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Restrictive Control and Information Pathologies in Organizations

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Although the relation of power to knowledge is an often discussed theme, a psychological and sociological scrutiny of the issue is lacking. A new conceptual and theoretical approach to this issue is presented here that distingushes between restrictive and promotive control. Restrictive control is a form of power exertion in which one actor pushes his wishes through against the interests of another actor. In contrast, if an actor influences the other in line with his or her interests, this is called promotive control. Information pathologies, i.e., avoidable failures of distributed information processing, are introduced as an inverse measure for the quality and quantity of knowledge production. It is hypothesized that restrictive control has negative consequences for the production of new or better knowledge, because it induces information pathologies that in turn lower the effectiveness of joint action. These two hypotheses are tested in a study on 21 successful and 21 unsuccessful innovations with a dual qualitative and quantitative approach. The interpretive analysis of interviews with the main actors of each innovation case as well as the statistical analysis of questionnaire responses by the same actors strongly corroborate both hypotheses. Methodological problems, theoretical perspectives, and practical consequences are discussed.

The second half of this century has seen the transition from industrial to informational societies. The coming century will see communication and information processing becoming even more important for the handling of any issue in politics, in the economy, or in private affairs. The amount of information produced is

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presently doubling every few years; that is, the growth of information is exponential. Yet the multiplicity of information, shaded by differing opinions, interests, and belief systems, furthers so-called intelligence failures or information pathologies (Wilensky, 1967), which may lead action into undesirable directions. The more information is available, the more difficult it is to find necessary and useful information. Information pathologies can have quite different causes, for example, insufficient on-the-job training, blindness due to long-term experience, noncommunication out of mistrust and antipathy, and unfiltered communication leading to information overload, as well as hierarchical communication barriers and ingroup stereotypes (see O'Reilly, 1983; Scholl, 1992a; Wilensky). Since relevant information advances the knowledge needed for a good decision, information pathologies are likely to subvert decision making into unwise actions with unexpected and sometimes disastrous consequences. It is therefore very important for scientific understanding as well as for practical applications to gain more insight into the forms, causes, and consequences of information pathologies.

Wilensky coined the term "information pathology" and applied it in studies on knowledge production in government and industry (1967). Yet his general approach, including all forms of avoidable intelligence failures, has not been followed by others. Instead, various more specific phenomena such as information overload (e.g., Driver & Streufert, 1969), biased communication due to political reasons (Pettigrew, 1972), biases in upward communication (e.g., Jablin, 1979), groupthink (e.g., Janis, 1982), self-serving information processing (e.g., Brockner et al., 1986), the noncommunication of unshared information (Stasser & Titus, 1987), or productivity losses in groups (e.g., Diehl & Stroebe, 1991) gained attraction as areas for empirical and theoretical investigation, which is understandable in an era of specialization. However, the more general view that regards all the different forms of information pathologies together may lead to more general insights. Therefore, the general idea of information pathologies introduced by Wilensky (1967) was taken up again. In this article research about the relationship between infomation pathologies and innovation success is reported. This topic is highly relevant in many Western societies with high rates of unemployment (such as Germany, where the study was carried out), because innovations are seen as a superior means of creating new jobs. Innovation success is, however, just one example of effective joint action. Thus, the hypothesis is advanced and tested that power exertion in the form of restrictive control (see below) is a major cause of information pathologies and thereby impedes good solutions to the problems concerned; that is, it impedes effectiveness.

Conceptual and Theoretical Assumptions

Wilensky (1967) uses the term "information pathologies" synonymously with the term "intelligence failures" to comprise the various deficiencies and

inadequacies of organizational information processing. High-quality information should be clear, timely, reliable, valid, adequate, and wide-ranging. An information pathology or intelligence failure therefore means "the inability to muster the intelligence needed for successful pursuit of organizational goals" (pp. viii–ix). Later, Wilensky exemplifies information pathologies in the following way:

> Sources of failure are legion: even if the initial message is accurate, clear, timely, and relevant, it may be translated, condensed, or completely blocked by personnel standing between the sender and the intended receiver; it may get through in distorted form. If the receiver is in a position to use the message, he may screen it out because it does not fit his preconceptions, because it has come through a suspicious or poorly-regarded channel, because it is embedded in piles of inaccurate or useless messages (excessive noise in the channel), or, simply, because too many messages are transmitted to him (information overload). (p. 41)

Since the information processing capacity of individuals and organizations and, consequently, human rationality is bounded (Kruglanski, 1989; Miller, 1956; Simon, 1957; Tversky & Kahneman, 1990), the utopian ideal of perfect rationality, as used in economic science, should not be taken as a yardstick for the assessment of information pathologies. Consequently, the following formal definition is introduced:

> Information pathologies are defined as avoidable failures of distributed information processing, that is, decision-relevant information that is *producible* is not produced, or that is *procurable* is not procured, or that is *transmissible* is not (accurately) transmitted, or that is *applicable* is not (accurately) applied in the decision-making process.

