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Individual Differences and Task Structure in the Performance of a Behavior Setting: An Experimental Evaluation of Barker's Manning Theory[1]

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Barker's theory of "undermanning" has attracted interest for its potential applications to a variety of problems in community psychology, although to date little attention has been given to mediating factors such as individual differences and the organizational structure of the setting task. The present study crossed two levels each of manning, task structure, and manipulated "competence" over 56 independent replications of a laboratory-based behavior setting. Direct observations of subject behavior confirmed that participants in undermanned settings worked harder, held more different positions, performed more difficult and more important jobs, and spent more time in the task-related areas of the setting, than did subjects in overmanned groups. However, interactions with the task and competence factors attenuated several of the manning effects, and undermanning's hypothesized influences on the subjective experiences of setting occupants were not found.

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One definitive characteristic of community psychology is its orientation toward greater understanding of environmental influences on behavior (Heller & Monahan, 1977; Kelly, 1966; Murrell, 1973), and recent reviews (e.g., Monahan & Vaux, 1980; Moos, 1973, 1976) have outlined several different psychological perspectives from which to conceptualize human environments.

One approach with potential applications to a wide range of issues in community psychology is Barker's Behavior Setting Theory (Barker, 1978; Gump & Adelberg, 1978; Price, 1976; Schoggen, 1978). The fundamental environmental unit in this conception is the behavior setting, a public place-activity such as a high school English class, church worship service, restaurant, or baseball game. As conceptualized by Barker (1968), the essence of a behavior setting resides not in the physical space or human activity alone, but rather in the *relationship* between "standing patterns" of behavior routinely performed as part of the setting[3] and characteristics of the surrounding physical milieu. Thus, behavior settings are entirely "extra-individual" influences on human behavior.

Behavior settings are ubiquitous in human environments, and one important process by which settings are hypothesized to influence occupants' behavior is through their "manning" conditons (Barker, 1960; Wicker, 1979). Specifically, "manning theory" deals with the effects of different numbers of people in a setting relative to the number required for optimal performance of the setting. That is, when there are fewer than the optimal number of people present (e.g., four players instead of five on the court for a basketball team) the setting is considered "undermanned." Undermanning has attracted considerable interest among behavior-setting theorists (e.g., Bechtel, 1974; Schoggen, 1978), principally because of the behavioral and psychological "claims" it is hypothesized to exert on occupants, including:

1. Greater effort to operate and maintain the setting, in terms of "harder" work or longer hours;
2. Performance of more difficult and more important tasks;
3. Involvement in a greater diversity of tasks and roles;
4. Less sensitivity to, and evaluation of, individual differences;
5. A lower level of maximal performance;
6. Greater functional importance of individuals within the setting;
7. Greater responsibility in the sense that the setting and the satisfaction it provides depend more on each occupant;
8. Thinking of oneself and others more in terms of task-related functions and less in terms of personality characteristics;
9. Lower standards and fewer tests of admission into the setting;

[3]The terms *behavior setting* and *setting* are hereafter used interchangeably to denote this concept.

10. Greater insecurity about one's own performance and about the continued maintenance of the setting;

11. Viewing oneself as more versatile—able to carry out satisfactorily a greater diversity of tasks;

12. More frequent occurrences of success and failure, depending on the outcome of the setting's functions and the individual's evaluation of the setting's importance (Barker, 1960; Barker & Schoggen, 1973).

Not surprisingly, this behavioral and psychological "claim" of undermanned settings has been cited as having potential applications to a range of different problems, including primary prevention (Schoggen, 1978), overpopulation (Wicker, 1973), environmental design (Bechtel, 1977; Gump & Adelberg, 1978), and the management of public costs and productivity (Bechtel, 1974).

