuristics seeks to achieve this end in Sections 7 and 8; at this stage, I merely wish to avoid another misunderstanding.

(b) The second misunderstanding in question concerns the allegedly "utopian" or "idealistic" character of critical heuristics' intent (Jackson, 1985, p. 881; 1991b, p. 193f; Wilmott, 1989, p. 74; Flood and Jackson, 1991b, p. 217f). The charge is based on a Marxist view of social theory and maintains that a critical approach must theoretically account for the "material conditions" that give rise to practical propositions. This objection seems to ignore one of the specific points that distinguish critical heuristics from previous efforts to deal with the problem of practical reason, namely, the attention given to the limited (but practicable) goal of securing cogent critical argumentation *under everyday conditions of imperfect rationality*, i.e., under asymmetric distribution of expertise, power, and argumentative skills. The goal is *not* to secure an ideal speech situation in Habermas' terms but rather to deal critically (and practically) with the fact that such a situation is never given. The critics have argued that only a critical theory of society, such as advocated by Jürgen Habermas, can properly account for the sources of unequal distribution of power, namely, by explaining the nature and development of material social conditions. This may be true but provides no argument against pursuing the idea of a critical heuristics of social systems design, as distinguished from a critical theory of society. The two approaches to the problem of practical reason pursue different ends and

[5] It seems to me that it is in fact Flood and Jackson's (1991b) grid of systems methodologies which is rather problematic as far as its handling of complementarism is concerned. From a critical point of view, no systems approach must ever assume its application context to be (even ideal-typically) "unitary" or "pluralistic" (i.e., non-coercive), especially if that assumption is then taken to imply that in the situation at hand, systematic critically normative reflection on the practical dimension of reason need not be an essential part of "systems rationality" and a basically instrumental concept of rationality is good enough. Quite counter to Jackson's (1991a, p. 141; similarly 1991b, p. 193) account – according to which "it would be wrong to see Ulrich's approach as advancing critical systems conclusions, for … it is not committed to the complementary and informed use of all varieties of the systems approach" – critical systems heuristics to me represents the one approach in Flood and Jackson's grid that is truly oriented toward a *critically* complementary use of systems methodologies.

cannot replace each other (cf. the section "Conclusions: Critical Theory or Critical Heuristics?" in Ulrich, 1983, pp. 152-172). A critical theory of society might surely provide a useful background for developing tools of emancipatory reflection and critical argumentation; however, a sufficiently broad and substantial critical theory of society – a theory that would fully describe and explain the specific material conditions which in different sectors of specific societies produce asymmetric distributions of power and, thus, of argumentative chances – seems far from being available today. Even if it existed, is it not utopian to assume that it could claim general (standpoint-free?) validity and that it could help us not only to understand but also practically to *secure* conditions of undistorted discourse, i.e., ideal conditions of complete rationality? Is it not far less utopian to assume that equal distribution of power and undistorted discourse will always remain an ideal and, hence, to put the systems idea to work **[||592]** on the job of dealing critically with everyday conditions of imperfect rationality, rather than seeking to base critical systems thinking – that is, *practicable* strategies of critique and emancipation – on such a universal theory? As against the inherently elitist Utopia of an omnipotent social theory, I propose the "emancipatory" effort of critical heuristics to empower ordinary citizens so that they know how to deal with situations of unequal expertise and power. It seems to me that critical heuristics is indeed capable of demonstrating practical strategies for so empowering ordinary people, and I will try to explain my basic conjectures in this respect. Let us, then, turn to the question of how critical heuristics seeks to operationalize this critical intent.[6]

[6] In what follows, I cannot of course give a full account of how exactly critical systems heuristics seeks to operationalize critically normative systems thinking. For this I must again refer the reader to the original sources (esp. Ulrich, 1983; 1984; 1987; 1988a) and, in addition, to some discussions of critical heuristics by various authors (e.g., Flood and Jackson, 1991a; 1991b, pp. 197-222; Jackson, 1985; similarly 1991b, pp. 187-194 and passim; Steinmann, 1986; 1987). It should have become clear by the previous remarks that my reference to these additional sources does not mean that I always agree with their comments on critical systems heuristics – they may none the less be helpful to other readers.

4. ECOLOGICAL THINKING AND DESIGN AS THE STUDY OF CONTEXTS OF APPLICATION

Perhaps the most fundamental concept of critical systems heuristics is the "context of application." As the *context of application* I designate that section of the natural (ecological) and societal world which is to be considered as relevant when it comes to justifying a design's or a proposition's normative content, i.e., the value judgments flowing into it and the life-practical consequences it may have for those affected by its implementation (cf. Ulrich, 1983, pp. 224ff; 1987, p. 278). On the context of application depend virtually all judgments that determine a design's instrumental and practical rationality, from the "facts" that we recognize as relevant for defining the problem and on which different parties involved can agree ("What is the case?") to the design's actual or potential life-practical consequences and ecological impacts we identify ("What impacts are to be expected, and who will be affected by them?") and to the value judgments by which we evaluate those facts and impact assessments ("What should be the case, what is our criterion of improvement?").

The crucial point is that the context of application is never given objectively; it needs to be delimited by *judgment* from the total universe of facts and value implications that might be considered.[7] It cannot therefore be justified by **[||593]** reference to experience alone. The "right" boundary judgments depend on the subjective interests, values, and knowledge of those who judge, which is to say that boundary judgments (if recognized as such and laid open to everyone concerned) will tend to be disputed. A theoretically sufficient ("objective") justification will not be available; at best an "informed consent" of all those involved and affected can be attained.

It follows that any justification of some theoretical (instrumental) or practical (normative) proposition, be it a problem definition, a design, an evaluation or any other kind of validity claim, raises a *genuinely systems-theoretical issue:* What is the "whole system" to be considered, and what other aspects of the total universe are to be treated as "environment"? To say it more pointedly: *There are no propositions without environment.*[8] Not even the best conceivable effort at securing comprehensive ecological thinking can escape the implication of this systems-theoretical insight, namely, that the

[7] Note that the concept of the context of application here immediately leads us to one possible (though unusual) explanation of the earlier mentioned interdependence of instrumental and practical reason: instrumental judgments depend for their validation on assumed contexts of application, which in turn depend on normative assumptions about the "right" section of the total universe to be considered.

[8] See Section 1, first paragraph, regarding my use of the term "environment" here.

ecological rationality of a disputed design cannot be established by referring to the comprehensive inquiry undertaken or by the systems methodology employed.