Human knowledge is developed by integrating relevant pieces of information. Information pathologies slow down, bias, or even impede the acquisition of knowledge necessary for good problem solving and decision making. Thus, information pathologies can be seen as the inverse concept of socially produced valid knowledge. Information pathologies may develop out of a multitude of circumstances; the causes may, for example, be found in individual shortcomings such as lacking problem awareness or wishful thinking, or in interaction deficits such as problems in consensus formation or in the exertion of restrictive control. This brings us to the next conceptual question.

Power Exertion and Restrictive Control

The terms *power* and *influence* are used quite differently in diverse cultures as well as in different social sciences. Consequently, they need to be defined before the central hypothesis of this article can be formulated. The German term *Macht* and its English translation *power* differ with regard to their meaning: in German, *Macht* is used in the sense that one actor pushes his/her own interests against the interests of the other; *Macht* is therefore seen as intolerant, unappreciative, inconsiderate, and uncooperative. On the other hand, *Einfluss* (influence) has the opposite connotations of tolerance, appreciation, consideration, and cooperation, though it is seen as being as strong as *Macht* (Pelz & Scholl, 1990). In English,

however, *power* is seen more as a general energy used in a much broader sense, even including aspects of electricity. In social psychology, the usual definition of *power*/*Macht* is based on the English concept: *Power* is seen as a potential that becomes influence if used (Argyle, 1990; Cartwright, 1959; French & Raven, 1959; Raven, 1992). This definition is very broad because it includes any social impact from helpful information to killing someone.

Yet other definitions do exist that are more similar to the German conceptualization explained above; they are more common in sociology and political science. For instance, Etzioni (1968) formulates:

> An application of *power* changes the actor's situation and/or his conception of his situation—but not his preferences. . . . The exercise of *influence* entails an authentic change in the actor's preferences; given the same situation, he would not choose the same course of action he favoured before influence was exercised . . . influence involves not suspension or suppression of their preferences but a respecification of their commitments. (pp. 359–360)

Similar conceptual distinctions can be found in Partridge (1963, p. 111), Abell (1977, pp. 5–6), and Scholl (1991, 1992b), who defines *Macht*—the German equivalent of power exertion—as a social impact against the basic preferences or interests of the interaction partner. To avoid misunderstandings I have not used the word *power* here, but have chosen instead *restrictive control*, as it is less confusing; if someone wants to push his own interests against the interests of others, he or she should act in a way restricting them in the fulfilment of their interests. On the other hand, *Einfluss*—the German equivalent of *influence*—is defined as a social impact in line *with* the interests of the other, and is called here *promotive control*. The difference between both forms of control can be exemplified by a lawyer who gives good advice to a friend, helping her to find a better way of handling her affairs (expert promotive control), or who uses his knowledge to get the upper hand in a quarrel with a neighbor by driving him into a detrimental lawsuit (expert restrictive control). Both forms of control imply that "forces are activated in the person's life space," which is how Cartwright (1959) defined power in Lewinian terms, though they represent very different classes of interpersonal acts. Therefore, the conceptual distinction between power used against the interests of another actor (i.e., restrictive control) and power used in line with the interests of the other (i.e., promotive control) is necessary for formulating the following central hypotheses, which also have a great deal of important practical implications.

Knowledge and Power

The relation of knowledge to power is an old philosophical theme: Whereas Plato argued that the most thoroughly reflecting people, the philosophers, should be the rulers of the society, history has shown that rulers and philosophers are different kinds of people (Popper, 1945). Moreover, whereas knowledge can be primarily improved by critical discussions and investigations, power is often used to suppress