Based originally on Barker's extensive observations in two small towns (Barker, 1960), manning theory's basic tenets were subsequently supported by findings from a large number of field studies, conducted primarily in high schools (Barker & Gump, 1964; Wicker, 1968, 1969a; Willems, 1967) and churches (Wicker, 1969b; Wicker & Kauma, 1974; Wicker, McGrath, & Armstrong, 1972; Wicker & Mehler, 1971). Taken together, these studies confirmed that members of small organizations, whose behavior settings were presumably undermanned, were more often "performers" (i.e., held central positions), and had more experiences of perceived involvement, support, and obligation to the organization than did members of large organizations. However, these findings were all correlational in nature and the extent to which manning conditions alone actually *caused* greater involvement, obligation, and so on, was not established. One could easily conjecture, for example, that inherently energetic and motivated people self-select themselves into smaller organizations, where their impact is more immediately apparent. In addition, although manning effects should theoretically be most apparent at the level of individual settings, none of the studies cited examined manning effects on this level. One church having a lower membership per setting than another does not necessarily mean that the first church's settings are undermanned in any *absolute* sense (i.e., in having literally too few occupants for adequate performance). Finally, Barker's interest in developing a purely "extra-individual" science of behavior fostered a neglect of important individual differences among occupants in nearly all the studies cited. The psychological stress which undermanning places on occupants (see characteristic 10 above) may not suit everyone equally well, and thus a more useful ecological model may be one of person-environment *fit* (cf. French, Rodgers, & Cobb, 1974; Pervin, 1968).

In response to the need for greater experimental control, and the importance of individual settings, Wicker and his colleagues (Petty & Wicker,

1974; Wicker, Kirmeyer, Hanson, & Alexander, 1976) followed up the Barker group's field work with a series of laboratory studies on manning. In each of their experiments, small groups of male college students raced a miniature electric car around a tabletop track under conditions that required varying numbers of participants for optimal task performance. Undermanned, adequately manned, and overmanned conditions were compared in their effects on group performance and verbal interaction, and on subjects' reported involvement in the task. All studies found greater reported involvement in the undermanned settings, but few if any manning effects on task performance or verbal interaction.

External validity is always an issue in laboratory studies, and there is reason to question the generalizability of the particular task used in these experiments. Wicker et al. (1976) themselves speculated that the car-race activity did not generate enough different behavioral indices (e.g., effort expended, quality of performance) to provide a sufficient test of the predictions. In addition, the inherent appeal of the "gamelike" task may have distorted (magnified) the "claim" effects of overmanned settings. This latter possibility raises the nature of the setting *task* and its relationship to manning as issues, neither of which have been addressed directly by behavior setting theorists.

Steiner (1972) has developed a useful typology of group tasks, including two he labels "additive" and "conjunctive." A task is additive when the outcome of the group working on it is determined by the sum of the individual efforts of group members, so that the more members there are, the better the outcome (Steiner's example is a tug-of-war). A conjunctive task, on the other hand, is one in which the group's productivity is entirely dependent on the single poorest individual performance (e.g., as on a manufacturing assembly line).

Participation in additive and conjunctive tasks could have varying consequences for an individual, particularly if he or she is only marginally capable of meeting performance requirements. For example, a marginally competent individual would probably prefer an undermanned setting as long as the task was additive and his participation helpful to the group. However, under conjunctive conditions poor performance would hurt the entire group, and the marginally competent individual may prefer an overmanned setting, where the likelihood of having to participate is reduced. Interestingly, most of the field work done by Wicker and his colleagues in support of Barker's hypotheses (e.g., Wicker, 1969b; Wicker & Kauma, 1974; Wicker & Mehler, 1971) was based on church settings, which probably include a large proportion of additive tasks (e.g., worship service, fellowship meeting, potluck supper, etc.). Wicker's laboratory car race (see Wicker, 1979, pp. 148-157), on the other hand, was much more a conjunc-

tive task, which might account for the absence of manning effects there.

The present study was designed to examine the mediating influences of individual differences and task structure on manning in a laboratory-based setting. Under- and overmanning were the two manning levels, while additive and conjunctive instructions provided two different task structures for the setting program. In addition, half of the settings studied included a member evaluated as "incompetent" on the task, while the other half contained members who were all characterized as sufficiently competent. The study thus crossed two levels each of person, manning, and task factors in a $2 \times 2 \times 2$ factorial design.

