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Critical heuristics of social systems design

Werner ULRICH
Office of Evaluation Research, Department of Public Health & Social Services, Rathausgasse 1, CH-3011 Bern, Switzerland

Abstract: Health care planning, city and regional planning, energy and transportation planning, environmental design and other areas of social systems design are becoming issues of increasing concern to policy makers. Faced with complex steering problems that may have far-reaching societal implications, they except help from applied disciplines such as Operational Research, systems science, technology assessment, program evaluation, cost-effectiveness analysis, and similar approaches to scientifically informed planning. But these approaches offer little help in critically reflecting on the normative implications of the problem definitions and solution proposals they inspire.

Critical Heuristics seeks to provide both the involved planners and affected citizens with a conceptual framework for identifying and discussing the normative implications of problem definitions, systems designs, program evaluations, etc. The paper introduces some key concepts of Critical Heuristics and briefly discusses their significance to 'rational' planning.

Keywords: Planning, philosophy, systems, values, heuristics

Applied science and the problem of justification break-offs

OR as an applied science

The stuff of applied disciplines such as OR/MS is what epistemologists call the 'context of application', in distinction to the so-called 'context of justification'. Epistemologists such as Karl R. Popper (1961, 1968, 1972) have claimed that the context in which science is applied is relatively irrelevant for the justification of its propositions. In distinction to this position, I propose to understand—and indeed define—applied science as *the study of contexts of application*. Of course this definition renders the distinction between the two contexts obsolete. From an applied-science point of view, the distinction is really quite inadequate: To justify the propositions of applied science can only mean to justify its effects upon the context of application under study. The key problem that makes applied science, as compared to basic science, so difficult to justify lies in the *normative content* that its propositions gain in the context of application.

By 'normative content' I mean not only the value judgements—the normative premises—that inevitably flow into practical propositions such as recommendations for action, design models, planning standards or evaluative judgments, but also their normative implications in the context of application, i.e., the life-practical consequences and side-effects of the 'scientific' propositions in question for those who may be affected by their implementation.

Speaking of the 'context of application' is a scientifically neutral way to say that applied science, whenever it really gets applied, tends to affect citizens that have not been involved in the scientific justification of its propositions. What does it mean to be scientific, or to 'justify' the propositions of applied science, in view of the uninvolved being affected?

The problem of practical reason

Basically, the answer is to understand 'justification' no longer as the business of the involved only, but as the common task of both the involved

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and the affected. Hence a *dialogical concept of rationality* must replace the conventional 'monological' understanding of rational justification. Whereas the latter relies on deductive logic and empirical corroboration or falsification attempts on the part of the involved, the former must be grounded in a model of rational discourse that would explain the conditions for reaching 'rational' (as opposed to merely factual) consensus among all the involved and the affected in regard to the 'rightness' (acceptability) of a design's normative content.

The problem of how rational discourse can redeem the validity claims of practical propositions—their claim to secure improvement *and* to be rationally justifiable—is known as the *problem of practical reason*. The branch of philosophy dealing with this problem, practical philosophy, has recently experienced a considerable renaissance. Contemporary practical philosophers such as Paul Lorenzen (1969); Lorenzen and Schwemmer (1975) and Jürgen Habermas (1971, 1973, 1975, 1979; see also McCarthy, 1978) have developed 'ideal' models of practical discourse. They give us essential insights into the conditions that would allow us to justify disputed validity claims. The problem is only that these models, *because* they are ideal designs for rational discourse, are impractical (not realizable): They assume ideal conditions of rationality that will always remain counter-factual. In fact they presuppose what they are supposed to produce, namely, rational argumentation—the ability and will of all participants to argue cogently and to rely on nothing but the force of the better argument. Most importantly, they do not take into account the *inevitability of argumentation break-offs*. In practical discourse, just as in conventional 'monological' justification strategies, every justification attempt must start with some material premises and end with some conclusions that it cannot question and justify any further. In other words, every chain of argumentation starts and ends with some judgments the rational justification of which must remain an open question.

Critical heuristics, or how to deal critically with justification break-offs

From what has been said it follows that the crucial problem for any applied scientist seeking to justify his propositions is the question of how to deal critically with the justification break-offs that inevitably flow into these propositions. As long as he does not learn to make transparent to himself and to others the justification break-offs flowing into his designs, the applied scientist cannot claim to deal critically with the normative content of these designs.