critical thinking (Popper, 1945). The rise of the sciences was, for example, dependent on basic rights of freedom and especially on independence from religious and political powers. This line of thought has unfortunately not been scrutinized in detail in psychology or sociology, though some evidence of the relation of certain forms of power to knowledge has been produced over the years. For instance, democratic leadership seems to stimulate more creativity than authoritarian leadership (Lewin, Lippitt, & White, 1939); the correct solution to a problem is more often disregarded by a group, the lower the status of the member who suggested the solution (Torrance, 1955); groups develop more and better solutions if their leader acts as a process facilitator instead of pushing his or her own opinion (Maier, 1967); and groups with nondirective leaders use more of the available facts and suggest more solutions than groups with directive leaders (Flowers, 1977). Everyday observations show even more convincingly that powerful people often stop discussions if they see their interests being endangered, that people with deviant opinions come under conformity pressure or are driven out of the decision-making process, or that information is held back or manipulated in favor of a preferred course of action. Less powerful people are often excluded from representing their ideas from the outset, and if they take part in decision making they are often reluctant to express their opinions freely because they fear being punished by the dominant people.

In all these experimental and real-life cases, power exertion is used to restrict other people. Consequently, we can condense the available evidence into a simple general hypothesis: (Ia) Power exertion in the form of restrictive control has a negative effect on the amount and validity of knowledge production because the optimal flow of information is damaged (Scholl, 1991; for a more fundamental derivation of hypothesis Ia see Scholl, 1992b). Because of the assumed inverse relationship between information pathologies and the production of knowledge this thesis can be reformulated into the parallel—and in our innovation project, empirically investigated—hypothesis (Ib): Power exertion in the form of restrictive control raises the number or extent of information pathologies. The central hypotheses Ia and Ib are assumed to be valid only with this definition of power exertion as restrictive control. Here, the interaction process is focused on the question of who will prevail and the reciprocal means to win the issue. In contrast, with the exertion of promotive control the interaction process is focused on the question of how to find better ways to secure the interests of both parties involved, and thereby on the problem itself, to detect better solutions.

If we assume in a subsequent hypothesis (IIa) that the production of better knowledge raises the likelihood of successful solutions for any complex problem, then the exertion of restrictive control deteriorates indirectly, via an insufficient growth of knowledge, the effectiveness of the whole process. In experimental studies with relatively simple problem-solving tasks, effectiveness is often equated with the amount of knowledge produced. However, this does not make much sense if complex practical problems are being researched. The growth of knowledge can

only partly determine the effectiveness of a solution because erroneous assumptions may point to the same (good or bad) alternatives as correct assumptions. Moreover, the best knowledge does not guarantee that action is taken adequately, or, even worse, there is the danger of "paralysis through analysis." Consequently, effectiveness has to be introduced analytically and empirically as a distinct variable. For the purpose of our empirical investigation, where information pathologies are used as an inverse measure of knowledge production, hypothesis IIa is reformulated into IIb: The number and extent of information pathologies have a negative impact on the effectiveness of complex tasks.

The Empirical Investigation

Hypotheses I and II can be tested in any situation in which complex problems have to be handled by more than one person. In the study reported here, we looked at product and process innovations that are especially dependent on proper communication and information processing. The term *innovation* points to the fact that something new has to be produced for which the existing knowledge is not sufficient, and the production, procurement, transmission, and application of information is especially needed to augment and improve the existing knowledge. Innovations are highly relevant for the improvement of life conditions and necessary for the survival of organizations and firms in a globalizing economy. Today, much more than in earlier times, the worldwide economic competition is an innovation competition. Studying information pathologies, that is, relevant information that is not produced, not procured, not (accurately) transmitted, or not (accurately) applied in innovation processes, is thus very relevant from a theoretical as well as a practical point of view. And if power exertion in the form of restrictive control instigates such information pathologies (see hypothesis Ib) whereas promotive control furthers the growth of knowledge, then an important set of practical measures is available to raise the probability of innovation success, or—generally—effectiveness (see hypothesis II).

Method

Overview

The research team[1] approached several firms of different size, regional location, and industry to carry out the study. In 16 firms, 21 successful and 21

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[1]The team included sociologist Lutz Hoffmann, psychologist Christof Gierschner, and the present author as the principal investigator. We would like to thank the German Research Council for funding the project over three years.

unsuccessful innovation cases were intensively studied. In each firm we chose, together with the executives, one or two successful as well as one or two unsuccessful product and/or process innovations, such that the difference in success could not be attributed to differing characteristics of the organization or industry, but rather had to be sought in the innovation process itself. The most important members of each innovation project were identified by interviews with the executives and the innovators themselves. Most of them (5 on average) could be approached, with the exception of those who had left the organization or worked abroad. They were intensively interviewed by two interviewers, such that the innovation process could be ascertained and blind spots in the report of an interviewee could be detected by cross-checking the reports of the others. From these comparative interviews a case report was written with special attention being given to reported and inferable information pathologies. A qualitative analysis of the hypothesized relations was performed on the basis of these case reports.

