ORGANIZATIONAL BEHAVIOR AND HUMAN PERFORMANCE 31, 145–172 (1983)

Task Interdependence and Job Design: Test of a Theory

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This paper develops the concept of task interdependence and integrates it in the Hackman and Oldham (1976) theory of job design. Two dimensions of initiated task interdependence and received task interdependence are developed as multidimensional concepts, each being made up of the elements of scope, resources, and criticality. A distinction is made between the two psychological states of experienced responsibility for one's *own* work and personal outcomes, and experienced responsibility for *others'* (dependents') work and personal outcomes for whom one initiates task interdependence. Autonomy is hypothesized to be related only to experienced responsibility for one's own work outcomes while initiated task interdependence is related to experienced responsibility for others' work outcomes. Initiated interdependence is also hypothesized to be positively related to the affective positive work and personal outcomes, while received task interdependence is negatively related to these variables. New subscales for the measurements of these constructs are developed and reliability and validity coefficients are reported. The substantive results give support to the motivating potential of initiated task interdependence. However, the results do not support the hypotheses associated with received task interdependence. While autonomy was found to be much more strongly related to *all* the critical psychological states than the Hackman–Oldham theory would predict, job feedback yielded negative results. These findings are discussed by identifying potential areas of future research and extending the concept of interdependence to the wider organizational context.

Hackman and Oldham's (1976, 1980) work constitutes one of the most elaborate and widely accepted theories of job design. Drawing on previous research (Hackman & Lawler, 1971; Turner & Lawrence, 1965), Hackman and Oldham developed a job design theory with five core job characteristics: skill variety, task identity, task significance, autonomy, and job feedback. These job characteristics give rise to corresponding critical psychological states experienced by the employees. Skill variety, task identity, and task significance together lead to feelings of experienced meaningfulness, autonomy leads to experienced responsibility, and job feedback leads to knowledge of results. Through these critical

The author thanks Martin G. Evans for his advice and assistance at all stages of this research and two anonymous reviewers for their comments and suggestions on an earlier draft. Funding for the preparation of this manuscript was provided by the faculties of Graduate Studies and Research, and Management, McGill University. Requests for reprints should be sent to M. N. Kiggundu, School of Business, Carleton University, Ottawa, Ontario, Canada K1S 5B6.

0030-5073/83/020145-28$03.00/0

psychological states, jobs which are high on the core characteristics will, according to the theory, be associated with employee responses of high job satisfaction, intrinsic motivation, work effectiveness, and low absenteeism and turnover.

The theory has generated much empirical research (e.g., Arnold & House, 1980; Champoux, 1980; Evans, Kiggundu, & House, 1979), and others have used it as a starting point for developing more comprehensive theories of job design (e.g., Griffin, 1980; Katz, 1978; Umstot, Bell, & Mitchell, 1976). Yet, the theory has been criticized for being incomplete in its conceptualization of all potentially motivating job characteristics and moderator variables. These drawbacks have been recently debated by Lawler and Cummings and published by Karmel (1980).

Recently, Kiggundu (1981) elaborated on the theory of job design by developing the concept of task interdependence. Drawing from previous research in job design (Hackman & Oldham, 1976; Turner & Lawrence, 1965), sociotechnical systems theory (Trist & Bamforth, 1951; Trist, Higgins, Murray, & Pollock, 1963), role theory (Kahn, Wolfe, Quinn, Snoek, & Rosenthal, 1964), studies of interorganizational relations (Aiken & Hage, 1968; Lynch, 1974), and social psychological means–ends studies (Crombag, 1966; Thomas, 1957), Kiggundu (1981) argued that task interdependence is an important job attribute with significant motivating potentials. For example, Turner and Lawrence (1965) developed the concept of direction of interaction, by which they meant whether or not the job required the worker either to initiate or to receive task interactions for/from other(s). Trist and Bamforth (1951) and Trist *et al.* (1963), studying the effects of task interdependence resulting from technological changes in methods of coal getting, found that (1) there were high levels of task interdependence between shifts; (2) roles constituting each of the shifts were also highly interdependent; and (3) employee morale, behavior, and health depended on whether or not the employees were in jobs primarily of initiating or receiving task interdependence. Emphasizing the interdependent nature of the work and its effects on the production process, Trist and Bamforth argued

> Disorganization on the filling shift disorganizes the subsequent shifts, and its own disorganization is often produced by the bad preparation left by these teams. . . . So close is the task interdependence that the system becomes vulnerable from its need for one hundred per cent performance at each step. (1951, p. 18)

Drawing from the literature review cited above, Kiggundu (1981) defined task interdependence as the connectedness between jobs such that performance of one depends on the successful performance of the other. He also differentiated between initiated task interdependence and received task interdependence. Initiated task interdependence can be de-

fined as the extent to which work flows from one particular job to one or more other jobs such that the successful performance of the latter depends on the initiating job. Received task interdependence, on the other hand, is the extent to which a person in a particular job is affected by the workflow from one or more other jobs.

These concepts were illustrated drawing from Thomas' (1957) study of means interdependence. In that study, Thomas gave the example of a two-person crew working with an antiaircraft gun. The first person hands the shells to the second, who in turn loads them into the weapon. Passing the shells by the first person provides the means for the second person to fulfill the task requirements of loading and firing the gun. Therefore, the first person initiates, while the second receives task interdependence. This workflow arrangement is interdependent rather than dependent because the first person could not continue passing the shells unless the second accepted them for loading the weapon. Initiated task interdependence and received task interdependence are conceptualized as two independent job dimensions.