Critical Heuristics (or by its full name: Critical Heuristics of Social Systems Design) is a new approach to both systems thinking and practical philosophy, an approach that aims to help the applied scientist in respect to this task. It does not seek to prove theoretically why and how practical reason is possible (as do all presently known 'schools' of practical philosophy) but rather concentrates on providing planners as well as affected citizens with the heuristic support they need to *practice* practical reason, i.e., to lay open, and reflect on, the normative implications of systems designs, problem definitions, or evaluations of social programs.

In order to achieve this purpose, Critical Heuristics takes three requirements to be essential:

First, to provide applied scientists in general, and systems designers in particular, with a clear understanding of the meaning, the unavoidability and the critical significance of justification break-offs;

Second, to give them a conceptual framework that would enable them to systematically identify effective break-offs of argumentation in concrete designs and to trace their normative content; and

Third, to offer a practicable model of rational discourse on disputed validity claims of such justification break-offs, that is to say, a tool of cogent argumentation that would be available both to 'ordinary' citizens and to 'average' planners, scientists, or decision takers.

For each of these three basic requirements, Critical Heuristics offers a key concept. I can only give a brief introduction here; for a more complete explanation, the reader is referred to the main sources (Ulrich, 1983, 1984); for a helpful review see Jackson (1985). The application of these concepts has been illustrated in two earlier-published case studies (Ulrich, 1981b; 1983, Chapters 7 and 8).

Key concept no. 1: Justification break-offs as boundary judgments (whole systems judgments)

Systems science offers a concept that is helpful to understanding the meaning of justification break-offs, though unfortunately its critical significance is not always adequately understood. I mean the well-known concept of *boundary judgments*.

Whenever we apply the systems concept to some section of the real world, we must make very strong a priori assumptions about what is to belong to the system in question and what is to belong to its environment. The boundary judgments representing these assumptions can therefore be understood in a twofold, and complementary, way:

– as *whole systems judgments* [1], i.e., the designer's assumptions about what belongs to the section of the real world to be studied and improved and what falls outside the reach of this effort;

– as *justification break-offs* with regard to the demarcation of the context of application that is to be relevant when it comes to justifying the normative implications of a design for those affected by its effects.

In contemporary systems science, the problem of boundary judgments is either entirely ignored (typically in textbook exercises and case studies) or else it is discussed in terms of formal criteria of modelling, rather than in terms of the normative content of whole systems judgments and corresponding justification break-offs. Frequently, models of 'systems' are presented as if the boundaries were objectively given, and the model itself does not tell us whether the boundaries in question have been adequately chosen. If the problem is discussed at all, it is seen merely from a modelling point of view: so as to facilitate the modelling task, boundaries are determined according to the availability of data and modelling techniques. But even from a merely technical modelling point of view, this way of dealing with the problem of boundary judgments is inadequate. First, the implicit criterion is that everything that cannot be controlled or is not known falls outside the boundaries of the model, so that the model itself looks neat and scientific. In point of fact, the reverse criterion should be applied: we cannot understand the meaning of the model (and hence, the system in question) if we do not understand the model-environment. Hence aspects that are not well understood ought to be considered as belonging to the system in question rather than to its environment, at least until their significance has been studied. Second, such studying of boundary questions must not be restricted to the 'is' (or 'will be') but must always include the 'ought'. Whether or not a certain boundary judgment is rational depends less on what boundaries are presently established than on what the boundaries should be, given the purpose of the model (the systems map or design). The normative content of the answer to the question of what the boundaries should be cannot be justified by referring to data availability, to presently accepted boundaries, or to the success of purposive-rational action. The normative content can be justified only through the voluntary consent of all those who might be affected by the consequences. Hence all the citizens affected, be they involved in the process or not, ought to be regarded as being part of the context of application.

Such an openly and critically normative understanding of boundary judgments has far-reaching implications for systems science and systems design. To mention but two of them:

(a) Systems science will have to employ a new, 'critically-normative' [2] concept of what represents an adequate definition (map, design) of a system: We shall say that *a definition (map, design) of a system is 'adequate' if it makes explicit its own normative content.* [3]

[1] A concept I owe to C. West Churchman, see especially Churchman (1970). Cf. in this context his 'ethics of whole systems' in *Challenge to Reason* (1968). Cf. also Ulrich (1983, pp. 226–230) and passim (see index to the book).

[2] I call a discipline 'critically normative' if it offers methodical help not only in formulating and justifying scientific propositions but also in laying open the normative implications of the standpoint from which it derives and justifies its propositions, rather than misunderstanding or representing this standpoint as objective. Cf. Ulrich (1984, pp. 327).