Case studies based on interviews have the advantage of showing up events that are totally new and surprising for the researcher, because data are generated from the subjects' perspectives. On the other hand, this methodology relies heavily on qualitative interpretation. Therefore, questionnaires with standardized items were also employed, which could be used without any further qualitative interpretation of the researchers in a quantitative analysis. This dual-method approach enabled a more thorough test of the hypotheses in question.

After the interview each participant received a questionnaire measuring information pathologies, promotive and restrictive control, innovation success, and other relevant variables in a standardized format. The return rate of the questionnaires was, at 81 percent, very good. A preliminary version of the questionnaire was applied in the first 4 of the 42 innovation cases and was then completely revised. This left 142 respondents from 38 innovations to form the basis for the quantitative analysis.

Measurement

For the qualitative analysis the existence and kind of information pathologies were first discussed immediately after the interviews by the two members of the research team who had carried out the interviews in the case at hand. After finishing the field work, they were compared and formally rated by one of them (summarized in Gierschner, 1991) and independently by the principal investigator. Initial estimates of the two independent raters correlated .76. The ratings were then compared and the most plausible estimate and labeling was determined. To get an estimate of the error reduction or reliability gain obtained by this discussion, it was compared to a doubling of the length of a test; applying the Spearman-Brown formula to the correlation of .76 yielded a reliability estimate of .88 for this qualitative measure. The classification of the information pathologies according to their

apparent causes was developed and carried out by the author in line with earlier theoretical analyses (described in Scholl, 1990, 1992a).

In the questionnaire, restrictive and promotive control were operationalized as distinct variables in the context of the dual-concern model of conflict management (Pruitt & Rubin, 1986) and introduced in the following way:

> Innovation processes often give rise to differences of opinion. Please answer some questions about the process of discussion and decision-making concerning the innovation: when differences of opinion occurred, the process of discussion and decision-making was characterized by
>
- words of command by superiors	not at all 0—1—2—3—4—5—6 very often
- pressure from "above"	not at all 0—1—2—3—4—5—6 very often
- attention to all opinions	not at all 0—1—2—3—4—5—6 very often
- controversial, intensive discussion	not at all 0—1—2—3—4—5—6 very often
- mutual convergence	not at all 0—1—2—3—4—5—6 very often
- harmonizing opposite opinions	not at all 0—1—2—3—4—5—6 very often

The first two items, intended to measure restrictive control (Cronbach's α = .82), focus on hierarchical restriction as the most important form of restrictive control in organizations (Buschmeier, 1995). Here the words "command" and "pressure" suggest that the interests of the subordinates are not taken into account. Promotive control was operationalized with the following four items: These items focus on the consideration of all opinions involved, on mutuality in discussions, and on the readiness to change one's opinion; they are somewhat more heterogenous (Cronbach's α = .62). The implied mutuality secures that the opinions of all sides and the interests behind them are respected. For the two measures of restrictive and promotive control the answers of all respondents per innovation case (mean = 4) were averaged, yielding additional reliability and validity gains from complementary perspectives. To get a numerical estimate for the resulting reliabilities, the Spearman-Brown formula was applied to this averaging operation, because it is equivalent to a quadruplication of test length.[2] This procedure gave a reliability estimate of .95 for restrictive control and .87 for promotive control.

The measure of information pathologies was selected from a larger item pool because several quite diverse aspects were included (see the discussion above). The following, in themselves more or less reliable, rating blocks (a)–(e) with 7-point scales were chosen for building an index of information pathologies (condensed text):

> information pathologies are more severe, the more
> (a) information is received biased, in a roundabout way, too late, or not at all (4 items, Cronbach's α = .84),
> (b) it is difficult to utter deviant opinions vis-à-vis superiors, colleagues, subordinates or

[2]These estimates may be somewhat too high. However, since the true test length varied with the number of respondents per case, Cronbach's alpha could not be computed over all answers to all relevant items per case in one single step.

people from other departments (4 items, Cronbach's $\alpha = .55$),
(c) important information is too abstract or too difficult to comprehend (2 items, Cronbach's $\alpha = .59$),
(d) important information is uncertain, rumoured, doubtful or from unofficial sources (4 items, Cronbach's $\alpha = .72$),
(e) an idea is accepted if the risk is played down (1 item).