Task interdependence was also conceptualized as a multidimensional concept with three subdimensions, namely (1) scope, (2) resources, and (3) criticality. *Scope* is the breadth of interconnectedness of a particular job with other jobs. It is akin to the concept of workflow pervasiveness as used by Hinings, Hickson, Pennings, and Schneck (1974). By workflow pervasiveness, they mean the extent to which the work of a subunit connects with that of other units. Scope has been measured in different ways by different investigators. For example, Blau (1966) used the total number of contacts between the focal job and other jobs over a period of time. Lynch used the percentage of tasks connected with the focal job that are dependent on others doing their job, and Overton, Schneck, and Hazkett (1977) used the time spent in interdependent contacts. This has been the most common dimension of task interdependence measured by various investigators. Most studies include an operational element that is closely related to the concept of scope as defined above. *Resources* is the degree to which the interdependence between two or more jobs involves receiving or giving resources necessary to do the job. These resources may include materials, tools, and equipment (Jenkins, Naddler, Lawler, & Cummann, 1975), information or instruction (Billings, Kilimoski, & Breaugh, 1977), and money, raw materials, personnel, or programs (Aiken & Hage, 1968). This dimension, although not as commonly studied as scope, has been conceptualized and analyzed at both the organizational and individual levels. *Criticality* is the extent to which the interdependence between the focal job and one or more other jobs is crucial for the performance of the focal job. It is akin, but not similar, to the concept of

workflow immediacy as defined by Hickson, Hinings, Lee, Schneck, & Pennings: "the speed and severity with which the workflows of a subunit affect the final outputs of the organization" (1977, p. 222).

Criticality as a dimension of task interdependence has almost been entirely neglected by investigators except those who have manipulated interdependence in laboratory settings (Crombag, 1966; Thomas, 1957). This is a difficult concept to operationalize or manipulate in the field. One approach would be to construct structural networks whereby tasks are differentiated into an integrated workflow and to measure the degree to which successful performance of the focal job is dependent on the performance of other interdependent jobs within the workflow networks (Brass, 1981, pp. 337–338).

AN INTEGRATED THEORY OF JOB DESIGN

In view of the above evidence, the Hackman and Oldham (1976) theory would be strengthened by including both initiated and received task interdependence as core job characteristics. Their theory thus elaborated will be used as the basis for developing testable hypotheses.

Task Interdependence, Autonomy, and Experienced Responsibility

In the Hackman and Oldham theory, autonomy was hypothesized to be the only dimension that leads to the critical psychological state of experienced responsibility for work outcomes. However, empirical evidence did not support this proposition. Instead, it was found that experienced responsibility is determined not only by autonomy but by other job dimensions as well. This finding is not surprising, inasmuch as earlier work by Hackman and Lawler had indicated that autonomy without control is necessary but not sufficient for inducing feelings of experienced responsibility. They concluded that "autonomy is probably best viewed as a necessary but not sufficient condition for feeling personal responsibility for work outcomes" (1971, p. 263).

It is argued here that initiated task interdependence is one other dimension that is related to the focal person's experienced responsibility for work outcomes. Thomas (1957) found that when workers facilitate the work of others, they experience a sense of responsibility. This results from expectations specifying that the initiating workers perform their tasks so that the task performance of others is maximally facilitated and minimally hindered. Those occupying roles high on initiated task interdependence would experience a high sense of responsibility in relation to those whose jobs are being facilitated. Horsfall and Arensburg (1966), in a study of the bottoming room in a shoe factory, also found that employees who were in roles of high initiated interdependence experienced a strong sense of responsibility because others depended on them for means (shoes

to work on), task distribution (some types of shoes were more difficult to work than others), or reward distribution (since wages were paid by piece rates). Turner and Lawrence found a significant positive correlation of .53 between required interaction and the employees' sense of responsibility (1965, p. 166).

These findings seem to indicate that autonomy and initiated task interdependence make different contributions to total experienced responsibility for work outcomes. Autonomy leads to experienced responsibility for one's own work outcomes, whereas initiated task interdependence leads to experienced responsibility for the work outcomes of others for whom one initiates work. Autonomy and initiated task interdependence together lead to total experienced responsibility. Therefore, persons holding jobs high on both autonomy and initiated task interdependence would experience high total responsibility for their own and others' (dependents') work outcomes. This conceptualization provides an elaboration of that part of the Hackman and Oldham theory which relates autonomy to experienced responsibility.

The hypothesized relationships between autonomy, initiated task interdependence, experienced responsibility, and work and personal outcomes are shown in Fig. 1. Each of the cells shows different levels and forms of experienced responsibility. Cells 1 and 4 are exact opposites. Cell 1 yields the highest level of total experienced responsibility from both autonomy and initiated task interdependence. Jobs in Cell 4 with little or no autonomy or initiated task interdependence are devoid of experienced responsibility. Cells 2 and 3 hypothesize different forms of experienced responsibility and are therefore qualitatively different. It should be noted that the original theory (Hackman & Oldham, 1976) does not make predictions for Cells 1 and 2 or Cells 3 and 4.

Initiated Task Interdependence and the Outcome Variables

Hackman and Oldham state that, through the mediating effects of experienced responsibility, autonomy is positively related to the workers' valued personal and work outcomes. Therefore, the appropriate mediating variable in these relationships is experienced responsibility for one's own work outcomes. Through the mediating effects of experienced responsibility for others' work outcomes, initiated task interdependence is also positively related to the employees' valued personal and work outcomes of internal work motivation, work satisfaction, growth satisfaction, and quality performance.

Several studies support the motivational potential of initiated task interdependence. Kahn *et al.* (1964) argue that interdependence creates some pressure that arouses in the focal person a psychological force of some magnitude and direction. Lawler, Porter, and Tannenbaum (1968)

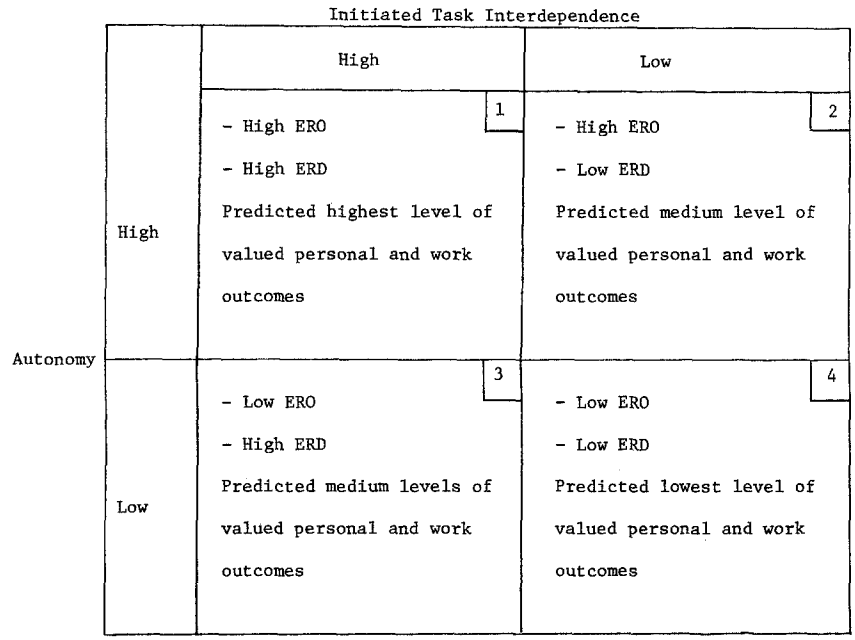

FIG. 1. Hypothesized relationships between autonomy, initiated task interdependence, and experienced responsibility. ERO, experienced responsibility for one's *own* work outcomes; ERD, experienced responsibility for *others'* work outcomes.