Perhaps we should briefly consider an *example*. I think the on-going debate in many countries on the problem of nuclear waste disposal illustrates the importance of the context of application well. Typically, projects are undertaken that should establish scientifically the feasibility and safety of long-term storage, say, in some deep layer of rocks. And just as typically, the different parties – proponents and opponents, including the experts on all sides – are at cross-purposes (sic!). They disagree not because the ones argue rationally and the others don't, as the parties mutually reproach each other, but rather because their assertions of facts and their ethical judgments relate to different contexts. In particular, it is of obvious importance whether and to what extent the interests of future generations belong to the context of application to which refer the disputed propositions as to the technical feasibility, the safety, and the political or ethical legitimation of waste disposal projects. The dispute is really about the question of what is the "right" context of application (Does it include future generations, and if yes, how many hundreds or thousands years does it stretch into the future?); it is *not* primarily about different scientific judgments as to nuclear waste decay times, rock formations, and so on, or about principally different moral principles. How else should we explain the fact that the opposed parties frequently enough refer to the same scientific findings or moral claims, and yet they disagree fundamentally?[9] **[||594]**

5. UNDERSTANDING JUSTIFICATION DEFICITS AS BOUNDARY JUDGMENTS

A second important aspect of the context of application is this. From a systems-theoretical viewpoint, *any* deficit of justification can, in principle, be equated with an insufficiently delimited context; for if we are willing to handle some relevant aspect as part of the application context but then, nevertheless, consider it insufficiently in our analysis and argumentation, we have in fact added it to the problem environment.

Apart from such normal deficits of justification *within* a chain of argumentation, it is of course also a normal fact that every attempt to justify a proposition or a design must

[9] Regarding the difficult issue of how systems thinking and design might seek to include future generations in its context of application, see Ulrich (1990c). Also of fundamental importance in this context is a critical systems perspective of ethics, compare Ulrich (1990b; 1994).

start with some premises and end with some conclusions which it cannot question any further. That is, every chain of argumentation begins and ends with some *justification break-offs*. Systems theoretically speaking, this rather trivial observation translates into a much more helpful formula: *Any deficit of justification implies a boundary judgment with respect to the relevant context of application, and vice-versa.*

This insight is indeed important for a critical systems approach; it provides us with a basic point of departure for developing a systematic, rigorous, *and general* approach to critically-normative systems thinking – general in the sense that is should be relevant to any kind of applied inquiry and design, be it based on a conventional "hard" systems methodology such as systems dynamics (Forrester, 1961, 1969; Wolstenhome, 1990) or viable systems diagnosis (Beer, 1979, 1981, 1985), a "soft" systems approach such as soft systems methodology (Checkland, 1981; Checkland and Scholes, 1990; Wilson, 1984), strategic assumption surfacing and testing (Mason, 1969; Mason and Mitroff, 1981) or interactive planning (Ackoff, 1974, 1978, 1981a, 1981b; see also Flood and Jackson, 1991b, and Jackson, 1991b, for short descriptions of all the methodologies mentioned thus far, including critical heuristics), some other systems-based approach or any other kind of approach.

6. DEALING CRITICALLY WITH BOUNDARY JUDGMENTS

Critical systems heuristics, inspired originally by Churchman's (1968, 1971, 1979) "dialectical" systems approach but then developed systematically within a framework of contemporary practical philosophy and critical theory, has worked out a list of twelve types of boundary judgments, each of which inevitably flows into any systems design. The list can be presented either as a *table of critically heuristic categories* (see Table I) or as a *checklist of boundary questions* (see Table II).

Conceiving of boundary judgments in terms of basic *categories* has the advantage of relating the boundary judgments back to their origin in a reconstruction **[||595]** of Kantian a priori science within a framework of communication-theoretically based practical philosophy. In the course of this reconstruction, the transcendental status claimed by Kant for his categories (as a priori concepts of experience) was analyzed carefully with respect to its critical intent and attention was given to the goal of preserving this critical intent in the transition from Kantian a priori science to critical

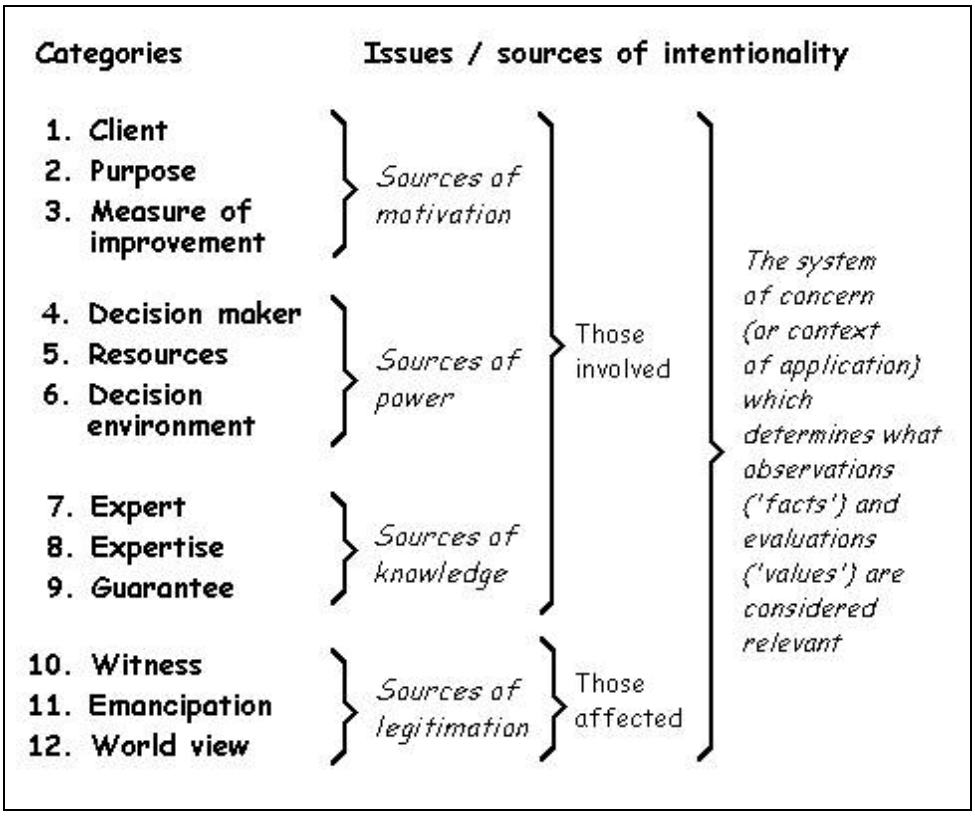

Table I: Basic categories for describing the normative content of systems designs in terms of boundary judgments. The first category of each group refers to a *social role*, the second to the crucial type of *role-specific concerns*, and the third to the related *crux* in determining the boundary judgments in question. The first category of each group is basic, while the two others serve an auxiliary function. Source: Ulrich (1983, p. 258)

heuristics, i.e., to merely relatively a priori concepts of practical reason. Relatively a priori they are in that they are constitutive of mere "forms of judgment," that is, they are devoid of empirical and normative content but are in need of being substantiated empirically and normatively. As such they are presupposed in any adequate definition (description, design) of a system, for it is only by making explicit the empirical and normative content of these categories, or of the respective boundary judgments, that a critical solution to the problem of practical reason (and of rational justification in general) can be secured.