Combining these item blocks into a total score of information pathologies per respondent yielded a reliability of .72 (Cronbach's α). Subsequently, the scores of all respondents per case were averaged, as argued above, which gave a reliability estimate of .91 (Spearman-Brown).

Innovation success was determined in a fourfold way because there is usually much ambiguity in the judgments on it, especially for intermediate innovations:

1. Successful and unsuccessful innovations were chosen at the beginning of the investigation in each firm by management judgment.
2. Respondents rated several success dimensions on 7-point scales from total failure (–3) to total success (+3) with high reliability (Cronbach's $\alpha = .90$):

- I think the innovation is . . . all in all . . .	a total failure (–3).....(+3) total success
- . . . with regard to the economic performance . . .	a total failure (–3).....(+3) total success
- . . . with regard to the experience made . . .	a total failure (–3).....(+3) total success
- . . . with regard to the final solution . . .	a total failure (–3).....(+3) total success
- . . . with regard to the prior expectancies . . .	a total failure (–3).....(+3) total success

   The average on these scales per respondent was taken and again averaged over all respondents per case yielding a reliability estimate of .97 (Spearman-Brown). The total average for the (according to management judgment) successful innovations was +2.3 and for the unsuccessful innovations –0.2; the difference is highly significant: $t\,(36) = 10.7$, $p < .001$. The innovation sample was split into cases below +1.0 and above +1.0, such that perfect agreement was reached with management judgment except in three cases: Two of them were excluded from the analysis because of this ambiguity, reducing the final sample size for questionnaire measures from 38 to 36 cases; the third judgment was reversed because clear economic data (see 3) supported the questionnaire ratings.
3. Additional economic data were collected for the product innovations and the interviews were scanned for the status of the process innovations; these sources corroborated the dichotomous judgment from the preceding analysis.
4. Ratings of (a) complexity, (b) innovativeness, and (c) phase in the life cycle showed no significant differences between successful and unsuccessful innovations. That meant that these two groups of innovations were comparable; the failures could be attributed neither to higher complexity of the subject, nor to extreme innovativeness, nor to a very early phase in the life cycle in which success may not yet have been visible. Though a clear demarcation of the success or failure of innovations is said to be extremely difficult (Hauschildt,

1993, chapter 11), the obtained estimates and cross-checks secured a very high reliability and validity of this dichotomous measure.

Results

Qualitative Case Analysis

In the qualitative analysis of the innovation case reports, 135 instances of information pathologies could be ascertained. Guided by the definition of information pathologies given above, we classified them as follows. We found 25 instances of producible information that was *not produced*, for example, because of hindrance through others or a lack in basic knowledge; 22 instances of procurable information that was *not procured*, for example, by foreclosing participation or by not seeking the experience of others; 40 instances of transmissible information that was *not at all or not correctly transmitted*, for example, because of insufficient understanding, overly long communication chains, departmental egoism, or manipulative intentions; and 48 instances of applicable information that was *not at all or not correctly processed and applied*, for example, because of interest-bound bias, conformity pressures, or the well-known "not-invented-here" syndrome.

Testing hypothesis IIa gave an average number of information pathologies of 2.2 for the 20 successful innovations and of 4.74 for the 19 innovation failures,[3] $t\,(37) = 6.48$, $p < .001$, which corroborated the hypothesis. The effect size, according to Cohen (1988), was very large, $d = 1.5$.

The information pathologies showing up in the case reports were embedded in process characteristics that suggested a causal interpretation. One example may clarify this:

> Two project managers had to devise and implement a new computerized system for materials' administration but had enormous problems with the resistance and even sabotage from their former superiors. Only when their superiors retired and they themselves were promoted to these positions they could go ahead with the project. They then decided not to involve the operators of the old and the new system in the change process because they again feared insurmountable disturbances. When the new system was ready for operation chaos was produced, it did not function at all. Only when the operators were included in the correction and the debugging process and could contribute their practical day-to-day experiential knowledge did the system gradually function in the intended way.

In the above case, we concluded that the phase of nonparticipation of the operators should be classified (a) as an instance of procurable information that was not procured, and (b) that its likely cause could be classified as a case of hierarchical restrictive control because the project managers apparently used their newly

[3]Two of the 42 original cases had to be excluded because of success ambiguity (see Method section) and for one case the interviews were too sparse such that no case report was written.

acquired power position for planning and implementing the system in a nonparticipative manner. In this way, we looked for the likely causes of all the ascertained information pathologies and condensed the inferred causes into a fivefold classification, condensed from Wilensky (1967) and Scholl (1990, 1992a), see Table 1.