found that managers' affective responses were more positive for self-initiated interactions than for other-initiated interactions. Specifically, the managers reported self-initiated interactions to be more satisfying, valuable, interesting, and precise than other-initiated interactions.

Received Task Interdependence

Initiated task interdependence is hypothesized to be potentially motivating, but received task interdependence has the opposite effect. Several studies give support to this claim. Thompson (1967) seems to imply that increased received task interdependence leads to a decrease in autonomy, and therefore indirectly reduces motivation and work satisfaction. Trist and Bamforth also found that miners who were in roles of high received task interdependence (1) refused to accept responsibility for production, (2) developed norms of low productivity, (3) did not utilize their full potentials, and (4) engaged in "self-compensatory" absenteeism and turnover more than others. Trist *et al.* also found that the amount of time miners spent on nonproductive activities increased with the amount of technological received task interdependence. This ranged from a high of 63% for the pullers, whose tasks were high on received interdepen-

dence, to only 8% for the stonemen (1963, p. 120). This evidence taken together leads to the proposition that there is a negative relationship between received task interdependence and the employees' valued personal and work outcomes of internal motivation, work satisfaction, growth satisfaction, and performance.

Although initiated and received task interdependence are conceptualized as independent job dimensions, within a closed system, changes in one could lead to corresponding changes in the other. Accordingly, motivation created by increases in initiated task interdependence for one part of the work force could be offset by increases in received task interdependence for the other part. However, in an open system work situation, workers would be expected to receive and initiate task interdependence both within and outside the boundaries of their work group. In practice, one would not expect receiving and initiating task interdependence to be limited to roles within the immediate work group or organization. These two job characteristics would therefore operate independently.

The purpose of this paper is to provide an empirical test of the hypothesized relationships as shown in Fig. 1 and the predicted negative relationships between received task interdependence and the valued personal and work outcomes.

METHOD

Sample

Data were collected from 138 head office employees of a large Canadian life insurance company located in southern Ontario. Entry to the organization was obtained through the personnel department of the company on a research rather than consulting basis. Care was taken in selecting the participating work areas to ensure adequate variance in the major variables of interest for the present study. Sixteen preliminary interviews were held with selected individuals from the work areas which had been selected for participation in the study. These interviews were designed to give the researcher the opportunity to explain the purpose of the study to potential respondents and to assess the "climate" and suitability of the organization for a research study of this kind.

Measures of Task Interdependence

The subscales for measuring the dimensions of task interdependence and experienced responsibility for dependents' outcomes were deductively developed using Nunally's (1967, p. 87) three stages of (1) specifying the domain of observables, (2) determining the degree to which those observables correlate with one another, and (3) determining whether or

TABLE 1
MEASURES OF TASK INTERDEPENDENCE

Item	Item total correlations: Pretest (N = 26)	Item total correlations: Main sample (N = 138)	Type of item
NIDP			
1. To What extent does your job have an impact on the work of other people outside your work group? That is, does your job feed into the jobs of other people?	.54	.53	S
2. To what extent do the jobs of your section or work group depend on the performance of your job?	.50	.48	C
3. How much effect does your job have on the performance of the rest of the jobs in your section?	.62	.62	C
4. To what extent does your job require you to provide help or advice that other people must have to be able to do their jobs?	.66	.63	R
5. To what extent does your job require you to provide other people with support services that they need to do their work?	.77	.59	R
6. What percentage of your time do you spend giving help or advice other people need to do their work?	.47	.63	S
7. What percentage of your job activities go on to affect other peoples' work?	.63	.65	S
8. How many hours a day do you spend providing support services other people need to do their jobs?	.45	.51	R
9. Other peoples' work depends directly on my job.	.73	.64	S
10. Unless my job gets done, other sections cannot do their work.	.62	.46	S
11. Unsatisfactory performance of my job would delay the work performance of other people.	.64	.48	C

12. I provide other people with the help or advice they *need* to do their work.	.60	.59	R
13. I provide other people with materials, tools, or supplies which they *need* to do their work.	.58	.45	R
14. I provide other people with information they need to do their work.	.62	.63	R
15. I provide support services which other people need to do their work.	.87	.68	R
RIDP			
1. How much does your job require support services provided by other people?	.68	.59	R
2. To what extent do you depend on other peoples' work to obtain the tools, materials or equipments necessary to do your job?	.67	.62	R
3. To what extent do you receive the information you need to do your job from other people?	.46	.52	R
4. What percentage of your job activities are affected by the work of other people?	.73	.66	S
5. Give the number of people whose work affects the activities of your job.	.49	.59	S
6. How long would it take your job performance to be affected by performance changes of other peoples' work?	.53	.47	C
7. For what percentage of your job performance are you dependent on support services provided by other people?	.50	.71	R
8. I spend a great deal of time on contacts with other people which help me get my work done.	.47	.51	S
9. My job cannot be done unless other sections do their work.	.74	.56	C
10. I depend on other peoples' work for information I need to do my work.	.78	.73	R
11. I depend on other peoples' work for materials, tools, or supplies that I need to do my job.	.53	.56	R
12. My job depends on the work of many different people for its completion.	.75	.62	S
13. Most of my job activities are affected by the work activities of other people.	.71	.70	S

Note. NIDP, initiated task interdependence; RIDP, received task interdependence; S, scope; C, critically; R, resources.

not the measures of each elements behave as if they measure the construct.