The twelve critically heuristic categories are organized into four groups of three categories each. Constitutive of each group is a distinct social role; the first **[||596]** three groups relate to roles and concerns of *those involved* (having a say) in the planning process, whereas the fourth group refers to *those affected* but not involved.

The four groups of categories are intended to address the following key issues of critically normative (systems) design:

1. The design's *value basis:* What are (ought to be) the sources of motivation that provide the necessary sense of direction and purposefulness? What purposes are served? Whose purposes are they? and What is (ought to be) the decisive measure of success?
2. The design's *basis of power:* What are (ought to be) the sources of control built into the design? That is, who controls the necessary means and resources? Where does the necessary decision authority reside? What is (ought to be) environment to that decision power, i.e., lay beyond its control?
3. The design's *basis of knowledge:* What are (ought to be) the sources of expertise that contribute the necessary information, practical experience and know-how, organizational and design skills? What is the role played by expertise?
4. The design's *basis of legitimation:* What are (ought to be) the sources of legitimacy vis-à-vis those affected but not involved? Is there a sense of self-reflection and responsibility built into the design? Who argues the case of those who cannot speak for themselves, including nature and those not yet born?

This way of explaining the intent of the categories quite naturally leads us to the second mentioned possibility of introducing them, namely, by means of boundary questions. But before, I would like briefly to consider a possible objection.

It might be asked why sociological categories rather than, for instance, ecological categories are given a basic critically heuristic importance for tracing the normative content of designs, and whether there is not a danger of hidden *anthropocentrism* in this conceptual framework. The answer is, I think, that identifying a design's normative content does indeed pass through the awareness of humans and in this sense is inescapably anthropocentric; the question is not whether we are anthropocentric or not but only how critically we deal with the fact that we are. It is essential to understand what norms are all about: "Norms regulate legitimate chances for the satisfaction of needs." (Habermas, 1973b, p. 251) Norms may of course address the needs of nonhuman species or of nature in general, but they still need to be articulated, and respected, by humans. In that sense norms belong not to "the" phenomenal world of nature but to "our" world of society, as Habermas likes to say. For instance, when ecological issues are at stake, nature (e.g., some endangered species) does not speak for itself **[||597]**; it is through the awareness of responsible men and women (be that awareness of an

(1)	Who is (ought to be) the *client* of the system S to be designed or improved, i.e., belong to the group of those whose purposes (interests and values) are served?
(2)	What is (ought to be) the *purpose* of S, as being measured not by the declared goals of the designers but by the design's actual or potential consequences?
(3)	What is (ought to be) S's built in *measure of improvement*, as judged by the trade-offs accepted in respect of conflicting purposes?
(4)	Who is (ought to be) the *decision maker*, i.e., who has (should have) the power to define and to change S's measure of improvement?
(5)	What *components* (resources and constraints) of S are (ought to be) controlled by the decision maker, that is, what conditions of successful planning and implementation of S are (should be) under his control?
(6)	What resources and conditions are (ought to be) part of S's *environment*, i.e., not controlled by the decision maker?
(7)	Who is (ought to be) involved as *planner* or designer of S?
(8)	What kind of *expertise* is (ought to be) considered in the design of S, i.e., who is (ought to be) considered an expert and what is (should be) his role?
(9)	Who or what is (ought to be) assumed to be the *guarantor* of S, i.e., where do (should) the involved seek some guarantee that the design will be implemented and will secure improvement?
(10)	Who belongs (ought to belong) to the *witnesses* representing the concerns of those affected by S but not involved in its design, including those who cannot speak for themselves because they are handicapped, unborn, or part of the nonhuman nature?
(11)	To what extent and in what way are the affected given (ought they be given) the chance of *emancipation* from the premises and promises of the involved? Are they (should they be) treated not only as means but also as "ends in themselves"?
(12)	What *world view* actually underlies (ought to underlie) the design of S? Is it the world view of (some of) the involved or of (some of) the affected?

Table II: Checklist of critically heuristic boundary questions for identifying and debating the normative content of systems designs in the "is" ("ought") mode. Adapted from Ulrich (1987, p. 279f); originally in Ulrich (1984, pp. 338ff).

ethical, religious, or purely aesthetic character) that systems design will respect nature as a value in itself. It is therefore desirable that conceptual frameworks for ecological thinking include sociological categories referring to the value basis, as well as to the basis of power, of knowledge and of legitimation, of any ecological discourse. Perhaps critically heuristic categories such as the "client" (beneficiary), the "purpose," and the "measure of improvement" of a design, its "environment," its assumed "guarantor," its provisions for the "emancipation" of those not belonging to the client, etc., are apt to increase the attention we give to the tacit anthropocentric assumptions of many ecological discourses, say, about environmental impact assessments; for although they were not specifically developed to that end, they burst the frequent limitation of such discourses to natural-science categories. **[||598]**

Let us now turn to the second way of presenting the boundary judgments. Table II shows the checklist of critically heuristic *boundary questions*. As before, the questions are grouped according to the four key issues mentioned. The advantage is that now the need for determining boundary judgments both in the descriptive (is") and in the normative ("ought") mode can be made explicit. It is in fact imperative that the boundary questions be employed in both ways, so that differences between "is" and "ought" answers get identified and can drive the process of unfolding the design's normative content further. In the *"is" mode,* the questions serve to trace the boundary judgments that are actually presupposed in a design; "presupposed" as being measured by the factual or anticipated consequences rather than by the planners' premises. In the *"ought" mode,* the questions help to clarify the normative basis for evaluating the "is" answers.

A systematic opposition of "is" and "ought" answers thus becomes possible. It has several advantages:

1. It renders the critical intent of the questions, and thus the need for such questioning, *evident* and *practicable.*

2. It does justice to the earlier-mentioned *interdependence of theoretical and practical reason.* This interdependence can now easily be understood in terms of its pragmatic consequence, namely, the fact that boundary judgments of the "is" mode are contingent on those of the "ought" mode, and vice-versa. For example, whether or not future generations are considered to belong either to the client or to those affected will determine how far into the future a design's factual or potential consequences are traced; the earlier-mentioned case of radioactive waste disposal provides an obvious illustration.

3. It allows for *more rigor in questions of "fact."* It is true, questions of "fact" and questions of "value" have now become inseparable, but this need not imply a loss of scientific rigor. On the contrary, empirical answers can now be given based on clear normative presuppositions about the relevant context of application, a qualification that means not less but more rigor.

4. It provides for *rigor in questions of "value."* Opposing "is" and "ought" boundary judgments provides a systematic way to evaluate a design while, at the same time, laying open the normative basis of the evaluation itself. This is what *critically normative evaluation* is all about: evaluation that is *methodical without incurring any illusion of objectivity*.

