Sprache & Kognition, 14, 1995, Heft 2, S. 91–95

Some Pathologies in the Study of Pathologies. A comment on Anders Jansson (1994)

Joachim Funke

Institut für Psychologie der Universität Greifswald

Summary: In a recent paper Anders Jansson (1994) argued that a certain set of maladaptive behavior can be seen as antecendent to bad performance rather than as a consequence of control problems when dealing with the dynamic system "Moro". It is outlined in this paper: (a) that the pathologies are not clearly defined, thus leading to the situation that two pathologies with an identical set of indicators lead to opposite empirical results; (b) that the observation of pathologies cannot be free from influences due to feedback of results; (c) that indicators of important variables are missing, namely information about subjects' models and knowledge; (d) that the theoretical model which the author comes up with reflects linear thinking and may, thus, be in itself "pathological". For these reasons Jansson's arguments are evaluated as being not convincing.

Einige Pathologien bei der Untersuchung von Pathologien. Ein Kommentar zur Arbeit von Anders Jansson (1994)

Zusammenfassung: Anders Jansson (1994) plädiert dafür, eine bestimmte Klasse fehlangepaßten Verhaltens als Vorläufer statt als Folge schlechter Leistungen beim Umgang mit dem komplexen System «Moro» anzusehen. Die vorliegende Stellungnahme argumentiert: (a) daß die Pathologien nicht klar definiert sind, was dazu führt, daß für zwei Pathologien mit dem gleichen Indikatorsatz gegenteilige empirische Befunde ermittelt werden; (b) daß eine Beobachtung von Pathologien nicht frei ist von Einflüssen, die auf die erzielten Leistungen zurückgehen; (c) daß Indikatoren für bedeutsame Variablen fehlen, insbesondere über Wissen und Modellannahmen der Probanden; (d) daß das von Jansson vorgelegte theoretische Modell typisch für lineares Denken ist und damit selbst als «pathologisch» bezeichnet werden müßte. Aus den genannten Gründen wird Jansson's Argumentation nicht als überzeugend angesehen.

Anders Jansson is interested in maladaptive behavior during dynamic decision making tasks. In these tasks subjects have to interact with computer simulations ("microworlds") which are intended to reflect real world decision problems. According to Brehmer and Dörner (1993), microworlds should help to "escape both the narrow straits of the laboratory and the deep blue sea of the field study", a statement which is not common sense for all researchers in this area (for a critical presentation of different points of view see Funke, 1995).

In the case of Jansson, the selected domain of reality refers to a small Sahel-tribe called the Moros. Subjects had "to improve the living conditions for the tribe in the long term" (p. 163) – a task that seems to be fairly complex because it is not directly evident what one should do. A total of 25 variables could be affected by subjects' decisions, and subjects could ask for detailed information about 45 specific issues. The 40 student subjects were instructed to think aloud and their verbalizations were tape-recorded. They were not allowed to interact with the simulation system directly but had to interact with the experimenter instead, who gave the instructions to the computer program.[1]

One may ask if such a tribe simulation, mediated by an experimenter and compressing 40 years of simulation to 150 minutes, really is a task "that closely resembles a natural dynamic decision task in all its essentials" (p. 160) – but I do not want to argue with the author on this (see for more details Funke, 1995). What is more interesting to me is the question of whether we learn something about maladaptive behavior by reading Jansson's paper. To answer this question I will pose some questions to

All quotations without further reference refer to Jansson (1994).

Thanks to Axel Buchner (Trier), Dietrich Dörner (Bamberg), Hannelore Weber (Greifswald), and Katja Wiemer (Bonn), for helpful comments on a draft version. The paper was written during a substitute professorship of the author at Ernst-Moritz-Arndt Universität Greifswald.

1 There is no evidence in the article that any precautions against experimenter bias have been taken.

myself and to the reader before coming to a conclusion.

How Clearly are the Pathologies Defined?

Jansson's main question is: are pathologies the consequences of failures or their precursors? Jansson starts with an overview over different types of maladaptive behavior. According to previous research[2] he describes seven pathologies which differentiate between "bad" and "good" problem solvers.[3] These seven categories of "maladaptive" behavior are called "acting directly on feedback" (P1), "insufficient systematization" (P2), "insufficient control of hypotheses and strategies" (P3), "no self-reflection" (P4), "selective information gathering" (P5), "selective decision making" (P6), "thematic vagabonding" (P7). All pathologies have a certain set of indicators their number ranging between 4 and 6 which were judged in the actual behavior of subjects according to a so-called "double indication method". This method took care of assigning a pathology to a subject only if *each* indicator for this pathology could be identified in subjects behavior. Also, a subject was called free from a certain pathology only then if *no* indicator for that pathology was found. Tabel 1 shows the connection between the seven pathologies and their 13 indicators in a systematic way.