The pretest questionnaire included items specifically developed for this study to measure the concepts of received and initiated task interdependence and for each covering the three subdimensions of scope, resources, and criticality. These items were distributed in Sections I and II of the Job Diagnostic Survey (JDS) developed by Hackman and Oldham (Note 1). A third section was also created for open-ended items which could not be accommodated in the 7-point Likert-type scales of Sections I and II.

The pretest questionnaire included 66 items, 34 for initiated task interdependence and 32 for received task interdependence. Item-total analyses were carried out for these scales using procedures outlined by Nunnally (1967, p. 261). Three criteria were used for selecting the final items: (1) an item had to have an uncorrected item-total correlation equal to or greater than .45; (2) the final items chosen would have to represent all the three subdimensions of task interdependence as conceptualized above; and (3) the items had to represent all the three sections and formats of the questionnaire. In all, 15 items were selected for initiated task interdependence, and 13 for received task interdependence.

Pretest

After the preliminary interviews, a questionnaire was developed and pre-tested on a group of 30 employees from the targeted work areas. The pretest questionnaire included items designed to measure received and initiated task interdependence, experienced responsibility for others' outcomes, and other variables of the study. Debriefing sessions were held after the pretest questionnaire had been completed in order to obtain qualitative data on the acceptability and "face validity" of the research instrument to the participants. The pretest constituted the first stage in the development of the subscales for the measurement of task interdependence.

Table 1 gives the items used to measure initiated task interdependence and received task interdependence and the item-total correlations both for the pretest and main study samples. It also shows which subdimension of task interdependence, scope, criticality, and resources each item was intended to measure.

Data Collection

After the pretest, the final questionnaire was developed and printed in a small booklet. Participants met in groups of 2–16 on company time in one of the company's training rooms. During each session, the investigator was introduced by a member of the company's personnel department who then left the room. The investigator explained the purpose of the study,

his university affiliation, the research rather than consulting nature of the study, and the voluntary nature of the employees' participation. Participants were encouraged to ask questions. Data collection took 17 sessions, each lasting 1½–2 hr over a period of 2 weeks.

Instruments

The primary data collection instrument was the Job Diagnostic Survey (JDS; Hackman & Oldham, Note 1). However, certain changes were made to accommodate the new items which were included to measure dimensions of task interdependence and experienced responsibility for dependents' (ERD) outcomes. The five core job dimensions and their three corresponding psychological states were measured using the JDS subscales. Job satisfaction, internal motivation, and job involvement were measured using the Lawler and Hall (1970) 16-item scale. Using this scale, the job attitudes of job satisfaction, internal motivation, and job involvement have been found to be factorially independent (Cummings & Bigelow, 1976; Lawler & Hall, 1970). Propensity to leave was measured using two items individually used by Kraut (1975) to predict short-term and distant turnover and by Waters, Roach, and Waters (1976) to predict future tenure.

It should be noted that the JDS contains only items measuring experienced responsibility for one's *own* work outcomes. Therefore, new items had to be developed for this study to measure experienced responsibility for *dependent's* work outcomes. These were developed following procedures similar to those used for the dimensions of task interdependence.

RESULTS

Scale Reliability Coefficients

The number of items, internal consistency, and median off-diagonal coefficients for the major variables of this study are reported in Table 2. The internal reliability coefficients for the JDS subscales are relatively high and comparable to the norms reported by Oldham, Hackman, and Stepina (Note 2). Reliability coefficients for the two measures of task interdependence and experienced responsibility for the dependent's work outcomes were high in the .80's and compare favorably with those obtained for other job dimensions and psychological states.

Median off-diagonal correlations provide an indication of the discriminant validity of the items measuring different constructs. This method has been used by Hackman and Oldham (1975) and Steers and Braunstein (1976) for validating their instruments. The median off-diagonal correlations reported in Table 1 are quite low and comparable to those found by Hackman and Oldham (1975). This provides some evidence for the construct validity of the scales used in this study.

TABLE 2

RELIABILITY AND MEDIAN OFF-DIAGONAL COEFFICIENTS FOR TASK INTERDEPENDENCE, OTHER JOB CHARACTERISTICS, PSYCHOLOGICAL STATES, AND OUTCOME VARIABLES

	Skill variety	Task identity	Task significance	Autonomy	Job feedback	NIDP	RIDP	EM	ERO	ERD	KR	MOT	SAT	GRW	JVL
Number of items	3	3	3	3	3	15	13	4	6	9	4	4	6	3	6
Internal consistency reliability	.78	.62	.59	.70	.63	.85	.85	.81	.77	.83	.84	.89	.88	.81	.64
Median off-diagonal correlations	.23	.15	.22	.28	.10	—	—	.33	.43	.41	.10	.33	.38	—	.27

Note. NIDP, initiated task interdependence; RIDP, received task interdependence; EM, experienced meaningfulness; ERO, experienced responsibility for one's own work outcomes; ERO, experienced responsibility for dependents' work outcomes; KR, knowledge of results; MOT, internal motivation; SAT, job satisfaction; GRW, growth satisfaction; JVL, job involvement.

Descriptive Statistics and Intercorrelations

The means, standard deviations, and intercorrelations among the major variables of this study are given in Table 3. The descriptive statistics and intercorrelations for the measures of task interdependence are comparable to those of other job dimensions except job feedback, the intercorrelations of which are negative. Similarly, the statistics associated with experienced responsibility for dependents' work outcomes are comparable to those of other psychological states. These results show that the descriptive statistics and pattern of intercorrelations for the new subscales are similar to those of other groups of variables to which they belong.

As expected, the correlation between initiated task interdependence and experienced responsibility for *dependents'* work outcomes (ERD) is positive and statistically significant ($r = .32$, $p = .000$), while that with experienced responsibility for one's *own* outcomes (ERO) is only marginally significant ($r = .15$, $p = .49$). The correlations between initiated task interdependence and the outcome variables are also as predicted. Specifically, initiated task interdependence is positively correlated with internal motivation, job satisfaction, and growth satisfaction and negatively correlated with the tendency to leave the work place. However, the correlation with tendency to leave, though in the expected direction, is marginally below traditional levels of statistical significance ($r = .13$, $p = .083$).