The first two categories of the general classification refered to individually centered information pathologies (number of instances in successful/unsuccessful innovations in parentheses). (1) *Lack of problem awareness* (9/17), including primarily a lack of information search (5/8), insufficient basic knowledge (1/5), blindness from long-term experience (2/2), and three ungrouped instances (1/2). Another individual cause was (2) *wishful thinking* (9/15), including biased information selection (4/8), devaluation of the knowledge of others (2/4), and conceit leading to undervaluation of the problems and the knowledge of others (3/3).

The next two categories refered to characteristics of interactions. (3) *Problems in consensus formation* (5/23), including departmental egoism (1/7), deficient efforts to understand (2/3), personal antipathy (0/4), an organizational split between information processing and decision making (1/3), overly long information chains (0/3), and harmonizing instead of critical discussion, a groupthink facet (0/2), plus two ungrouped instances (1/1). The largest category was (4) *restrictive control* (18/32), including nondelivery of information in order to favor one's own intentions (8/3 [!]), refusal of subordinate participation (3/7), obstruction of information acquisition (3/6), upward camouflage of bad news (an anticipated restrictive control reaction; 1/5), concealment of goals to push unlegitimized interests (2/4), ignoring differing opinions because of a superior power position (0/3), manipulation of information (0/2), and conformity pressures as another facet of groupthink (0/2), plus an unlegitimized intervention (1/0).

The last category referred to the idea of knowledge itself. (5) *Inadequate assumptions about the nature of knowledge* (2/5), including playing off experience against "scientific" knowledge and vice versa (1/3), the illusion of objectivity whereas practice-relevant information is usually interest-bound (0/2), and a climate of error-avoidance in which learning by trial and error is impeded (1/0).

Table 1. Main Causes of Information Pathologies

	Innovation success		
Causes of information pathologies	Yes	No	Total
Lack of problem awareness	9	17	26
Wishful thinking	9	15	24
Problems in consensus formation	5	23	28
Exertion of restrictive control	18	32	50
Inadequate assumptions about knowledge	2	5	7
Total	43	92	135

Nondelivery of information, obstruction of knowledge acquisition, refusal of subordinate participation, euphemistic upward communication, concealment of goals, ignoring other opinions, information manipulation, and conformity pressures were the subcategories that had restrictive control as their primary cause in common. Thus, restrictive control was the most important cause of the number of information pathologies, corroborating hypothesis Ib. Two thirds of the information pathologies induced by restrictive control were observed in unsuccessful innovations (32 out of 50, $\chi^2(1) = 3.92$, $p < .05$), which again confirms hypothesis IIb, especially for those information pathologies induced by restrictive control. A thorough qualitative analysis of the cases, such as that reported above, strongly supported the hypothesized causal interpretation that restrictive control furthers information pathologies, which, in turn, have a negative impact on innovation success, that is, on effectiveness.

Nondelivery of information, the only subcategory which was more often observed in successful than in unsuccessful innovations, can be read as a means of counterpower against exerted or anticipated restrictive control by upper management levels circumventing thereby the likely negative effect on innovation success. It was typical for those cases in which the (finally successful) innovation was carried out by conspiracy against upper management people. (See the special analysis by Hoffmann, 1991.)

Quantitative Questionnaire Analysis

The measurement of information pathologies by questionnaire gave another, complementary picture of those problems with which innovators have to struggle. The results of the different item blocks in their relation to the success of the innovation are reported first, mainly for descriptive reasons.

Flaws in information transmission included those instances in which information is received biased, in a roundabout way, too late, or not at all. Successful innovations experienced fewer problems, $t(36) = 2.3$, $p < .05$, with such flaws ($M = 1.7$) than unsuccessful innovations ($M = 2.4$). *Difficulties in uttering deviant opinions* vis-à-vis superiors, colleagues, subordinates, or people from other departments were smaller, $t(36) = 2.1$, $p < .05$, in successful innovations ($M = 1.1$) than in failing ones ($M = 1.6$); yet, as the values on a scale from 0–6 demonstrated, it was seldom a severe problem to utter a deviant opinion, even in the unsuccessful cases. Innovation processes should be hindered if important information is *too abstract or too difficult* to comprehend: Information in unsuccessful cases seemed to be a bit more abstract and difficult to understand ($M = 3.4$) than in successful cases ($M = 2.9$), but the difference was not significant. If important information is *uncertain, rumored, doubtful, or from unofficial sources,* this can be an important obstacle: For successful innovations this was lower ($M = 2.4$) than for unsuccessful ones ($M = 2.9$), $t(36) = 1.9$, $p < .05$. Finally, the single item measure that *an idea is accepted if the risk is*

played down showed a more frequent use of that information manipulation, $t(36) = 3.6$, $p < .01$, in unsuccessful cases ($M = 2.9$) than in successful ones ($M = 1.5$).