5. Important differences between "ought" and "is" answers will *draw attention to possible sources of failure or conflict* in the design. They can thus drive the process of uncovering the design's potential weaknesses (or chances for improving it). **[||599]**
6. Finally, the approach yields a basis not only for self-reflectively critical evaluation but also for *pluralistic evaluatio*n (Ulrich, 1982, p. 66f). It reconciles a scientific approach (relying on expertise and theoretical-instrumental reason) with a concern for alternative perspectives of (different groups of) those affected.
7. Taking all the previous points together, the approach seems apt to provide a framework not only for individual critically normative reflection but also for *cogent intersubjective argumentation* on disputed validity claims of systems designs, both in respect to "facts" and in respect to "values." Therein resides its *emancipatory*, in addition to its critical, significance.

The last point, concerning critical heuristics' emancipatory potential, is essential for understanding its critical importance; for under everyday conditions of imperfect rationality and structural inequalities, rational argumentation (at least for critical purposes) cannot possibly be achieved without reconciling the two divergent requirements of *equal participation* of all those concerned, regardless of their power, expertise, and argumentative skills, and of *cogent argumentation* on the part of everybody who participates. Emancipation for me means to render those who are unequal, because less skilled or subject to structural conditions of inequality, equal and competent participants. Let us then turn to this important issue.

7. THE POLEMICAL EMPLOYMENT OF ECOLOGICAL BOUNDARY JUDGMENTS[10]

The critically heuristic concepts that have been introduced thus far are to provide a tool of reflection for tracing the normative social and ecological implications of systems design. But they cannot guarantee such reflection. How then can affected citizens cause the involved decision makers, planners, and experts to reflect on a design's normative content even though they may not be willing to do so on their own? How can affected citizens become competent witnesses of concerns that may not adequately be considered in a design? Given the conflicting demands of democratic participation (of the witnesses) and of cogent argumentation (on the part of everybody involved, including the

[10] Parts of the following section are adapted from Ulrich, 1987, pp. 281-282.

witnesses), how can ordinary citizens bring in their concerns without being convicted of lacking competence, "expertise," or "rationality"? And why should those involved and in power bother to take account of the concerns of those who are affected but not involved?

These are questions of eminent importance for a critical concept of rational **[||600]** (systems) practice. To my knowledge, no available model of rational discourse (including the ideal discourse models of contemporary practical philosophy) thus far provides a satisfactory *and practicable* answer. It would thus be all too presumptuous for critical heuristics to claim that it has the answers, and yet I think that critical heuristics – its specific use of the systems idea – yields a key to at least a partial solution of the problem: it can ensure to those affected a position of equal critical competence.

Critical heuristics' basic conjecture in this regard may by now be familiar: Any use of expertise presupposes boundary judgments with respect to the context of application to be considered. No amount of expertise or theoretical knowledge is ever sufficient for the expert to justify all the judgments on which his recommendations depend. When the discussion turns to the basic boundary judgments on which his exercise of expertise depends, the expert is no less a layman than are the affected citizens.[11]

It follows that every expert who justifies his recommendations, or the "objective necessities" he may disclose in the name of reason, by referring to his expertise *without* at the same time laying open his lay status relative to the underlying boundary judgments, can be convicted of a dogmatic or cynical employment of boundary judgments. *Dogmatically* he employs them if he fails to recognize his lay status in respect to boundary judgments and hence asserts their objective necessity; *cynically*, if he very well sees through their character as justification break-offs but, against his better judgment, conceals them behind a façade of objectivity or pretends other than the true ones to be his boundary judgments.

Once citizens have understood the concept of boundary judgments in this way, they will know that planners or decision makers cannot justify their proposals on the basis of

[11] Paul Feyerabend's (1980, pp. 20, 162) observation, namely, that experts are often quite unable to justify routine procedures and routine arguments on which their claims for rationality depend, finds in the critically heuristic concept of boundary judgments a precise explanation: such routine premises of scientific disciplines embody the boundary judgments by means of which problems are bounded so that they fit the discipline's domain of competence. The fact that the delimitation of the "right" context of application to be considered cannot be justified by virtue of expertise is then concealed behind a façade of routine procedures and professional authority (e.g., "all experts agree that this is the way to do it," or "we don't know any other way to do it").

expertise and "objective necessities,“ except by relying unreflectively or cynically on value-laden boundary judgments. Provided they are given adequate methodical support, they will learn to see through – and to make transparent to others – the dogmatic character of such "objective necessities" in specific contexts of application. What is more, they will be able to argue *cogently* against the proposals in question, *without* having to become experts themselves.

Critical heuristics provides such methodical support with its unique concept **[||601]** of the *polemical employment of boundary judgments.* The concept has been derived from Kant's (1787, p. B767) concept of the "polemical employment of reason" (see Ulrich, 1983, pp. 301-310). For Kant, an argument is "polemical" if it is has no other purpose than to refute some dogmatically asserted validity claim. The rationality of such an argument, because it need not establish any theoretical or practical validity claim of its own, does not depend on its positive justification but only on its critical cogency.

The use of boundary judgments for merely critical purposes almost ideally fulfills this condition: Boundary judgments that are introduced overtly as personal value judgments need not claim to be based on expertise, for they entail no theoretical validity claims. Nor do they need to claim practical (normative) validity in the sense that other people would need to share them; it is quite sufficient that they be truthful (authentic) expressions of personal value orientations. In fact it is quite good enough to introduce these personal value judgments merely as tentative boundary *questions.*

For example, instead of saying "I think the future generations should also belong to your design's client, but I cannot see that they do," it is just as effective to ask: "I'm not quite sure whether it is possible, but shouldn't the future generations equally belong to the client of the proposed nuclear waste disposal site?" When you advance your own subjective boundary judgment as against the expert's tacit boundary judgment, what counts is not the possibility of a theoretical and practical justification of your judgment but rather the theoretical *impossibility* of such a justification – nobody will be able to prove you wrong.

In this way, ordinary citizens can indeed shift the burden of proof on to the planners or experts and oblige them to enter into an attempt at justifying their underlying assumptions; for otherwise, the mask of rationality and objectivity will slip and their dogmatic stance becomes all too apparent.

Once the proponents of the design in question can be made to discuss boundary judgments, the situation gets symmetric and both sides can with equal right advance their own boundary judgments. The point is that for a purely critical purpose, such symmetry of argumentation is sufficient: As against the expert's boundary judgments, laymen can now with equal right and with overt subjectivity advance their alternative boundary judgments, thereby embarrassing the expert for not being able to prove the superiority of *his* boundary judgments. In this way, ordinary citizens become competent to demonstrate three essential points:

(1) that boundary judgments do play a role in the expert's proposal;

(2) that his expertise and advantage of knowledge is an insufficient basis for the expert to justify his own boundary judgments or to falsify those of the critics; and **[||602]**

(3) that the expert who still seeks to justify his recommendations based on his better knowledge and competence must, in fact, rely on a dogmatic or cynic employment of boundary judgments and thereby disqualifies himself.