Table 1 shows at a first glance that the broad majority of the criteria imply a reduced intensity of certain amounts, levels, or proportions of behavior. Only two out of 34 specified effects will increase a certain behavior. Also, as can be seen from Table 1, there are perfect correlations between C01 and C02, between C03 and C05, as well as between C11 and C12. This leads to the question whether these perfectly correlated criteria could not be reduced to central, independent ones – a question which Jansson does not discuss.

A second point with respect to this Table 1 can be made when looking at the empirical effects indicated by bold type-face of the cell entries. P5 is the only pathology with no differential effects between the "good" and the "bad" – but what can also be seen from Table 1 is the fact that three out of 13 criteria do not show *any* significant differentiation between both groups, namely C04, C10, and C13, all of which concern decisions. One explanation could be that these three criteria have reliabilities so low that no effects could be found in any of the pathologies. Instead of providing relevant data about the reliability of his measures, Jansson claims it as a task for future research "to find reliable measures of each one of these pathologies" (p. 170).

But what is most striking in Table 1 is the fact that – in addition to the perfect correlated criteria – also two of the pathologies, P2 and P7, are perfectly correlated! Even the argument that the order of the five criteria for these pathologies may differ (eventually indicating a differential weight of the different criteria for the two pathologies according to some hidden rationale) must be rejected: the sequence of criteria is exactly the same in both pathologies P2 and P7 (cf. Tab. 1 from Jansson, 1994, p. 164). Now, the reader may think of "insufficient systematization" (P2) and "thematic vagabonding" (P7) as being two classes of maladaptive behavior which are very similar if not identical. The normal expectation, then, would be that both classes produce at least very similar if not identical patterns of data. Not so in the present case: Despite of these high similarities with respect to the underlying criteria, the frequency of occurrence respectively non-occurence for pathologies P2 and P7 in his sample of 40 subjects is (according to his Table 2) 29:11 with P2 and 11:29 with P7![4] It follows that two pathologies with the same set of indicators occur with an almost opposite proportion of presence and absence, depending solely on the fact that the same set of behavior is called "insufficient systematization" in the one case and "thematic vagabonding" in the other case. Jansson comments on the low frequency of P7 by stating that this pathology seems to be "more unusual" without even wondering about

2 To Jansson, previous research means: research by the Brehmer group and the Dörner group. For a more complete list of different approaches to complex problem solving see Buchner (1995). For a description of more types of maladaptive behavior see, for example, Reason (1990).

3 I do not like the term "bad" or "good" problem solver – it suggests that we can easily differentiate between performance of people by means of clear measurement. From my point of view, that is not at all justifiable in the current context of the task.

4 Interesting enough, this proportion 11:29 corresponds exactly to the proportion of "good" and "bad" performers (see p. 164). Could it be that this pathology is identical to saying that someone deals with the task in a good or bad manner according to the experimenter's taste?

Table 1: The correspondence between criteria C01 to C13 and the seven pathologies P1 to P7 (extracted from Jansson, 1994, Table 1)

Criterion	Pathology P1	P2	P3	P4	P5	P6	P7
C01: time difference between decision and info gathering	**l**	**l**	–	–	–	–	**l**
C02: information gathering stability	**l**	**l**	–	–	–	–	**l**
C03: proportion of detailed decisions made	**l**	–	**l**	**l**	–	–	–
C04: decision stability	m	l	–	–	–	–	l
C05: amount of total time spent	**l**	–	**l**	**l**	–	–	–
C06: amount of information collected	**l**	–	**l**	–	**l**	**l**	–
C07: proportion of changes to collateral issues	–	**l**	–	–	–	–	**l**
C08: proportion of changes to detailed issues	–	**l**	–	–	**l**	**l**	**l**
C09: level of focusing on detailed issues	–	–	**l**	**l**	–	–	–
C10: level of focusing on decisions	–	–	–	m	–	–	–
C11: amount of information categories employed	–	–	–	–	**l**	**l**	–
C12: amount of decision categories employed	–	–	–	–	**l**	**l**	–
C13: amount of decisions made	–	–	–	–	–	**l**	–

Note: The interpretation of the cell entries is l = less of that criterion and m = more of that for the given pathology. A "–" represents no connection between the corresponding criterion and the pathology. Bold letters indicate significant differences according to Table 5 (from Jansson, 1994) between "good" and "bad" performers. – The labels of the pathologies are P1 = acting directly on feedback, P2 = insufficient systematization, P3 = insufficient control of hypotheses and strategies, P4 = no self-reflection, P5 = selective information gathering, P6 = selective decision making, P7 = thematic vagabonding.

the fact that both pathologies should occur with the same frequency, for nothing more than for logical reasons!