Though additional questions on information-pathological aspects were available, only the measures mentioned above were included in the index of the amount of information pathologies because they constituted a reliable and—according to their content—valid compound measure. Thus, hypotheses Ib and IIb, which were tested in the preceding section with regard to the number of information pathologies, were now tested again with regard to their extent. Both hypotheses imply significant correlations with a specified sign.

The distribution-free Spearman rank correlation between restrictive control and the compound measure of information pathologies was $r_s = .42$ ($p < .01$, $n = 36$ cases), that is, the more restrictive control was exerted by superiors in innovation processes, the greater the extent of the information pathologies; this significant positive correlation supports hypothesis Ib. The Spearman rank correlation between the extent of information pathologies and innovation success (0 = failure, 1 = success) was $r_s = -.43$ ($p < .01$, $n = 36$ cases); this result supports hypothesis IIb. To check the statistical tenability of the implied mediating role of information pathologies, a LISREL analysis with rank correlations was run (instead of a partial correlation based on Pearson correlations). The assumed order: the more restrictive control $\rightarrow$ the more information pathologies $\rightarrow$ the less innovation success, was corroborated with a sufficient goodness of fit, GFI = .98, and an insignificant change value, $\chi^2(1) = 1.35$, $p = .25$.

Discussion and Conclusions

Methodological Considerations

The quantitative analysis on the basis of questionnaire items supported the results of the qualitative analysis very well. Of course, several methodological objections could be made. (a) Despite the corroborating LISREL analysis, correlations are still open to diverging causal interpretations. The causal ordering of restrictive control and innovation success could in particular be changed: It could be speculated that the more likely it is for possible failures to occur, the more restrictive control is exerted. However, the case histories are helpful in this respect: Restrictive control was primarily exerted to push one's own interests regardless of the consequences for the success of the innovation. In some cases restrictive control was even exerted to torpedo a likely success that would have been the success of another person or department. (b) The questionnaires were filled out in retrospect, and the known result of the innovation may have influenced the estimate of information pathologies. Such a bias cannot be ruled out, but the fact that the amount of information delivered and received (each variable measured reliably with several items) showed no significant difference between success innovations

and failures speaks against such a general bias. Moreover, the case reports, which are not so susceptible to such a quantitative bias, support the quantitative analysis. (c) The two-item measure of restrictive control is not optimal because it includes only position power; it should have been enlarged and enriched with other forms of restrictive control. In fact, in another part of the questionnaire we employed another six-item measure of restrictive control (Scholl, Hoffmann, & Gierschner, 1993). It was based on the general question, "How strong was the impeding impact against your intentions?" with follow-up questions on the harsher bases of restrictive control, that is, the legitimacy of superior position and of veto rights in other departments and the fear of withdrawn support, of hostility, and of a mighty coalition.[4] This estimate of restrictive control, averaged over the participants per case, furnished a similar correlation of .38 ($p < .05$; $n = 36$) with information pathologies (Scholl et al., 1993; Scholl, 1996).

Theoretical Considerations

The conceptual distinction between restrictive control and promotive control made above, which runs against a long research tradition in social psychology, may not be convincing by itself, but its usefulness—or even necessity—is underlined by the following results: Promotive control correlates –.39 ($p < .01$, $n = 36$) with information pathologies and .36 ($p < .05$, $n = 36$) with innovation success. That means promotive control has consequences opposite to those of restrictive control based on the consideration of the interests of the target persons. With the use of the traditional definition of power, these opposite consequences would have been collapsed and no meaningful correlations would have resulted. It should be noted for clarification that promotive control is, on the one hand, opposite to restrictive control with regard to the consideration of interests. On the other hand, the respective interaction processes are qualitatively different; they differ, for instance, in the bases primarily used (Buschmeier, 1995). Thus, neither concept can be described as a pole of just one dimension; this is underlined by the relatively small negative correlation of –.33 ($p < .05$, $n = 36$) between promotive and restrictive control.