I would like to try to illustrate the emancipatory power of my abstract conjectures by going back, once again, to the example of radioactive waste disposal. When some place has been proposed as a disposal site, there will be a debate between proponents and opponents. Let us imagine that there is a public hearing. On the side of the proponents, some experts who were involved in the planning process will first argue that the proposed site is right and, in fact, necessary in terms of geological and other environmental conditions, and that the suggested disposal facilities are technically safe. Later some other representatives of the proponents will explain to the citizens present the economic and other advantages that the planned facilities will bring to the local community, benefits such as new jobs, better housing, more tax money, etc. In one word, they will appeal to an instrumental kind of rationality and, ultimately, to utilitarian ethics (see Ulrich, 1988, pp. 124ff, on this concept of rationality). The proponents will demonstrate considerable knowledge of, and concern for, the local situation and, of course, display an impressive array of technical and geological data, economic projections, and all kinds of computer charts.

In this situation, it appears difficult for concerned citizens to face the experts and to question their arguments without immediately being convicted of lacking knowledge and expertise. Yet it is in fact the citizens who are in a position to convict the proponents of lacking rationality! If only they have some basic understanding of the importance of boundary judgments – ideally they would also have received some appropriate training in

the polemical employment of boundary judgments –, they might stand up and question, for instance, the asserted benefits:

> "How can you tell us that our community is going to be the prime beneficiary of the project? I am afraid that the lion's share of the benefits will be exported to other communities, for example, to the community where the nuclear waste is produced and where the public utility that operates the whole system will pay its taxes. I don't really know for sure … but what I know for sure is that the disadvantages will not be exported! The harm to our beautiful environment that will be done; the health risks to our population; the problem of controlling those radioactive wastes for hundreds and thousands of years to come; perhaps lower property values, the emissions from the construction site…. If your computer charts show that this project will produce a surplus of benefits, it seems to me that they do not describe our local situation here but include all the other communities where the benefits will really be." *(polemical employment of the client question)*

Perhaps one of the proponents will display another computer chart and be able **[||603]** to demonstrate that there will in fact be some tax benefits within the local community, or some other benefits that the critic has ignored. But a second citizen, encouraged by the principal logic of the critic's question, might continue that logic:

> "Okay, let us assume for a moment that you are right and we will get a lot of benefits. But I am afraid that not all citizens of this community will get an equal share of those advantages, nor will all get equally affected by the disadvantages. When you tell us that the benefits will outweigh the disadvantages, you seem to assume some statistical average citizen…. Or can you please explain to us exactly how you measure the difference of advantages and disadvantages? How do you take account of the unequal distribution of benefits and costs? And how of the fact that even where benefits and cost go together, no kind of benefit – certainly not money – will justify the harm done to our environment and perhaps to our health? Or may I ask you how many dollars you have counted as the price for those disadvantages?" *(polemical employment of the question of the measure of improvement)*

The experts, of course, will be quick to point out politely that the opponents do not really seem to understand and that perhaps they do not know enough to judge the results of the experts' investigations; that they miss the real issues; and that in any case their allegations, apart from being "merely subjective" and "ideologically motivated," are incompatible with the "facts." But such a reply, justified as it may be, does nothing to prove that the experts' "facts" and "objective necessities" are any less subjective than those of the critics. The critics can reply with the same right than no amount of "facts" or "expertise" can justify the experts' claims to present an objective account of the problem.

Once it has become transparent that defining the problem is, at bottom, a subjective political act, the experts indeed disqualify themselves by their own claim for objectivity.

If my example appears trivial to the reader, it should. *"Polemical arguments need not demonstrate the sophistication of the speaker but only the embarrassment of the other side."* (Ulrich, 1983, p. 308)

My conclusion with respect to the operationalization of a critically normative systems approach is this: *A critical employment of the systems concept is possible,* through the polemical employment of boundary judgments, *without the critic's knowing everything about the system in question.* Ordinary citizens, so long as they use boundary judgments for critical purposes only and do not assert the exclusive validity of their own answers to the boundary questions, can argue their concerns with respect to a systems design as cogently as any experts. What probably most citizens intuitively know, though they cannot really explain it, finds a precise and generally understandable explanation in the concept of boundary judgments: expertise does not supersede value judgments but inescapably presupposes them – namely, in the form of boundary judgments. **[||604]**

8. TOWARD SYMMETRY OF CRITICAL COMPETENCE

The conjectures presented thus far may have created the impression that a critically normative systems approach as I have suggested it, with its focus on a critical handling of boundary judgments, might well contribute to the emancipation of citizens from the premises of planners and experts, but only at the price of leading us into a mere *"symmetry of helplessness"* between the two sides (Rittel, 1963, p. 14, quoted in Höffe, 1979, p. 345).

It seems to me that an unproductive symmetry of helplessness is in fact already prevailing today. How else should we characterize the lack of argumentative understanding between the different parties that is so commonly observed in issues of environmental design, even where the different parties refer basically to the same scientific findings and to the same ethical principles?

My diagnosis in this paper has been that no side can argumentatively reach the other because the real debate is not about scientific findings and ethical principles but rather about divergent (hidden) boundary judgments. Critical heuristics might open the way up toward more symmetry of chances for cogent argumentation, at least in regard to the

"critical half" of such argumentation. I think it can help us to secure to all concerned parties some *symmetry of critical competence,* due to the fact that the polemical employment of boundary judgments is perfectly rational as far as its critical thrust is concerned.

What is more, critical heuristics can secure such symmetry *without presupposing an equal distribution of power, knowledge, and argumentative skills;* for unlike all the contemporary models of rational discourse – those contained in the writings of Popper, Lorenzen, and Habermas – critical heuristics does not presuppose an ideal, "oppression-free" situation of symmetrically distributed power, information, and communicative competence. To my knowledge, this represents a truly new consequence of critical heuristics: it is the first model of rational argumentation that explains the principal possibility, and gives us practical guidance, as to how a symmetry of critical competence can be obtained *under everyday conditions of imperfect rationality.*

I think this consequence is of some importance as a straw against the skeptical implications of the problem of holism. Skepticism is certainly in order with respect to the idea that a model of rational argumentation could *secure positive consensus* by purely argumentative means, as intended by the ideal discourse models of contemporary practical philosophy. That would mean to secure conditions of comprehensive rationality – an idea that becomes impossible once we have recognized the problem of holism. Due to the unsolved problem of holism, these models must in fact presuppose what they are supposed to achieve, namely, rational argumentation (hence the assumption of an "ideal speech situation" in Habermas' model).