[3] Cf. Ulrich (1983, p. 229). I have argued against the failure of contemporary systems science to employ the systems idea in a critically-normative manner, i.e., as a tool of practical rather than merely instrumental (or functional) reason, on various occasions and from different points of view, see e.g. Ulrich (1977, p. 1100 ff., 1980, 1981a, 1983, p. 21ff., p. 222 ff., p. 326 ff. and passim, 1987ab)

(b) The designer (applied scientist) will have to aim not at an objective but at a *critical solution to the problem of boundary judgments*. That is to say, it is his responsibility to secure the transparency of the boundary judgments on which he relies and to trace their possible normative consequences; but he cannot delegate to himself the political act of positively sanctioning these consequences—only the affected can. No standpoint, not even the most comprehensive systems point of view, is ever sufficient to validate its own implications. The rationality of a systems design is to be measured not by the degree to which it fulfills the impossible role of providing an elitary justification of its own normative implications, but rather by the degree to which it renders explicit the underlying justification break-offs and thus enables both those involved in and those affected by the design to reflect and discourse on the validity and legitimacy of these break-offs.

Key concept no. 2: A priori concepts of practical reason

In order to facilitate the systematic identification and examination of justification break-offs, Critical Heuristics has developed a check list of twelve *boundary questions*. They aim at boundary judgments that inevitably flow into any systems design. By means of these questions, both the involved and the affected can question a design's normative content and challenge the 'objective necessities' by which the other side may seek to justify or to dispute the underlying boundary judgments.

The twelve boundary questions [4] are given in Table 1.

The twelve boundary questions are organized into four groups of boundary judgments, each group comprising three kinds of categories:

– The first group asks for the *sources of motivation* flowing into the design in question: Who contributes (ought to contribute) the necessary sense of direction and 'values'? What purposes are to be served? Given a tentative planning purpose, whose purpose is it?

[4] The list is partly inspired by similar efforts on the part of C. West Churchman and Peter B. Checkland, though its justification in Critical Heuristics is independent of the two authors. Cf. Churchman (1971, p. 43; 1979, p. 79 ff.) and Checkland (1981, p. 223 ff.).

Table 1
Checklist of boundary questions, the answers to which inevitably flow as normative premises into any concrete systems design

1. Who ought to be the *client* (benificiary) of the system S to be designed or improved?
2. What ought to the *purpose* of S, i.e., what goal states ought S be able to achieve so as to serve the client?
3. What ought to be S's *measure of success* (or improvement)?
4. Who ought to be the *decision taker*, that is, have the power to change S's measure of improvement?
5. What *components* (resources and constraints) of S ought to be controlled by the decision taker?
6. What resources and conditions ought to be part of S's *environment*, i.e., should not be controlled by S's decision taker?
7. Who ought to be involved as *designer* of S?
8. What kind of *expertise* ought to flow into the design of S, i.e., who ought to be considered an expert and what should be his role?
9. Who ought to be the *guarantor* of S, i.e., where ought the designer seek the guarantee that his design will be implemented and will prove successful, judged by S's measure of success (or improvement)?
10. Who ought to belong to the *witnesses* representing the concerns of the citizens that will or might be affected by the design of S? That is to say, who among the affected ought to get involved?
11. To what degree and in what way ought the affected be given the chance of *emancipation* from the premises and promises of the involved?
12. Upon what *world-views* of either the involved or the affected ought S's design be based?

– The second group is to examine the *sources of control* built into a design: Who contributes (ought to contribute) the necessary means, resources, and decision authority, i.e., 'power'? Who has (ought to have) the power to decide?

– The third group of questions is to trace the *sources of expertise* assumed to be adequate: Who contributes (ought to contribute) the necessary design skills and the necessary knowledge of 'facts'? Who has (ought to have) the know-how to do it?

– The fourth group, finally, helps reflect on the *sources of legitimation* to be considered: Who represents (ought to represent) the concerns of the affected? Who contributes the necessary sense of self-reflection and 'responsibility' among the involved? How do the involved deal with the different world-views of the affected?

In short, the first group of boundary questions

asks for the *value basis* of the design; the second for its *basis of power*; the third for its *basis of know-how*; and the fourth for its *basis of legitimation*.