Received task interdependence was predicted to be negatively related to the positive work outcomes and psychological states. The results are not as supportive of the hypothesis as had been expected. Only the correlations with job involvement and knowledge of results are negative. However, only the correlation with job involvement is statistically significant. All other correlations with received task interdependence, except experienced responsibility for the dependents' outcomes, are practically zero. Failure to obtain significant negative correlations between received task interdependence and the positive work outcomes may be due to the fact that the jobs studied were relatively high on both initiated and received task interdependence. This was indicated, for example, by a significant correlation coefficient of .50 between the two measures of task interdependence. However, the results of the differences between initiated and received task interdependence should be interpreted with caution because the *differences* in correlations between these variables and the psychological states and outcomes are not statistically significant.

The correlations between autonomy and the other variables are stronger than predicted. Autonomy is significantly correlated with all the psychological states and positive outcomes. Only the negative correlation with tendency to leave fails to reach statistical levels of significance. Contrary to expectations, autonomy is positively related to experienced

TABLE 3

MEANS, STANDARD DEVIATIONS, AND INTERCORRELATIONS BETWEEN MEASURES OF TASK INTERDEPENDENCE, JOB CHARACTERISTICS, CRITICAL PSYCHOLOGICAL STATES, AND OUTCOMES

	$\bar{X}$	*SD*	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1. NIDP	4.46	1.11	—																
2. RIDP	4.05	1.15	.50[a]																
3. Autonomy	5.41	1.16	.17	.07	—														
4. Task significance	5.56	1.18	.46	.29	.27	—													
5. Skill variety	4.79	1.53	.29	.18	.61	.26	—												
6. Task identity	5.05	1.40	−.07	−.17	.36	.18	.27	—											
7. Job feedback	3.68	0.78	−.09	−.06	−.10	−.16	−.12	−.03	—										
8. ERD	4.83	1.03	.32	.18	.52	.23	.41	.16	−.18	—									
9. ERO	5.74	0.89	.15	.05	.53	.20	.51	.31	−.12	.64	—								
10. TER	5.19	0.89	.28	.14	.58	.24	.50	.24	−.17	.95	.85	—							
11. EM	5.28	1.10	.23	.09	.54	.35	.55	.32	−.16	.48	.67	.60	—						
12. KR	5.32	1.02	−.07	−.11	.25	.13	.12	.30	−.28	.08	.15	.12	.31	—					
13. Internal motivation	6.21	0.72	.24	.09	.44	.38	.30	.21	−.01	.39	.42	.44	.47	.11	—				
14. Job satisfaction	4.97	1.13	.25	.02	.61	.21	.57	.33	−.01	.52	.55	.58	.62	.27	.50	—			
15. Growth satisfaction	4.98	1.27	.26	.06	.60	.21	.60	.29	−.05	.49	.50	.54	.67	.28	.47	.91	—		
16. Job involvement	3.98	0.98	.12	−.17	.30	.19	.23	.09	.09	.21	.30	.26	.43	.20	.42	.41	.41	—	
17. Tendency to leave	2.32	0.95	−.13	.04	−.13	−.16	−.13	−.10	.02	−.26	−.27	−.28	−.31	−.05	−.32	−.41	−.41	−.35	—

Note. $N = 138$; NIDP, initiated task interdependence; RIDP, received task interdependence; ERD, experienced responsibility for the dependents' work outcomes; ERO, experienced responsibility for one's own work outcomes; TER, total experienced responsibility; EM, experienced meaningfulness; KR, knowledge of results.

[a] Correlations $\geq .15$ are significant at .05 or better.

responsibility for dependents' work outcomes. This correlation is even higher than that reported for initiated task interdependence. The difference however, is not statistically significance. These results show that autonomy is more strongly associated with each of the psychological states than the other job dimensions, including task interdependence. These results are contrary both to the theory developed in this paper and to the original Hackman and Oldham (1976) theory which reports that autonomy should be related to experienced responsibility for one's own work outcomes (ERO) and not any other psychological states.

The correlations between the core job dimensions and the psychological states and outcomes are given in the rest of Table 3. The results are generally supportive of the original Hackman and Oldham theory, except the correlations between job feedback and both the psychological states and outcome variables. Most of these correlations are negative, and, although some are not statistically significant, the pattern of correlations is consistent.

Contrary to expectations, the correlation between job feedback and knowledge of results is negative and statistically significant ($r = -.28, p = .001$). However, the correlation between knowledge of results and feedback from agents (not included in Table 3) was found to be positive and statistically significant ($r = .45, p = .000$). These results suggest that, for this sample, feedback from agents was a more salient determinant of knowledge of results than feedback from the job itself.

Initiated Task Interdependence, Autonomy, Experienced Responsibility, and Outcomes

It was predicted, as illustrated in Fig. 1, that levels of experienced responsibility for dependents' outcomes (ERD), experienced responsibility for one's own outcomes (ERO), and valued personal and work outcomes would differ depending on the amount of autonomy and initiated task interdependence in the job. The results of a 2×2 nonorthogonal analysis of variance with initiated task interdependence and autonomy as the factors are reported in Table 4. The procedures used are as outlined by Nie, Hull, Jenkins, Steinbrenner, and Bent (1975, Chap. 22) for these types of data. Specifically, where the interaction terms between the two factors did not yield significant effects, the ANOVA produces a multiple classification analysis (MCA) table with values of eta square. The eta square indicates, for each factor, the proportion of variation in the dependent variable explained by each of the two factors. The MCA becomes meaningless, however, if the interaction terms are significant, and in that case the eta square were not reported.

Table 4 shows that, as predicted, initiated task interdependence has a statistically significant effect on experienced responsibility for depen-

TABLE 4
VARIANCE EXPLAINED IN PSYCHOLOGICAL STATES BY INITIATED TASK INTERDEPENDENCE AND AUTONOMY

	Sum of Squares	*df*	Mean square	*F* value	Significant level	η^2
ERD						
Main effect	47.512	10	4.751	6.600	0.000*	
NIDP	6.540	4	1.635	2.271	0.067*	11.56%
Autonomy	32.776	6	5.463	7.588	0.000*	31.36%
Two-way Interactions	15.884	16	0.993	1.379	0.169 ns	
ERO						
Main effect	38.916	10	3.892	8.046	0.000*	
NIDP	0.720	4	0.180	0.372	0.828 ns	
Autonomy	34.940	6	5.823	12.039	0.000*	
Two-way Interactions	16.450	16	1.028	2.126	0.013*	
EM						
Main effect	55.741	10	5.574	6.553	0.000*	
NIDP	2.303	4	0.576	0.677	0.610 ns	5.76%
Autonomy	46.941	6	7.824	9.198	0.000*	34.48%
Two-way Interactions	19.748	16	1.234	1.458	0.136 ns	
KR						
Main effect	19.991	10	1.999	1.960	0.047*	
NIDP	3.846	4	0.962	0.943	0.443 ns	2.56%
Autonomy	15.750	6	2.792	2.736	0.017*	12.25%
Two-way Interactions	14.138	16	0.884	0.866	0.609 ns	

Note. ERD, experienced responsibility for dependents work outcomes; EM, experienced meaningfulness; ERO, experienced responsibility for one's own work outcome; KR, knowledge of results; NIDP, initiated task interdependence.