Symmetry of *critical* competence is quite good enough, however, to give **[||605]** all concerned parties an equal chance to argue their case, in the sense that they should be in a position to express their concerns and to show them to be of equal legitimacy as those of other parties. A merely critical solution to the problem of rational argumentation cannot of course *secure* argumentative understanding; but inasmuch as the disagreeing parties, and especially those who have the advantage of expertise or power, can be made to discuss basic boundary judgments, there will be an argumentative situation in which each party can rationally confront the other's assumptions. Each party can then, so long as it does not argue dogmatically or cynically, bring in its own views on the "is" or "ought" premises of a proposal and can cite "good grounds" to support their concerns, i.e., facts and norms that might find general agreement, such as basic ethic principles, human rights, principles of democracy, existential needs of all men, environmental concerns, etc.

The point against skepticism is this. *If rational argumentation is possible at least for critical purposes, skepticism is no longer a rational choice.* An enlightened society does not depend on the possibility of complete rational justification, but it might very well depend on the possibility of rational criticism – on the possibility of ordinary citizens to argue cogently against false validity claims of those who have the say. Skepticism to me does not seem compatible with the idea of an enlightened society, not any more than does technocracy. As against the technocratic notion that decisions are enlightened if they follow the "objective necessities" disclosed by experts, a truly enlightened society will pose the idea of an open "market place of ideas" where all concerns can be expressed equally and decisions are then made democratically in the light of transparent premises and consequences. The fact that ultimate positive justifications are impossible is no reasonable argument against bringing in one's "good grounds": skepticism, if made an argument against any effort of reaching argumentative understanding or, at least, of laying open the implications of alternative views, is no less dogmatic than the expert's refusal to substantiate his recommendations by citing good grounds rather than by merely referring to his superior expertise only.

Once that a critical solution to the problem of rational argumentation has been shown to be possible under everyday conditions of imperfect rationality and structural inequality, another important step beyond skepticism becomes possible: it becomes possible to reconcile the two conflicting requirements that an enlightened society must somehow balance, namely, the democratic participation of all those affected by a decision, and cogent argumentation on the part of all those involved in it, including the witnesses of the affected. Thus the concept of a polemical employment of boundary judgments, although it cannot (and does not aim to) secure rational practice in a technocratic sense, can perhaps contribute at least to a democratically enlightened systems practice. **[||606]**

9. SUMMARY AND OUTLOOK

This is what I have basically tried to say about the idea of a *critical holism* as related to ecological thinking:

1. Inasmuch as both ecological and systems thinking are meant to secure comprehensive thinking, they share a common basic problem, the *problem of holism*. Hence, systems thinking cannot be expected to be the remedy for the difficulties of holistic ecological thinking and design.

2. However, systems thinking is more than holistic thinking. If we understand it differently from contemporary systems methodologies, namely, as a critical idea of reason, systems thinking yields new insights and tools for dealing with the problem of holism. *Critically normative systems thinking* is the key; it takes account of the two-dimensionality of reason and seeks to deal critically with the interdependence of instrumental and practical (normative) validity claims.

3. There exists a systems methodology that actually has begun to undertake the necessary effort of operationalizing the idea of a critically normative systems approach. It is called *critical systems heuristics* and I have tried to explain some of its basic ideas. The key idea is the systematic study of the contexts of applications on which the validity claims of both theoretical/instrumental and practical propositions depend, and the main tool is the analysis of the boundary judgments that determine the context of application, both in the "is" and in the "ought" mode.

4. On this basis it can also be shown how rational criticism is possible under everyday conditions of imperfect rationality and structural inequalities. Symmetry *of critical competence* can thus be secured. Critical heuristics thus represents the first systems methodology that really employs the systems idea for critical and emancipatory purposes. If we want to render systems thinking and design more sophisticated, I think this sort of undertaking is just as urgent as are continued efforts at increasing the instrumental power of our problem-solving methodologies (which are vital, too).

I would like to conclude with a brief outlook to the kind of further efforts that critical holism might inspire. Generally speaking, it is obvious that a few first tools of critical reflection and argumentation such as the critically heuristic categories and the polemical employment of boundary judgments do not exhaust the importance of critical holism. Rather, critical holism implies a far-reaching program of redefining the epistemological and practical-philosophical foundations of the so-called "new paradigm" (as promoted, e.g., by Capra, 1983; Feyerabend, 1989; Friedmann, 1987; Meyer-Abich, 1984) that is gradually shaping up in fields such as ecology and environmental design, social **[||607]** and health planning, planning theory, management theory, ethics, science theory, etc., and which ultimately will probably influence all the applied disciplines. Let me therefore try to suggest a few possible applications and developments of critically holistic systems thinking, with special regard for the domain of environmental design.

(1) Critical revision of systems methodologies:

Critically holistic thinking, as operationalized by critical systems heuristics, to me represents not just one more systems methodology in addition to system dynamics,

viable systems diagnosis, interactive planning, soft systems methodology, etc. As I have said, I do not question the need for a continued development of these instrumentally oriented systems methodologies, as instrumental effectiveness and efficiency is of course vital for good problem solving. But at present the *bottleneck issue* seems to be the one-dimensionality of these methodologies, i.e., their methodological uselessness with respect to their own normative implications. I think critically heuristic concepts need to be, and indeed *can* be, integrated with these instrumentally oriented methodologies. To be sure, some of the basic concepts of these approaches will require a thorough revision – but what a fascinating task is waiting here!

(2) Toward a critical concept of environmental impact assessment:

Critical holism has immediate implications for present-day conceptions of environmental impact assessment, certificate of need procedures, and other approaches to the evaluation of ecologically relevant projects. These tools need to be embedded in a critically normative frame of reference in which (counter to their present natural-science orientation) both theoretical-instrumental and practical-normative premises and consequences of claims to *"environmental compatibility"* could be handled systematically. At the same time, this new frame of reference should avoid the tacit anthropocentrism of the "certificate of need" procedure, by incorporating a new, critically holistic approach to ethics (see Ulrich, 1990b).

(3) Ecology as practical philosophy of nature:

I think that both general and applied (human) ecology will need a new philosophical foundation, namely, as critically normative disciplines. We must learn to understand *ecology as an effort of practical reason* and, accordingly, enrich it by concepts of critical systems thinking. I am afraid that the classical philosophy of nature, fashionably "brushed up" with some concepts of functionalistic and evolutionary systems theory, with some cybernetics and chaos theory, and perhaps with Feyerabend's anarchistic theory of knowledge or some "new age" thinking, will not do. Meyer-Abich's **[||608]** (1984) concept of a "philosophy of nature with a practical intent" might provide some guidance here, along with critical holism.

(4) Toward a critically heuristic training for citizens:

Finally, I connect with critically heuristic thinking some hopes for a different training in citizenship, one that would truly prepare young people and adults to become mature citizens. I believe that the systems idea, if we understand it as a critical idea

of reason, might become important as a "countervailing power" to face the steadily growing influence of expertise in our society, namely, by something like a generally available *expertise of lay people in dealing critically with expertise.* I think that critical holism offers a basis for developing the required nonelitist concept of expertise and rationality. Practically speaking, this goal will of course also require institutional innovations in our democratic decision processes. I think of *new arenas of participatory conflict resolution* such as "planning cells" and "citizen reports on technological projects" (Dienel, 1989; 1990), i.e., institutional arrangements within which citizens, together with experts and designers, can train themselves in critically heuristic debate.