The three questions of each group refer to the following three kinds of *categories*: the first question refers to *social roles* of the involved or the affected, the second to *role-specific concerns*, and the third to *key problems* or crucial issues in determining the necessary boundary judgments relative to the two previous categories. [5]

The critical relevance of these categories and corresponding boundary questions may best be seen by contrasting each 'ought' with the pertaining 'is' judgment:

1. Who *is* the actual client of S's design, i.e., who belongs to the group of those whose purposes (interests, values) are served, in distinction to those who do not benefit but may have to bear the costs or other disadvantages?
2. What is the actual purpose of S's design, as being measured not in terms of the declared intentions of the involved but in terms of the actual consequences?
3. What is, judged by the design's consequences, its built-in measure of success?
4. Who is actually the decision taker, i.e., who can actually change the measure of success?
5. What conditions of successful planning and implementation of S are really controlled by the decision taker?
6. What conditions are *not* controlled by the decision taker, i.e., what represents "environment" to him?
7. Who is actually involved as planner?
8. Who is involved as 'expert', of what kind is his expertise, what role does he actually play?
9. Where do the involved seek the guarantee that their planning will be successful? (E.g. in the theoretical competence of experts? in consensus among experts? in the validity of empirical data? in the relevance of mathematical models or computer simulations? in political support on the part of interest-groups? in the experience and intuition of the involved? etc.) Can these assumed guarantors secure the design's success, or are they false guarantors?
10. Who among the involved witnesses represents the concerns of the affected? Who is or may be affected without being involved?
11. Are the affected given an opportunity to emancipate themselves from the experts and to take their fate into their own hands, or do the experts determine what is right for them, what means quality of life to them, etc.? That is to say, are the affected used merely as means for the purposes of others, or are they also treated as "ends-in-themselves" (Kant), as belonging to the client?
12. What world-view is actually underlying the design of S? Is it the view of (some of) the involved or of (some of) the affected?

Contrasting 'is' and 'ought' boundary judgments provides a systematic way to evaluate the normative content of planning while at the same time laying open the normative basis of the evaluation itself: The 'is' questions aim at determining a design's effective normative implications in the light of the 'ought' answers, that is to say, without any illusion of objectivity. [6]

It remains to be explained why the title to this section speaks of *a priori concepts of practical reason*: First, the suggested boundary questions represent mere 'forms of judgments', that is, they are in need of being substantiated with respect to both their empirical and normative content. Second, they can help to fill critically-heuristic categories such as 'client', 'purpose', etc. with empirical and normative content, but not to *justify* this content. The boundary judgments identified or postulated remain dependent for their justification on a discursive process of consensus formation—a rational discourse—among the involved and the affected.

As previously suggested, contemporary models of ideal discourse do not provide a practicable way to redeem disputed validity claims of justification break-offs; it remains to be shown how practical discourse can secure at least a critical solution to this problem. [7]

[5] For a more detailed introduction of the twelve critically-heuristic categories, as well as the complementary quasi-transcendental ideas of Critical Heuristics not introduced here, see Ulrich (1983, p. 253 ff. Regarding the epistemological status of the ideas and categories cf. Ulrich (1983, p. 231 ff.).

[6] I have sought to illustrate this double employment of the suggested categories in two case studies, see Ulrich (1981b, or 1983, p. 343 ff. ('Project Cybersyn' in Allende's Chile, 1971–73; (1983, p. 372 ff. (health systems planning)).

[7] For a thorough introduction see Ulrich (1983, Chapter 5, esp. p. 301 ff.).

Key concept no. 3: The polemical employment of boundary judgments

The concepts that have been introduced thus far are to provide a tool of reflection for tracing the normative implications of systems designs. But they cannot guarantee such reflection. How then can affected citizens cause the involved decision takers, planners, and experts to reflect on a design's normative content if the involved are not willing to do so on their own? On the other side, how can the conflicting demands of democratic participation (of the affected) and of cogent argumentation (on the part of everybody involved, including the witnesses of the affected) be reconciled so that ordinary citizens can bring in their personal concerns without being convicted of lacking rationality or cogency?

Critical Heuristic's basic conjecture in this regard may by now seem 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. [8]

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.

Now anybody who is able to comprehend the unavoidability and the meaning of boundary judgments in general can also learn to see through—and to make transparent to others—the dogmatic or cynical character of the 'objective necessities' disclosed by experts in specific contexts of application. To this end, concerned citizens and professionals will have to master two tasks of argumentation:

1. They must be in a position to demonstrate that the boundary judgments of the involved cannot be justified rationally, i.e., cogently.

2. They should be able to translate their own subjective way of being affected by the boundary judgments in question into rational, cogent argumentation.

How can ordinary citizens without any special expertise or 'communicative competence' (as required by the ideal models of rational discourse) accomplish this apparent squaring of the circle? My answer is: by means of *the polemical employment of boundary judgments*.