Hypotheses were formulated using the parsimonious manning theory, and also in terms of a more comprehensive ecological conception of person-environment fit. Based on manning theory alone, it was predicted that occupants of undermanned settings, in comparison with occupants of overmanned settings, would show (a) more task-related behavior, including participation in more challenging and important activities and performance of a greater *variety* of different behaviors; (b) more time spent in task-related locations of the setting; (c) greater reported fit with the setting (i.e., motivation, involvement, and cohesiveness); (d) poorer task performance as a group; (e) better task performance *per occupant* (i.e., harder work); (f) less time spent talking; and (g) a greater proportion of talk time devoted to task-related talk.

Based on a person-environment fit conception, it was alternatively hypothesized that individual competence and task structure would *interact* with manning such that each of the undermanned versus overmanned differences predicted above would be greater for incompetent than for competent occupants (since incompetent occupants would much more likely show a poor fit and be selected out of participation in overmanned settings), and also greater under additive than conjunctive task conditions (since the flexibility of additive structure offers less resistance to all other effects operating in the setting).

METHOD

Subjects

Subjects for this study were 323 male introductory psychology students at Indiana University who participated to fulfill a course requirement; 68 subjects were part of a pilot experiment, while 255 participated in the study proper.

Materials

The materials used in this study included various supplies for the setting task (see below), two standardized personality tests, and a post-experiment questionnaire developed as part of the pilot study.

Task Materials. Four different frontal-elevation diagrams of bookshelves were hand drawn and posted on three walls of the experimental room to guide subjects as they worked on the task. One hundred flat decorative bricks (20 × 9.5 × 3.5 cm), 12 larger bricks (20 × 9.5 × 5.5 cm), and eight 85-cm lengths of pine shelf board were provided for building the shelves.

Personality Tests. Two abbreviated forms of the Army General Classification Test (AGCT; Science Research Associates, 1947) were administered to subjects as a basis for manipulating predicted competence on the task. Only the "block counting" sections of the AGCT were used, with one form including 60 of those items and the other only 40 items.

Two scales from the Personality Research Form (PRF; Research Psychologists Press, 1965) were also administered to each subject. The two scales were the Achievement (Ach) and Autonomy (Aut) scales, which were chosen for their potential usefulness as personality correlates of behavior on a small group task.

Posttask Questionnaire. The first step in developing the self-report questionnaire was to derive rationally 24 items assessing (a) subjects' reactions to the task in terms of the experimental hypotheses (e.g., the importance of individual differences, the subject's feelings of involvement in the task, and so on); and (b) the reported effectiveness of the competence, manning, and task manipulations. Each item consisted of a declarative statement to which subjects responded using a seven-point Likert scale in expressing their degree of agreement (i.e., strongly disagree, disagree, slightly disagree, neutral, slightly agree, agree, strongly agree). These 24 items were administered to the 68 pilot subjects after they completed the experimental procedure. Analysis of their responses supported the validity of the manning and task manipulations, although group differences on items testing the competence manipulation were only in the predicted direction.

The second step in analyzing the questionnaire data was a factor analysis of responses to the 24 items. Varimax rotation of the initial factor matrix yielded four factors with eigenvalues greater than 1.0 and, based on item content, the four were labeled Group Cohesiveness, Self-setting Incongruence, Involvement, and Satisfaction. As a third step in refining the questionnaire, the three to six items loading most heavily on each factor were combined into a scale and analyzed for internal consistency. Standardized item alphas for the four scales were .73 for Cohesiveness, .71 for Incongruence, .65 for Involvement, and .66 for Satisfaction.

Results from the pilot study were used to revise the questionnaire. Items which did not load on any interpretable factor were deleted, and one or two face-valid items were added to each scale with less than five items (e.g., "We worked well together as a group" was added to the Cohesiveness scale). In addition, face-valid items for a fifth scale measuring crowding and alienation (e.g., "I felt isolated from the group and the job it was doing") were added, bringing the total number of items in the revised questionnaire to 32. This 32-item questionnaire was administered to 255 subjects during the study proper. A factor analysis of their responses with Varimax rotation produced three factors with eingevalues greater than 1.0, which were labeled Cohesiveness, Incongruence, and Involvement. Reliability analysis produced standardized item alphas of .85 for the Cohesiveness scale, .77 for the Incongruence scale, and .67 for the Involvement scale. The structure of the self-report questionnaire thus held up well under this cross-validation of factors and scales.