* Significant at $p \leq .05$.

dents' work outcomes (ERD) with $F = 2.271$ ($p = .067$). Although the level of statistical significance is slightly above the traditional 5%, this is the strongest and only statistically significant effect between initiated task interdependence and the psychological states. As predicted, initiated task interdependence does not have a significant effect on experienced responsibility for one's work outcomes (ERO).

As predicted by the theory, autonomy yields significant effects with experienced responsibility for one's own work outcomes ($F = 12.039, p = .001$). The results also give some support to the hypothesis that initiated task interdependence is not related to experienced responsibility for one's own work outcomes ($F = .372, p = .828$, nonsignificant). Contrary to the hypothesis advanced in this paper, however, autonomy accounts for a very large variance of experienced responsibility for dependents' work outcomes. While initiated task interdependence accounts for just over 11.5% of the variance, autonomy accounts for over 31.3%. Moreover, in

all cases where the value of eta square was calculated, autonomy accounted for much more variance than initiated task interdependence.

The results of the analysis of variance relating to the psychological states of experienced meaningfulness and knowledge of result provide an indirect test of both the hypothesis advanced in this paper and the original Hackman and Oldham theory. Initiated task interdependence was hypothesized to be related only to one critical psychological state—experienced responsibility for dependents' work outcomes. The results associated with knowledge of results, experienced meaningfulness, and experienced responsibility for one's work outcomes give some support to this hypothesis. For all these three psychological states, the explained variance due to initiated task interdependence is small and nonsignificant.

However, these results are not consistent with the original Hackman and Oldham (1976) theory. According to the theory, autonomy is hypothesized to relate only to experienced responsibility for one's work outcomes. The results, however, show that autonomy accounts for statistically significant effects for all the critical psychological states. For example, autonomy accounts for over 34% of experienced meaningfulness and over 12% for knowledge of results.

The results of the analyses of variance with the outcomes as the dependent variables are shown in Table 5. Contrary to expectations, the variance explained by initiated task interdependence for each of the outcomes is not statistically significant. The variance explained by autonomy, however, is statistically significant for all the outcome variables except tendency to leave the work place. These results show that, as with the psychological states, autonomy accounts for a larger variance for the outcomes than initiated task interdependence. They also provide strong support for that part of the Hackman and Oldham (1976) job design theory which hypothesizes autonomy to be a strong determinant of the work and personal outcomes.

Task Interdependence Subdimensions, Outcomes, and Psychological States

Task interdependence was hypothesized as a multidimensional concept made up of the subdimensions of scope, resources, and criticality. As an exploratory investigation, this section discusses the relationships between each of these subdimensions for each of initiated and received task interdependence and the psychological states and outcome variables. The purpose of this analysis was to test whether or not certain subdimensions are more strongly related to the psychological states and outcomes than others.

The results of this analysis are reported in Table 6. The results show certain patterns of relationships which could not be detected by the previ-

TABLE 5
VARIANCE EXPLAINED IN OUTCOME VARIABLES BY INITIATED TASK INTERDEPENDENCE AND AUTONOMY

	Sum of squares	*df*	Mean square	*F* value	Significant level	η^2
Internal motivation						
Main effect	18.405	10	1.841	4.499	0.000*	
NIDP[a]	1.784	4	0.446	1.099	0.365 ns	5.29%
Autonomy	15.064	6	2.511	6.137	0.000*	26.01%
Total[b]	62.997	119	0.529			
Job satisfaction						
Main effect	66.384	10	6.638	7.537	0.000*	
NIDP	4.718	4	1.180	1.339	0.360 ns	6.76%
Autonomy	55.040	6	9.173	10.415	0.000*	38.44%
Total	162.387	119	1.365			
Growth satisfaction						
Main effect	94.578	10	9.458	9.048	0.000*	
NIDP	8.145	4	2.036	1.048	0.108 ns	7.84%
Autonomy	77.657	6	12.943	12.383	0.000*	40.96%
Total	208.509	119	1.752			
Job involvement						
Main effect	17.606	10	1.761	2.014	0.039	
NIDP	1.632	4	0.408	0.467	0.760 ns	3.24%
Autonomy	14.050	6	2.342	2.678	0.018*	14.44%
Total	112.905	119	0.949			
Tendency to leave						
Main effect	10.685	10	1.068	1.161	0.325	
NIDP	5.348	4	1.337	1.453	0.222 ns	4.84%
Autonomy	5.419	6	0.903	0.982	0.441 ns	4.84%
Total	110.980	119	0.933			

[a] NIDP, initiated task interdependence.

[b] Total, total source of variation. All the two-way interaction effects associated with these outcome variables were not statistically significant and have not been reported.