The results of our innovation study are in line with corresponding results from other research on the distinction between restrictive control and promotive control. Here members of organizations have been asked, after appropriate instruction, to recall episodes of (i) exerting restrictive control over another person, (ii) exerting promotive control, (iii) being the target of restrictive control, and (iv) being the target of promotive control. With follow-up questions about these episodes we found that less knowledge is produced and less effectiveness is obtained through

[4]Buschmeier (1995) has shown that these harsher bases are used more often to exert restrictive control and accordingly less often for promotive control.

restrictive control compared to promotive control (Buschmeier, 1995). Thus, the two main hypotheses of this article seem to be valid not only for complex innovation processes but also for daily human interactions. Restrictive control (or power exertion in the sense of hurting others' interests while pushing one's own intentions) impedes a possible growth of knowledge—mainly through the instigation of information pathologies—and thereby diminishes the effectiveness of joint action. This is mirrored in the saying "power is the chance not to learn"—in an epoch that requires more learning than any other before.

The theoretical and practical relevance of these two hypotheses is enormous, and further studies should be undertaken. Restrictive and promotive control are ubiquitous phenomena of interaction, effectiveness is sought not only in organizations but also in personal contexts, and knowledge is a valuable prerequisite for any effective action. The inclusion and refinement of these two hypotheses could enrich many scientific debates on interaction, group dynamics and leadership, decision-making in economic and political organizations, negotiation and conflict resolution, and national and international politics.

Practical Applications

Most people like to have power (Mulder, 1977) to proceed in the way that seems to them the most favorable. The more power, as a potential, they have, the more they are likely to use it and to use it in a restrictive sense (Kipnis, 1976), that is, power tends to corrupt. Though restrictive control forecloses open and enriching discussions, many powerholders are convinced that they already know the best way for themselves and do not bother very much about the consequences of this way for others. Unfortunately, human knowledge and rationality are more imperfect than most of us want to admit, and other people often have complementing knowledge, such that mutual promotive control has, at least in the long run, much more positive consequences than restrictive control, which moreover often results in costly struggles and battles. It is interesting to note that most of the techniques of organizational development implicitly include measures to reduce restrictive control, to enhance mutual promotive control, and thereby to stimulate knowledge production. Participation has already been mentioned, and cooperative leadership is commonly emphasized. Creativity techniques such as brainstorming try to bar any criticism, a mild form of coercive restrictive control, to increase the number and quality of ideas. Structural group techniques such as semiautonomous groups and quality circles annul hierarchical restrictive control and build on mutual promotive control. Techniques of negotiation and conflict resolution try to avoid escalating power struggles and to instead channel these energies into joint problem solving. These more or less approved techniques and the respective training and consulting activities could profit from a thorough reflection of our two central hypotheses.

In the practice of organizations today two tendencies compete with each other: On the one hand, managers like power, presumably even more than other human beings (McClelland, 1975), and they tend to use it and to defend hierarchies in organizations that give them the positional power with which restrictive control is mainly exerted. On the other hand, information processing is becoming more and more important for gaining the necessary knowledge for coping with complex modern organizations and their environments; exerting restrictive control is counter productive for this aim, as we have seen in our investigations and as practitioners of organizational development intuitively know. Consequently, managers should learn to rearrange organizational procedures and practices to minimize restrictive control, but this seems to run against their preference for position power and the exertion of restrictive control. The history of semiautonomous groups is a telling example: Although many thorough experiments have shown the superior productivity of this form of power redistribution, even the demonstrated success has not led to a quick or even a slow diffusion of this organizational innovation, but very often the organizational practice has fallen back into traditional forms of work organization because of management resistance (Jenkins, 1971; Ulich, 1994). Instead, a much less autonomous form of work groups has been installed on a large scale, namely, work groups within the framework of lean production or business reengineering that are no longer relatively autonomous but just enjoy somewhat more discretion and somewhat greater decision rights than within traditional organizations (Weber, 1997). Thus, work could probably be organized in a still more productive form, but even the less autonomous groups are a historical step toward less restrictive control and higher effectiveness.

We can conclude that the net result of these two competing tendencies of power exertion in the form of restrictive control versus optimal knowledge acquisition seems to be a slow process of flattening organizational structures and a slow progress in changing organizational cultures toward more participation and cooperation. Formulated in more abstract terms: Restrictive control often succeeds in the short run because the resulting inferior knowledge and effectiveness do not show up immediately and may be easily attributed to other factors. But in the long run the superior knowledge gained by promotive control will succeed over the desire for power and its use as restrictive control. It will be exciting to see whether, because of its superiority over restrictive control with respect to knowledge production, promotive control is going to play a stronger role in structuring our information societies.

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