Experimental Task. The task chosen for this study involved constructing a set of bookshelves out of bricks and shelf boards according to a detailed set of plans. The extent to which a group executed the task according to the plans provided a quantitative measure of group performance, and responses to a posttask questionnaire assessed individual subjects' motivation to participate (as well as other variables). This task met all of the structural and dynamic criteria Barker presented in his definition of the behavior setting (cf. Barker, 1968, pp. 18-26). For example, it entailed several standing patterns of behavior (e.g., brick carrying, brick laying, talking, studying the plans), to which the physical surroundings were made "circumjacent" (i.e., enclosing) and "synomorphic" (i.e., functionally congruent). Both the number of shelf units and the size of the room in which they were built dictated an optimal group size of five, and instructions were varied to make the task either additive or conjunctive in structure.

Procedure

Following the pilot study, 255 subjects were run in 56 groups of either 2 or 3 subjects (undermanned condition) or 6 or 7 subjects (overmanned condition; groups of 2 and 6 members were occasioned by the failure of a subject to show up for the experiment). Subjects began the experiment in a room containing individual cubicles where each subject chose a seat and received an identifying number to wear. Once seated no subject could see anything but the three walls of his own cubicle and a table in front of him, although sounds from adjacent cubicles were quite audible. Each subject was given a copy of the AGCT and asked to complete a series of 10 practice problems presented on the first page. The four-page AGCT forms had identical first and last pages, but the second and third pages of the long

forms contained 20 items each, while the same two pages on the short form had only 10 items each. In 28 of the groups all subjects were given the short form, while in the other 28 one member, chosen at random, received the long form and the others all got the short one.

When all subjects in a group had read the directions and completed the practice problems, the experimenter reviewed the directions with them and indicated that they would have 5 minutes to complete the remainder of the test. Subjects began work at the start of a stopwatch, and after 5 minutes the experimenter stopped them and collected the tests. No subject ever completed the test, but those with the short form invariably completed a page or two more than those with the long form. While the AGCT tests were being "scored," subjects remained in the cubicles and completed the four PRF scales.

After all subjects had completed the PRF scales the group was escorted to the experimental room, a 3.85 × 2.7 × 2.5-meter chamber containing the four shelf diagrams, bricks and boards, a desk in one corner, a large timer with sweep second hand, an unobtrusive microphone connected to a tape recorder in another room, and a one-way observation window (the layout of this room is presented in Figure 1).

The experimenter began by introducing himself and had each subject do the same by giving his name, year in school, major, and hometown. This aspect of the procedure was intended to break down the anonymity of the

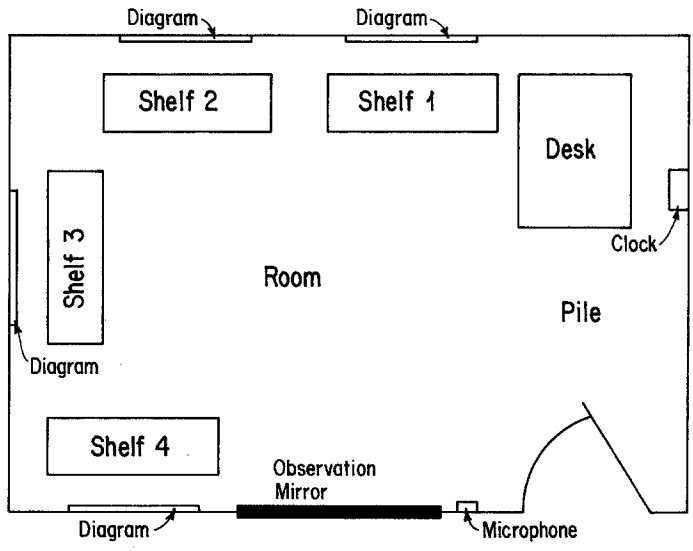

Fig. 1. Physical layout of the experimental setting.

situation and to facilitate verbal communication later as the group worked on the task. Subjects were then read either of two sets of instructions. Both sets included the same initial paragraph describing the setting:

> In this room are piles of bricks and boards. Note that there are two kinds of bricks, large and small. On the walls are four diagrams of bookshelf units, with a front view and a side view of each unit displayed. Note that the large bricks are used only as bases for the units, while only small bricks are used for the sides. The diagrams are *not* drawn in perspective but they are drawn accurately. Your job as a group will be to build all four of the units.