If we succeed in achieving some of these changes in science, education, and politics, perhaps our children will one day find the idea of holistic thinking easier to handle than we do today.

I have demanded of you some tolerance for abstract conjectures. These conjectures nevertheless pursue a practical intent. Let me summarize this practical intent thus: In order to simplify difficult issues, we need first to understand them thoroughly. It is my hope that we will not spear the pains of studying the idea of holistic thinking much more thoroughly, so that one day we shall be able to truly simplify – and that is, practice – the systems idea, *without compromising its critical significance.*

References

Ackoff, R.L. (1974). *Redesigning the Future,* Wiley, New York.

Ackoff, R.L. (1978).*The Art of Problem Solving,* Wiley, New York.

Ackoff, R.L. (1981a). *Creating the Corporate Future,* Wiley, New York.

Ackoff, R.L. (1981b). The art and science of mess management. *TIMS/ORSA Interfaces* **11**, 20-26.

Banathy, B.H., and Banathy, B.A., eds (1990), *Toward a Just Society for Future Generations,* Proceedings of the 34th Annual Meeting of the International Society for the Systems Sciences (ISSS) in Portland, Oregon, July 8-13 1990, Vol. I: Systems Design, ISSS/California State Polytechnic University, Ponoma, California.

Beer, St. (1979). *The Heart of Enterprise,* Wiley, Chichester, England.

Beer, St. (1981). *Brain of the Firm,* The Managerial Cybernetics of Organization, 2nd rev. ed., Wiley, Chichester, England (1st ed. Penguin, Harmondsworth 1972).

Beer, St. (1985). *Diagnosing the System for Organisations,* Wiley, Chichester, England. **[||609]**

Capra, F. (1982). *The Turning Point,* Simon & Schuster, New York.

Checkland, P. (1981). *Systems Thinking, Systems Practice,* Wiley, Chichester, England.

Checkland, P., and Scholes, J. (1990). *Soft Systems Methodology in Action,* Wiley, Chichester, England.

Churchman, C.W. (1968). *The Systems Approach,* Dell Publishing, New York, rev. ed. 1979.

Churchman, C.W. (1971). *The Design of Inquiring Systems,* Basic Books, New York.

Churchman, C.W. (1979). *The Systems Approach and Its Enemies,* Basic Books, New York.

Dienel, P.C. (1989). Contributing to social decision methodology: Citizen reports on technological projects. In Vlek, Ch., and Cvetkovich, G. (eds), *Social Decision Methodology for Technological Projects.* Kluwer, Dordrecht, Netherlands, pp. 133-151.

Dienel, P.C. (1990). *Die Planungszelle,* Eine Alternative zur Establishment-Demokratie, 2nd ed., Westdeutscher Verlag, Opladen (1st ed. 1977).

Feyerabend, P.K. (1980). *Erkenntnis für freie Menschen,* revised German edition of *Science in a Free Society* (New Left Books, London 1978), Suhrkamp, Frankfurt a.M., Germany.

Flood, R.L., and Jackson, M. C. (1991a). Critical Systems Heuristics: Application of an emancipatory approach for police strategy toward the carrying of offensive weapons. *Syst. Pract.* **4**, 283-302.

Flood, R.L., and Jackson, M.C. (1991b). *Creative Problem Solving: Total Systems Intervention,* Wiley, Chichester, England.

Flood, R.L., and Jackson, M. C., eds (1991c). *Critical Systems Thinking: Directed Readings,* Wiley, Chichester, England.

Flood, R.L., and Ulrich, W. (1990). Testament to conversations on critical systems thinking between two systems practitioners. *Syst. Pract.* **3**, 7-29. [Reprinted in Flood, R. L., and Jackson, M. C., eds (1991c), *Critical Systems Thinking: Directed Readings,* Wiley, Chichester, England, pp. 185-206 (Ch. 12).]

Forrester, J.W. (1961). *Industrial Dynamics,* MIT-Press, Cambridge, Mass.

Forrester, J.W. (1969). *Principles of Systems,* Wright-Allen Press, Cambridge, Mass.

Friedmann, J. (1987). *Planning in the Public Domain,* From Knowledge to Action, Princeton, Princeton University Press, New Jersey.

Habermas, J. (1964). Gegen einen positivistisch halbierten Rationalismus. *Kölner Zeitschrift für Soziologie und Sozialpsychologie* **16**, 636-659.

Habermas, J. (1971a). *Knowledge and Human Interests,* Beacon Press, Boston, Mass.

Habermas, J. (1971b). *Towards a Rational Society,* Beacon Press, Boston, Mass.

Habermas, J. (1973a). *Theory and Practice,* Beacon Press, Boston, Mass.

Habermas, J. (1973b). Wahrheitstheorien. In Fahrenbach, H. (ed.), *Wirklichkeit und Reflexion,* Neske, Pfullingen, Germany, pp. 211-265.

Habermas, J. (1984). *Theory of Communicative Action, Vol. 1: Reason and the Rationalization of Society,* Beacon Press, Boston, Mass.

Habermas, J., and Luhmann, N. (1971). *Theorie der Gesellschaft oder Sozialtechnologie – Was leistet die Systemforschung?* Suhrkamp, Frankfurt a.M.

Haldane, J.B.S. (1931). *The Philosophical Basis of Biology,* Hodder and Stoughton, London.

Höffe, O. (1979). *Ethik und Politik, Grundmodelle und -probleme der praktischen Philosophie*, Suhrkamp, Frankfurt a.M.

Jackson, M.C. (1985). The itinerary of a critical approach. Review of W. Ulrich's "Critical Heuristics of Social Planning." *J. Oper. Res. Soc.* **36**, 878-881.

Jackson, M.C. (1991a). The origins and nature of critical systems thinking. *Syst. Pract.* **4**, 131-149.

Jackson, M.C. (1991b). *Systems Methodology for the Management Sciences*, Plenum Press, New York and London. **[||610]**

Kant, I. (1786). *Groundwork of the Metaphysics of Morals*, 2nd ed. (B), translated by H.J. Paton, Harper Torchbooks, New York, 1964.

Kant, I. (1787). *Critique of Pure Reason*, 2nd ed. (B), translated by N.K. Smith, St. Martin's Press, New York, 1965.

Kant, I. (1788). *Critique of Practical Reason and Other Writings in Moral Philosophy*, translated by L.W. Beck, University of Chicago Press, Chicago, Ill., 1949.

Mason, R.O. (1969). A Dialectical Approach to Strategic Planning. *Manage. Sci.* **15**, B403-414.

Mason, R.O., and Mitroff, I.I. (1981). *Challenging Strategic Planning Assumptions*, Wiley, New York.