* Significant at $p \leq .05$.

ous analyses. Taking initiated task interdependence first, the results show that the two subdimensions of resources and criticality are significantly and positively correlated with the critical psychological states. Scope is not correlated with the psychological states, except knowledge of results, which shows a negative but nonsignificant correlation. Both criticality and resources are positively and significantly correlated with experienced responsibility for the dependents' work outcomes. A similar pattern of results emerges with the outcome variables. Both resources and criticality are positively and significantly correlated with internal motivation, job satisfaction, and growth satisfaction and negatively correlated with tendency to leave. These results, taken together, seem to suggest that positive affective and psychological responses are more likely to be experi-

TABLE 6

ZERO-ORDER CORRELATIONS BETWEEN TASK INTERDEPENDENCE SUBDIMENSIONS, PSYCHOLOGICAL STATES, AND OUTCOME VARIABLES

	No. of items	ERO	ERD	TER	EM	KR	Internal motivation	Job satisfaction	Growth satisfaction	Tendency to leave
Initiated task interdependence										
1. Scope	5	−.00	.11	.08	.13	−.14	.17*	.11	.13	−.11
2. Resources	7	.24*	.39*	.36*	.24*	−.02	.24*	.27*	.28*	−.10
3. Criticality	3	.08	.25*	.20*	.21*	.05	.19*	.26*	.24*	−.18*
Received task interdependence										
1. Scope	5	.02	.16*	.11	.10	−.11	.16*	.03	.07	.02
2. Resources	6	.17*	.20*	.21*	.21*	−.05	.09	.09	.11	.03
3. Criticality	2	−.12	.04	−.01	−.19	−.05	−.02	−.12	−.17*	−.02

Note. N ranges from 138 to 119 due to missing data. ERO, experienced responsibility for one's own outcomes; ERD, experienced responsibility for dependents' work outcomes; TER, total experienced responsibility; EM, experienced meaningfulness; KR, knowledge of results.

*$p \leq .05$.

enced if the job involves providing resources (e.g., materials, information, personnel) to others in order to do their jobs and if such interdependence is critical for the successful performance of their jobs.

The results associated with received task interdependence are different from those discussed above. The subdimensions of received task interdependence are not as strongly related to the psychological states and outcome variables as those of initiated task interdependence. Resources is positively and significantly correlated with most of the psychological states, while criticality tends to yield negative correlations. The correlations between scope and the psychological states are nonsignificant except experienced responsibility for the dependents' work outcomes. A similar pattern of correlations emerges between the three subdimensions and the outcome variables. These results are not easy to explain. They seem to suggest, however, that received task interdependence has negative effects on employees' affective responses when such interdependence is critical for the successful performance of their jobs. When such interdependence involves receiving resources from others, however, it does not evoke negative affective responses.

DISCUSSION

The concepts of initiated task interdependence and received task interdependence were developed and integrated in the Hackman and Oldham (1976) theory of job design. These two job characteristics were conceptualized as multidimensional, each made up of the elements of scope, resources, and criticality. The empirical results were somehow supportive of the theory and gave credence to the argument that task interdependence is an important aspect of the job with significant motivational effects.

1. Scale Development

Scales for measuring initiated task interdependence, received task interdependence, and experienced responsibility for the dependents' work outcomes were developed and validated. The reliability and validity results were satisfactory, especially for research purposes. Moreover, they are comparable to the reliability and validity coefficients for the Job Diagnostic Survey as reported by Hackman and Oldham (1975). The availability of sound instruments is a necessary condition for theory testing. It is even more important for the development of theory relating to task interdependence because Turner and Lawrence (1965) developed the concept of task interdependence but did not include it in subsequent analyses of their data because their measures were not psychometrically adequate. It is possible that subsequent replications of Turner and Lawrence's work

did not follow up on the concept of interdependence due to lack of reliable and valid instruments.

The concept of task interdependence has been investigated in several areas of organizational research including organizational structure and design (Brass, 1981; Gosselin, Note 3), technology (Lynch, 1974; Overtone *et al.*, 1977; Tushman, 1979), and work group linking arrangements based on sociotechnical systems theory (Kolodny & Dresner, Note 4). Therefore, it is expected that the measurements of task interdependence developed in this study will contribute toward the development of sound instruments for further empirical work in these and related areas.

2. Task Interdependence and the Outcomes

The results were supportive of the hypothesized relationships between initiated task interdependence and the work and personal outcomes. These results were particularly strong for the subdimensions of resources and criticality but not scope. This suggests that employees react positively to task interdependence when it involves providing resources to others and when such interdependence is critical for the successful performance of others' jobs. However, the scope or breadth of interconnectedness by itself does not necessarily induce positive affective responses. These results compare with those by Brass (1981), who found positive relationships between general satisfaction and criticality but not centrality. These results may explain at least in part why experimental means–ends studies of interdependence focusing on criticality and resources (Crombag, 1966; Thomas, 1957) have found stronger effects than those concentrating only on scope (Turner & Lawrence, 1965).

The expected negative relationships between received task interdependence and the outcomes were not found. Instead, the relationships between received task interdependence and the outcomes were practically zero. Moreover, the results for the subdimensions of received task interdependence were mixed. Specifically, resources and scope tended to yield positive results with the outcomes while the results associated with criticality were, as predicted, negative. Several explanations may account for these results. First, the subscale for measuring received task interdependence may have been rather weak and lacked adequate discriminant and convergent validity. The high correlation of .50 between received and initiated task interdependence suggests lack of adequate operational discrimination between the two concepts of interdependence. Second, the conceptualization and identification of the elements of task interdependence may have been incomplete. For example, the extent to which task interdependence potentially affects employee responses may depend on whether or not such interdependence is shared among a group of em-

ployees or is exclusively discharged by a single employee. As Hackman (personal communication) explains, it is not just a matter of different levels of task interdependence; it is also the nature of the interdependence that changes when it's *me* working and being interdependent with people who have other tasks or jobs, versus when it's *us* working on a single task or job, and being interdependent in carrying out that shared task. In this study, no differentiation was made between individual and group task interdependence. Moreover, no differentiation was made between face-to-face and "long-distance" interdependence between employees. Recently, Brass (1981) has suggested the need to differentiate within-unit and outside-unit interdependence.

These alternative ways of conceptualizing task interdependence and the empirical findings of the present study suggest a need for a reformulation of the relationships between task interdependence and the valued personal and work outcomes. This reformulation should, among other things, include differential predictions for each of the subdimensions of criticality, resources, and scope for each type of task interdependence (see Table 5).