For the additive condition the second paragraph of instructions was designed to facilitate involvement of all occupants equally:

> You may organize your effort as a group in any way you like. There will be a 5-minute limit on the time you have to complete the job, and your score will be determined by how much you get done in 5 minutes and by how accurately you follow the plans. For reasons of safety, when you carry bricks from the pile to the shelf units you may carry only two at a time—that is one in each hand. At no time may you carry more than two. Feel free to talk among yourselves as you work on the task. Again, you may organize your effort in any way you like, but remember that you have only 5 minutes in which to do the job and that you may carry only two bricks at a time. Are there any questions?

For conjunctive tasks, the second paragraph was designed to maximize the responsibility of individual occupants, especially the slowest one:

> There are a few rules that you must follow in doing this job. A shelf may be built by only one group member—no more than one on any given shelf. If a group member finishes the shelf he is building he may do anything here in the room except work on another one. He may give suggestions and advice to others but may not help them build their shelves. Anyone can carry bricks to the shelves, but for reasons of safety only two bricks—that is, one in each hand—can be carried per trip by any group member. The work will be *timed*—when the *last* unit is complete, the clock will be stopped. The group member who is the slowest to complete his shelf will therefore be the one who determines the score for the entire group. Again, no more than one person on any shelf, no more than two bricks per trip, and most importantly, the clock will not stop until the last person is finished. Are there any questions?

After the instructions were read and clarified for the group, an assistant entered the room to inform the experimenter either that all subjects in the group had made a satisfactory score on the pretest, or that most members had "passed" but one (the subject with the long form) had been very slow and performed much more poorly than the others. The experimenter thanked and dismissed the assistant, commenting on the feedback in a casual way but taking care to acknowledge by number any subject identified as incompetent.[4] No subjects ever commented directly on this act of labeling one of them incompetent.

[4]An example of the experimenter's comment at this point might have been something like: "Well, it looks like John here, number 2, may not do as well as the rest of you, but I guess I have no objection to him remaining if it's OK with the others."

The group then began the shelf-building task, and as he left the experimenter started the timer and tape recorder. Subjects' behavior was observed and recorded by two trained assistants from behind a one-way mirror. At the appropriate time (either at the end of 5 minutes or when the group was finished) the experimenter reentered the room, stopped the clock and tape recorder, and had subjects complete the posttask questionnaire. The assistants also entered the room and recorded, independently of each other, the time on the clock and the number of bricks correctly laid on each shelf. Once subjects had completed the posttask questionnaire they were fully debriefed on all aspects of the experiment.

Dependent Measures

Behaviors and Locations. Observations of subjects' behavior were made on a 5-second time-sampling schedule. Each observer was responsible for half-plus-one of the subjects (i.e., either two of three, or four of seven), so that the sampling interval for a given subject was either 10 seconds (undermanned condition, each observer alternating between two subjects at 5-second intervals) or 20 seconds (overmanned condition, each observer watching four subjects, one per 5-second interval). Two dimensions of activity were coded, behaviors performed and locations occupied. Interobserver reliability for the eight different observer pairs was calculated in terms of Cohen's (1960) dappa (k) using data for the one subject in each setting that both observers watched. For behaviors performed the k values ranged from .73 to .93 ($M = .87$), and for locations the range was .56 to .95 ($M = .81$). All values of k were significant at $p = .001$ or less.

Because raw behavior and location frequencies varied as a function of (a) the length of time each group was observed (differing between additive and conjunctive conditions) and (b) the number of subjects each observer rated (differing between undermanned and overmanned conditions), all raw frequencies were transformed into proportions of the total number of behavioral or location tallies made for that subject. These proportions were estimates of the amount of time a subject performed a behavior or occupied a location relative to the total amount of time he spent in the setting. Because of statistical nonindependence among the occupants of any given group, the proportions for the competent members of each group were averaged to obtain a single score.