Meyer-Abich, A. (1948). *Naturphilosophie auf neuen Wegen*, Hippokrates-Verlag, Stuttgart, Germany.

Meyer-Abich, K.M. (1984). *Wege zum Frieden mit der Natur*, Praktische Naturphilosophie für die Umweltpolitik, Hanser, Munich, Germany, and Vienna, Austria.

Popper, K.R. (1961). *The Logic of Scientific Discovery*, Basic Books, New York. [German orig. 1935; rev. American ed. Harper Torchbooks, New York,1968.]

Popper, K.R. (1972). *Objective Knowledge*, An Evolutionary Approach, Clarendon Press, Oxford, England.

Rittel, H. (1963). *Ueberlegungen zur wissenschaftlichen und politischen Bedeutung der Entscheidungstheorie*, polycopied manuscript, Studiengruppe für Systemforschung, Heidelberg, Germany. [Rev. version in Krauch, H., et al., *Forschungsplanung*, Hanser, Munich, Germany, and Vienna, Austria, 1966, pp. 110ff.]

Smuts, J.C. (1926). *Holism and Evolution*, Macmillan, London. [Reprint edition Greenwood Press, Westport, Conn., 1973.]

Steinmann, H. (1986). Über die normativen Grundlagen von Planungsentwürfen. Review of W. Ulrich's "Critical Heuristics of Social Planning: A New Approach to Practical Philosophy." *OR Spektrum* **8**, 118-120.

Steinmann, H. (1987). Review of W. Ulrich's "Critical Heuristics of Social Planning: A New Approach to Practical Philosophy." *Zeitschrift für betriebswirtschaftliche Forschung und Praxis* **39**, 94-96.

Ulrich, W. (1977). The design of problem-solving systems. *Manage. Sci.* **23**, 1099-1108.

Ulrich, W. (1980). The metaphysics of design: A Simon-Churchman debate. *TIMS/ORSA Interfaces* **10** (No. 2), 35-40. [Reprinted in a slightly expanded version in Van Gigch, J.P. (ed.), *Decision Making About Decision Making: Metamodels and Metasystems*, Abacus Press,Turnbridge Wells, England, 1987, pp. 219-226.]

Ulrich, W. (1981a). Systemrationalität und praktische Vernunft – Gedanken zum Stand des Systemansatzes. Translator's Introduction to Churchman, C.W., *Der Systemansatz und seine "Feinde,"* Haupt, Bern, Switzerland, pp. 7-38.

Ulrich, W. (1981b). A critique of pure cybernetic reason: The Chilean experience with cybernetics. *J. Appl. Syst. Anal.* **8**, 33-59.

Ulrich, W. (1982). Wissenschaftliche Evaluation als Aufgabe der Gesundheitsdirektion: Kanton Bern. In Gutzwiller, F., and Kocher, G. (eds), *Die Qualität medizinischer Leistungen* – Konkrete Möglichkeiten der Qualitätsmessung, -kontrolle und -förderung, Schweizerische Gesellschaft für Gesundheitspolitik, Zurich, Switzerland, pp. 61-79.

Ulrich, W. (1983). *Critical Heuristics of Social Planning: A New Approach to Practical Philosophy*, Bern, Switzerland: Haupt.

Ulrich, W. (1984). Management oder die Kunst, Entscheidungen zu treffen, die andere betreffen. *Die Unternehmung, Schweizerische Zeitschrift für betriebswirtschaftliche Forschung und Praxis* **38**, 326-346.

Ulrich, W. (1987). Critical heuristics of social systems design. *Eur. J. Operation. Res.* **31**, 276-283. [Reprinted in Jackson, M.C. , Keys, P., and Cropper, S.A. (eds), *Operational Research and the Social Sciences,* Plenum Press, New York and London 1989, pp. 79-87, and in Flood, R.L., and Jackson, M.C. (eds)., *Critical Systems Thinking: Directed Readings,* Wiley, Chichester, England, 1991, pp. 103-115 (Ch. 5).]

Ulrich, W. (1988a). Systems thinking, systems practice, and practical philosophy: A program of research. *Syst. Pract.* **1**, 137-163. [Reprinted in Flood, R.L., and Jackson, M.C. (eds)., *Critical Systems Thinking: Directed Readings,* Wiley, Chichester, England, 1991, pp. 245-268 (Ch. 12).]

Ulrich, W. (1988b). Churchman's "process of unfolding" – Its significance for policy analysis and evaluation. *Syst. Pract.* **1**, 415-428.

Ulrich, W. (1989). Systemtheorie der Planung. In Szyperski, N. (ed.), *Handwörterbuch der Planung*, Poeschel, Stuttgart, Germany, columns 1971-1980.

Ulrich, W. (1990a). What is called "Critical Systems Thinking"? The programmatic intent and current state of "Liberating Systems Theory." Introduction to the Symposium on "Critial Systems Thinking: Liberating Systems Theory for the Future.“ In Banathy, B.H., and Banathy, B.A. (eds), *Toward a Just Society for Future Generations,* Proceedings of the 34th Annual Meeting of the International Society for the Systems Sciences (ISSS) in Portland, Oregon, July 8-13 1990, Vol. I: Systems Design, ISSS/California State Polytechnic University, Ponoma, California, pp. 3-14.

Ulrich, W. (1990b). Critical systems thinking and ethics: The role of contemporary practical philosophy for developing an "ethics of whole systems.“ In Banathy, B.H., and Banathy, B.A. (eds), *Toward a Just Society for Future Generations,* op.cit., pp. 52-75.

Ulrich, W. (1990c). Critical systems thinking and future generations: The place of future generations in systems thinking. In Banathy, B.H., and Banathy, B.A. (eds), *Toward a Just Society for Future Generations,* op.cit., pp. 279-299.

Ulrich, W. (1994). Can we secure future-responsive management through systems thinking and design? *TIMS/ORSA Interfaces* **24** (No. 4), 26-37 (forthcoming).

Vester, F. (1983). *Ballungsgebiete in der Krise,* Vom Verstehen und Planen menschlicher Lebensräume, Deutscher Taschenbuchverlag, Munich, Germany.

Vester, F. (1988). The biocybernetic approach as a basis for planning our environment. *Syst. Pract.* **1**, 399-413.

Vester, F., and von Hesler, A. (1988). *The Sensitivity Model,* Regionale Planungsgemeinschaft Untermain, Frankfurt am Main, Germany (in English and German language).

Wilmott, H. (1989). OR as a problem situation: From soft systems methodology to critical science. In Jackson, M.C. , Keys, P., and Cropper, S.A. (eds), *Operational Research and the Social Sciences,* Plenum Press, New York and London 1989, pp. 65-78.

Wilson, B. (1984). *Systems: Concepts, Methodologies and Applications,* Wiley, Chichester, England.

Wolstenhome, E.F. (1990). *System Enquiry: A System Dynamics Approach,* Wiley, Chichester, England.