3. *Initiated Task Interdependence, Autonomy, and Experienced Responsibility*

This paper differentiates between experienced responsibility for one's own outcomes and experienced responsibility for dependents' work outcomes. The former is hypothesized to be related to autonomy, while the latter is related to initiated task interdependence. The results are somewhat supportive of these hypotheses. Initiated task interdependence was found to be related to experienced responsibility for dependents' work outcomes. It was not related to any of the other psychological states. Autonomy was also found to be related to experienced responsibility for one's work outcomes. Autonomy, however, was also found to be related to all the other psychological states. The pervasive nature of autonomy is contrary to the Hackman and Oldham (1976) theory. It is consistent, however, with some of the empirical results in the literature. For example, Arnold and House (1980) found that experienced meaningfulness was more strongly related to autonomy than to any of the theory-specific job characteristics of skill variety, task identity, and task significance. The same study also found that experienced responsibility and knowledge of results were each significantly related to all the core job characteristics, except task significance (see Arnold & House, 1980, p. 170). These results do not support the hypotheses of the original Hackman and Oldham (1976) theory relating specific job characteristics to specific psychological states.

Although the results of the present study are supportive of the Hackman and Oldham (1976) theory, those associated with job feedback

and knowledge of results are contrary to expectations. Job feedback was negatively related to the other job characteristics, the psychological states, including knowledge of results, and the outcome variables (see Table 2). These results are difficult to explain. Previous empirical research, however, has experienced difficulties with this job characteristic. For example, in the first published empirical test of the theory, Hackman and Oldham reported "noteworthy anomalies . . . involving the feedback dimension" (1976, p. 272). These anomalies were explained in terms of alternative sources of feedback which may account for the employees' knowledge of results. Some of these sources of feedback have been conceptualized and empirically tested by Greller and Herold (1975) and Greller (1980).

One possible explanation for the anomalies involving job feedback in the present study is that feedback from the job itself was outside the control of the particular sample studied. Recent studies have shown that employees value most highly those sources of feedback under their control (e.g., Greller, 1980). The majority of the employees studied were servicing clients and branches hundreds and thousands of miles away from their place of work at the head office. It is possible that they defined their jobs as including these distant clients whom they thought were also controlling sources of "job feedback." In that case, the positive correlation between knowledge of results and feedback from agents would suggest that the respondents were defining "agents" only in terms of head office personnel, but including information from the distant clients as job feedback.

Implications for Research

This section discusses areas of potential utilization for research and work redesign of this study.

1. Some of the empirical results of this study have been encouraging. Therefore, future research may be directed at constructive replications of these hypotheses and validation of the new measures of task interdependence using various research designs and settings. The conceptualization of task interdependence can be extended beyond the individual level of analysis. One of the criticisms of the Hackman and Oldham theory of job design is that it does not adequately take into account the fact that jobs exist as a network of interconnected positions. For example, Quale (1976) has argued that autonomous work groups are the most promising for redesigning work because the strong task interdependencies generally found on the shop floor in industry make any fundamental change for *individuals* nearly impossible.

One possible approach to studying task interdependence has been ad-

vanced by Brass (1981). Using structural networks whereby jobs are differentiated within an integrated workflow so that instead of focusing only on individual jobs, the researcher can identify different levels and types of interdependencies within and outside the formal work groups or organization. This methodology may yield empirical results which would provide more understanding about the differential effects of received and initiated task interdependence when such interdependence is (a) face to face versus "long distance," and (b) individually versus collectively discharged.

Extending the concept of task interdependence across work groups requires an examination of the role of the supervisors in acting as buffers, or boundary spanners, and protecting the employees from the direct effect of task interdependence. Most of the recent literature on supervision suggests that the supervisor is still the "man in the middle" (Driscoll, Carroll, & Sprecher, 1978; Sasser and Leonard, 1980). Research is necessary to determine the conditions under which supervisory facilitation or buffering of task interdependence is possible and desirable. This is particularly important since the development of new forms of work organization based on autonomous work groups and sociotechnical systems (Kolodny & Kiggundu, 1980; Susman, 1976) is partly based on the extent to which supervisors facilitate employee control and management of their own workflow interdependencies.

2. A second area of interest concerns the debate in the literature as to whether task interdependence is a structural, technological, or task-related variable. For example, Lynch (1974), using 384 employees of different departments of an academic library, factor analyzed data collected using Perrow's (1967) measures of technology as well as measures of interdepartmental and internal task interdependence. The items of the latter two concepts loaded on factors different from those of the technological variables. She therefore concluded that she was unable to empirically demonstrate the relationship of task interdependence to the construct of technology. Overton *et al.* (1977), however, using data from 71 nursing units found that their measure of task interdependence loaded on the same factors as those of technology. They therefore concluded that for their sample, task interdependence was empirically demonstrated as a technological variable.

Overton *et al.* (1977) explained that their factor solutions could have been unique to the nursing sample studied and that differences between the two studies could have been due to the different conceptual and methodological approaches used. Yet, the results of these two studies illustrate current problems of conceptualizing and classifying task interdependence. As a strategy for future research, it is suggested that a decent sample which meets McKelvey's (1975) guidelines for organizational research should be obtained. Data collected using measures of technology

developed and validated by Overton *et al.* (1977) and Leatt and Schneck (1981), job characteristics (JDS), and task interdependence developed for this study should be analyzed to determine whether the subscales of task interdependence would be associated with the task or technological variables.

3. The relationships between job feedback and other variables were unexpectedly negative. The traditional response for the problems of feedback as a job dimension has been to search for alternative sources of feedback for the employee (Greller & Harold, 1975; Greller, 1980). An alternative approach would be to develop a more comprehensive conceptual framework which explores the relationships between task interdependence, organization management information and communications systems, individual cognitive information-processing mechanisms, and knowledge of results. For example, Tushman (1979) has developed a theory linking task interdependence, hierarchical communication, and task characteristics using the information-processing approach. Extending this line of research may provide better understanding of the antecedents and consequences of knowledge of results and the relative contributions of alternative sources of feedback.

4. Finally, the present conceptualization of task interdependence as job characteristics leads to the speculation that these variables may be related to organizational stress. The early social psychological studies of role facilitation (Crombag, 1966; Kahn *et al.*, 1964; Thomas, 1957) and the sociotechnical studies (Trist *et al.*, 1963) found strong relationships between task interdependence and role stress. Recently, Karasek (1979) has found strong relationships between job demands, job decision latitude, and mental strain. Since task interdependence is likely to be related to job decision latitude and job demands, it can be speculated that measures of organizational stress would be related to task interdependence.

Data are required to test for these speculative propositions and improve our understanding of the conceptual meaning of task interdependence before practical suggestions can be made for redesigning new work organizations.

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RECEIVED: October 2, 1981.