Posttask Questionnaire. Group means for the Cohesiveness, Incongruence, and Involvement scales were analyzed as self-report variables.

Task Performance. The performance of each group was judged in terms of the number of bricks correctly laid by the group.

Verbal Interaction. Observers rated audiotapes recorded for each group as it worked on the task. Subject "talk time" was tallied for each 5-second interval in which verbal interaction occurred. Task-related talk consisted of questions, responses, directions, suggestions, and other communications related to work on the shelves. Interrater reliability for these judgments was excellent ($k = .86$, $p = .001$). Since durations of the tapes differed from group to group due to different amounts of time spent on the task, the two dependent variables actually analyzed were (a) the proportion of total task time in which talk occurred, and (b) the proportion of talk time that included task-related talk.

RESULTS

Breakdown of dependent variable means by the Competence, Manning, and Task factors is presented in Table I. Hypotheses were tested using analysis of covariance of group means and difference scores to meet the assumption of statistical independence. Group means on the PRF scales

Table I. One-Way Breakdowns of Dependent Variables by Manning, Task, and Perceived Competence

	Manning		Task		Perceived competence	
Dependent variable	Under	Over	Additive	Conjunctive	Comp.	Incomp.
Proportion of time						
In task behavior	.92	.76[a]	.87	.83[b]	.85	.89
Laying bricks	.42	.34[b]	.39	.37	.36	.36
Studying plans	.24	.17[b]	.20	.22	.21	.21
Carrying bricks	.25	.23	.26	.22	.26	.30
Doing nothing	.08	.24[a]	.13	.17[b]	.15	.11
At shelves	.82	.67[a]	.75	.74	.75	.72
In "room"	.06	.21[a]	.12	.14	.12	.12
At pile	.13	.12	.13	.12	.14	.16
Talking	.45	.71[a]	.68	.46[a]	(not available)	
In task talk	.95	.97	.98	.94[c]	(not available)	
No. diff. behaviors	3.36	2.90[a]	3.11	2.98	3.04	3.14
Group performance						
Bricks correct	81.9	103.8[a]	86.3	98.3	(not available)	
Self-report (arbitrary scale units)						
Cohesiveness	30.8	29.6	31.1	29.5	30.4	29.1
Involvement	19.0	18.3	19.2	18.2	19.0	17.5
Incongruence	11.0	12.0	11.4	11.5	11.3	11.8

[a]One-way main effect significant at $p < .001$.
[b]One-way main effect significant at $p < .01$.
[c]One-way main effect significant at $p < .05$.

were used as covariates, and all proportions were first subjected to arc sine transformations. Effects due to manning, task structure, and their interaction were tested using a two-way analysis of covariance with the data from competent subjects. Individual competence and its interactions with manning and task were analyzed using data from half the groups, those with both competent and incompetent members. The difference between the mean for competent members and the score for the incompetent member was calculated for each of these groups, and these difference scores were subjected to two-way (Manning × Task) analyses of covariance.

There were thus *two* analyses done on each of the dependent variables measured on individual subjects, one using group *means* of competent subjects (for the manning and task factors) and the other using *difference scores* between competent and incompetent members (for the Competence factor).

Behavioral Observations

Of the five subject behaviors coded, four (Carry, Lay, Supervise, and Study Plans) were task behaviors, while the fifth (Nothing) was not. Results[5] for all task behaviors combined (TB) indicated that undermanned groups performed much higher proportions of TB than did overmanned groups ($F(1, 43) = 95.4$, $p < .001$; overall multiple $R = .85$), and additive groups a higher proportion than conjunctive groups ($F(1, 43) = 7.0$, $p = .01$). There was also a significant Competence × Manning interaction ($F(1, 21) = 5.1$, $p = .04$), which is depicted in Table II. In undermanned settings both competent and incompetent subjects performed high proportions of TB, while in overmanned settings *incompetent* subjects performed a higher proportion of TB than did competent subjects. The Competence × Manning interaction was thus in opposite direction to that predicted. Subjects who had little reason to be confident of their own task competence were more likely to participate when the setting was overmanned, and the need for their contribution was low, than were subjects presumably more assured of their ability. Mean need for achievement was significantly negatively associated with performance of task behavior ($F(1, 43) = 8.3$, $p = .006$) indicating, somewhat counterintuitively, that groups higher in average need for achievement engaged in lower average proportions of task behavior.