Is the Observation of Pathologies Not Influenced by Feedback?

Jansson claims to present pathologies the occurrence of which is not influenced by any feedback about the results of interventions. His attempt is to register the behavior of his subjects "before they have received any feedback indicating catastrophes of any kind" (p. 161), "to analyse the behaviour of the subjects before they have experienced any more dramatic consequences of their decision making" (p. 162), "before they knew anything about the result of their decision making" (p. 170). The fact that he refers to this point three times underlines its importance – and indeed, there is reason to doubt that the presented data are really free from feedback influences.

Even if Jansson would only consider data from the first ten years of the simulation (to which range he does not restrict himself), these data would not be free from feedback influences! Even without obvious catastrophes, subjects are certainly able to estimate at least roughly their success during the first ten-years period. This rough estimate (e.g., "things are going crazy", "I don't reach my goals as quick as I want") leads to behavioral consequences. From what fact can Jansson conclude that these first ten years do not affect the internal model of the subjects? Actually, we do not know anything about these effects because Jansson provides no data to illustrate his point. It would have been easy to record the effects of the first ten years by measuring, for example, the expectancies of the subjects.

Do We Find Indicators of Important Determinants?

What are the reasons for subjects to exhibit maladaptive behavior with such an enormous frequency that one may even doubt the use of the category "pathology" for behavior which seems to be quite normal? Jansson argues (p. 172f.) that there are two import determinants, namely *lack of heuristic competence* and *insufficient mental models*. For both mentioned determinants diagnostic tools do exist (e.g., "Fragebogen zur heuristischen Kompetenz" [heuristic competence questionnaire]: Stäudel, 1988; "Kausaldiagrammanalyse" [causal diagram

analysis]: Beckmann, 1994; Funke, 1992; Müller, 1993) – Jansson has used none of them and, consequently, can only speculate on this point.[5]

Referring to Dörner and Schaub (1994, p. 448), there are four major causes of pathologies (which are not directly related to Jansson's two determinants, see above): (1) the restricted capacity of human thinking, (2) the tendency to guard our feeling of competence and efficacy, (3) the weight of the "actual problem", and (4) forgetting. In the light of this framework, one has to conclude: Jansson does not even try to get hold of any of these four determinants with his data.

Is There Any Theoretical Progress?

The theoretical integration presented by Jansson at the end of his article (p. 171 and Fig. 2) results in a one-way type of thinking by showing two simple paths, leading to either "bad" or "good" performance. This way of theorizing closely resembles the pathology of linear thinking (see Dörner, 1980): one chain of factors, without any feedback loops, leading to one of two extreme alternatives after a series of steps. It goes without saying that theories should be parsimonious, but not simplistic, ignoring elementary aspects of control (see, e.g., Brehmer, 1992). Instead of setting up a list of pathologies which can be reached via one path and can be escaped via another path, I think it would be more useful to organize errors around a general model of action regulation like the one described above. This procedure would imply to tap important determinants of pathologies by a set of instruments (which, by the way, are far from "ready to use"). Theoretical progress needs good data – if these are not properly collected, no important conclusion can be expected.

Conclusion

To sum up: The paper of Anders Jansson (1994) deals with an interesting topic within dynamic decision research. However, due to a number of serious flaws the study which he presents cannot answer any questions about the role of pathologies properly. First, the pathologies are ill-defined and the data presented contain obvious contradictions which the author fails to notice. Second, Jansson's treatment of feedback is naive in that he ignores subjects' abilities to estimate their performance from non-catastrophic system states. Third, Jansson does not even try to get hold of the determinants of maladaptive interventions – he simply speculates about them and confront the reader with unsatisfactory arguments. Finally, Jansson's theorising represents the type of linear causal-chain thinking which problem solving researchers have identified all too often in their "bad" subjects.

What we urgently need is more information about the internal models of the subjects as well as about the task under study (especially with respect to the amount of knowledge necessary for control, but also more solid information about the optimal way of dealing with such tasks). Also, the pathologies have to be characterized more precisely, and, if possible, grouped around different phases of action regulation. Their dimensional structure has to be confirmed empirically before they are used for descriptive purposes.

As long as these points cannot be made clear, statements about pathologies remain mostly speculative. From my point of view, the question of causality with respect to these pathologies can be illuminated only by means of properly controlled experiments.

5 At this point I do not want to discuss the very different psychometric qualities of these two instruments in more details. The interested reader should refer to Köller and Strauß (1994) concerning "Kompetenzfragebogen" and to Müller (1993) concerning causal diagramming. The latter technique was also evaluated by Beckmann (1994).

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PD Dr. Joachim Funke, Psychologisches Institut, Universität Bonn, Römerstr. 164, D-53117 Bonn. Email: Joachim.Funke@uni-bonn.de