Immanuel Kant, in his discussion of the 'polemical employment of reason' (1787, B767), calls '*polemical*' an argument that is directed against a dogmatically asserted validity claim and which does *not* depend for its cogency on its down positive justification. A polemical argument has only critical validity; but in regard to this merely critical intent, it must be rational, i.e., cogent. Thus the polemical employment of reason, as understood by Kant, has nothing in common with 'polemics' in the contemporary, vulgar meaning of the term; it aims at the cause rather than at the person, and it must be logically compelling.

The use of boundary judgments for merely critical purposes almost ideally fulfills this condition: Boundary judgments that are introduced overtly as personal value judgments entail no theoretical validity claim and hence do not require a theoretical justification. Hence no theoretical knowledge or any other kind of special expertise

[8] I find an interesting addition to this conclusion in Paul Feyerabend's new introduction to the revised German version of *Science in a Free Society* (1978). He observes that experts are often quite unable to justify routine procedures and routine arguments on which their claim for rationality depends; in discussing the assumptions underlying these procedures, they are indeed laymen. Our concept of boundary judgments suggests one possible explanation: the expert's routine procedures and arguments embody the basic boundary judgments by means of which problems are bounded in such a way that they fit his domain of competence. What falls outside this domain is relegated to an 'irrelevant' or 'irrational' ('merely subjective') status. The subjective, indeed dogmatic, character of such boundary judgments is then concealed behind a façade of routine procedures and professional authority ("all experts agree that this is the way to do it", or "we don't know any other way to do it").

or 'competence' is required. Indeed, it is not even necessary to pretend that a boundary judgment used polemically may not be false or merely subjective. What matters is only that no one can demonstrate the objective impossibility (and hence, irrelevance) of a polemical statement any more than its proponent can demonstrate its objective necessity.

Now the crucial point is this. So long as affected citizens employ their boundary judgments for critical purposes only, i.e., without asserting any positive validity claims, they can secure for themselves an advantage of argumentation by imposing the burden of proof upon the involved experts: As against the expert's boundary judgments, they can with equal right and with overt subjectivity advance their own boundary judgments, thereby embarrassing the expert for being unable to prove the superiority of *his* boundary judgments by virtue of his expertise. In this way, they can demonstrate three essential points:

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

(b) that his theoretical competence is insufficient to justify his own boundary judgments or to falsify those of hic critic;

(c) that an expert who seeks to justify his recommendations by referring to his competence or by asserting 'objective necessities' argues either dogmatically or cynically and thereby disqualifies himself.

Thus the polemical employment of boundary judgments enables ordinary people to expose the dogmatic character of the expert's 'objective necessities' *through their own subjective arguments*, without even having to pretend to the objective or to be able to establish a true counterposition against the expert. Therein, I believe, lies the enormous significance of Kant's concept of the polemical employment of reason for a critically-heuristic approach to planning, an approach that would actually mediate between the conflicting demands of democratic participation (of all affected citizens) and those of rational, cogent argumentation (on the part of the involved planners and experts).

To be sure, as soon as the affected claim positive validity for their boundary judgments, they lose their advantage of argumentation and disqualify themselves no less than the experts do. But it would be to mistake the situation if the polemical employment of boundary judgments were considered to produce a mere 'symmetry of helplessness'. [9] The polemical employment of reason secures to both sides an equal position for reasonable dialogue: each side, if only it renounces the dogmatic or cynical employment of boundary judgments, can now argue its case and work toward mutual understanding about the premises and consequences of planning, by advancing its own good grounds, i.e., 'facts' and 'values' capable of consensus such as existential needs of all individuals, ecological knowledge, ethical principles, principles of constitutional democracy, and so on. The fact that ultimate justifications remain impossible provides no sound reason for renouncing any effort to bring in one's own good grounds. Nor does it provide the other side with a good ground to refuse entering upon such an effort: scepticism, turned into an argument against any argumentative effort, is no less dogmatic than the expert's reference to 'objective necessities'. Hence a 'symmetry of helplessness' arises only with respect to dogmatic or cynical argumentation attempts; for the rest, an essential condition of rational discussion is secured, namely, the possibility of 'competent' participation of affected citizens in the process of unfolding the normative implications of planning.

Opening up the applied disciplines for such a process of unfolding is certainly no royal way to solve the problem of practical reason; but it might be an important step towards dealing critically with the justification break-offs that inevitably flow into the definition of specific contexts of application to be considered. It is only thus that applied science can hope to fulfill its mission–to secure improvement of the human condition, by studying contexts of application of human knowledge and design.

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[9] A concept coined by Horst Rittel in a different context, cf. (1963, p. 14).

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