Of the three individual task behaviors which occurred with significant frequency (Carry Bricks, Lay Bricks, and Study Plans), Lay Bricks was

[5]Three groups had partial missing data due to observer error or equipment malfunction, so analyses were based on 53 of the original 56 groups.

Table II. Proportions of Task-Related Behavior Broken Down by Perceived Competence and Manning

	Manning		
Perceived competence	Undermanned	Overmanned	Mean
Competent	.92	.76	.84
Incompetent	.91	.87	.89
Mean	.92	.81	.86

almost certainly the most difficult to perform, since it involved both deciphering the plans and hoisting the heavy bricks and boards safely (although, admittedly, it was impossible to tell how much effort subjects put into this activity), but Carry Bricks was little more than manual labor. Analyses of effects on these individual task behaviors indicated that undermanned groups spent significantly greater proportions of time laying bricks ($F(1, 43) = 10.8$, multiple $R = .52$, $p = .002$) and studying the plans ($F(1, 43) = 8.6$, multiple $R = .49$, $p = .005$) than did overmanned groups, while there were no effects on the behavior Carry Bricks. Manning theory was thus supported in its prediction that members of undermanned settings perform more difficult and more important tasks.

The hypothesis of involvement in a greater diversity of tasks was tested by calculating the mean number of different task behaviors engaged in by the members of each group. Analysis of this variable found no main effects or interactions involving the competence and task factors but did show that the members of undermanned groups performed significantly more different task behaviors than did the members of overmanned groups ($F(1, 43) = 17.4$, multiple $R = .51$, $p = .001$), again supporting manning theory.

For mean proportions of time spent at different locations within the setting, members of undermanned groups were more likely to occupy space around the shelves ($F(1, 43) = 37.1$, multiple $R = .82$, $p = .001$), and less likely to stay further back in the room ($F(1, 43) = 74.7$, multiple $R = .81$, $p = .001$), than were overmanned subjects. A significant Manning $\times$ Task effect on time spent at the brick pile ($F(1, 43 = 4.4$, multiple $R = .38$, $p = .04$) indicated that the highest proportions of time spent at the pile occurred in undermanned-conjunctive and overmanned-additive settings, while much lower proportions occurred in undermanned-additive and overmanned-conjunctive settings. Depicted in Table III, this interaction suggests that undermanning increases the efficiency with which space is used only under additive conditions. Finally, high need for achievement was associated with less time spent at the shelves ($F(1, 43) = 11.8$, $p = .001$), and more time spent in the room ($F(1, 43) = 12.5$, $p = .001$), findings which appear to be consistent with those reported above for task behavior.

Table III. Proportions of Time Spent at the Brick Pile, Broken Down by Manning and Task

	Task		
Manning	Additive	Conjunctive	Mean
Under	.12	.15	.13
Over	.14	.10	.12
Mean	.13	.12	.13

Performance

A Manning × Task[6] analysis of variance of the number of bricks correctly laid by each group indicated that overmanned groups laid significantly more bricks correctly than undermanned groups ($F(1, 47) = 13.4$, multiple $R = .55$, $p = .001$), supporting Barker's hypothesis that undermanned groups perform more poorly overall than overmanned groups. However, a significant Manning × Task interaction ($F(1, 47) = 12.3$, $p = .001$), presented in Table IV, indicated that overmanned groups performed significantly better than undermanned groups only under additive conditions. Furthermore, when group size was factored out as a covariate, undermanned groups performed significantly better than overmanned groups ($F(1, 47) = 6.9$, multiple $R = .67$, $p = .012$), indicating that undermanning elicits better performance or harder work *per occupant* than does overmanning.

Verbal Interaction

Overmanned groups generated a significantly greater proportion of talk time than did undermanned groups ($F(1, 47) = 24.1$, overall multiple $R = .68$, $p = .001$), and additive groups a greater proportion than conjunctive groups ($F(1, 47) = 16.8$, $p = .001$). Reanalysis of these data using group size as a covariate found no effect for manning, suggesting that the greater incidence of talk time in overmanned settings was due simply to the greater number of occupants present in that condition.

Additive groups also directed a higher proportion of talk towards the task than did conjunctive groups ($F(1, 47) = 4.0$, multiple $R = .31$, $p = .05$), suggesting that task-related talk between setting occupants is more frequent under additive than conjunctive task conditions.

[6]Task performance and verbal behavior were not measured for individual subjects, and thus could not be broken down using the competence factor.

Table IV. Breakdown of Group Performance as Number of Bricks Correctly Laid, by Manning and Task Controlling for Time

	Task		
Manning	Additive	Conjunctive	Mean
Under	74.0	90.9	81.9
Over	101.5	106.1	103.8
Mean	86.3	98.3	92.1

Posttask Questionnaire

Competence, manning, and task structure exerted no significant main or interactive effects on reported cohesiveness, involvement, and incongruence, although several differences showed trends towards significance (i.e., at $p = .10$). However, competent occupants who were higher in need for achievement than was the incompetent member of their group also reported higher levels of cohesiveness ($F(1, 21) = 10.2$, multiple $R = .65$, $p = .004$) and involvement ($F(1, 21) = 6.1$, multiple $R = .52$, $p = .02$) than did the incompetent member. In addition, competent occupants who were lower in need for autonomy than their incompetent co-worker also reported higher cohesiveness ($F(1, 21) = 4.3$, $p = .05$) than did the incompetent co-worker. High need for achievement and low need for autonomy thus produced higher reported cohesiveness and/or involvement when the occupant was also identified as competent rather than incompetent on the task.

To summarize these findings, direct observations of behavior supported manning theory's hypothesis that undermanning exerts greater claim on setting occupants in pulling them toward performing a greater number of more important task behaviors in the task-relevant locations of a setting. Occupants of overmanned settings were less likely to assume performer roles, particularly when they were perceived to be competent rather than incompetent on the task, a demonstration of person-environment interaction in the opposite direction of that predicted. Undermanned occupants also worked much harder on the task than did overmanned occupants.

However, task structure and personality needs did interact with and thus limit the manning effects, and structure also influenced occupants' verbal communication, while manning did not. Manning theory's predictions regarding occupants' subjective reports under different manning conditions were not supported.

DISCUSSION

The results of this study do not provide a definitive choice between the simple manning theory predictions and the broader conception of person-environment fit. However, the presence of task and individual-difference main and interaction effects, and the substantial amounts of variance accounted for when all factors are combined (i.e., the squared multiple *R*s), suggest that an ecological view encompassing both individual characteristics and environmental conditions provides the best fit to the data. For example, the finding that subjects labeled incompetent performed more task behavior than competent subjects in overmanned settings, while contrary to the prediction, still argues that individual factors can compete with and override manning influences under some conditions (e.g., the desire to repudiate a label of "incompetence" by assuming greater-than-expected task involvement). The significant influences of personality needs on behavior and subjective reports also support the need to recognize individual differences in the performance of behavior settings.

As predicted, manning effects on group performance and use of space were stronger under additive than conjunctive task structure, and thus another goal for behavior setting theorists should be the further elucidation of this and other factors related to setting "programs." For example, most previous manning studies have dealt with additive settings, and the present findings suggest, among other things, that undermanned groups may actually be more productive under conjunctive conditions. Delineation of other contextual factors will push the theory beyond its present assumption that behavior settings of a given type are interchangeable replications of each other, occurring in an all-or-none fashion, towards a more detailed understanding of the qualitative and quantitative dimensions making up human environments.

The psychological consequences of participating in an undermanned setting have never been clearly established, theoretically or empirically, although some of Barker's predictions suggest that they could be dramatic. The greater importance and opportunity to participate afforded each occupant, the reduced emphasis on individual differences, and the lower standards of admission in undermanned settings all suggest a climate that would be psychologically healthy for most people. On the other hand, the harder work, greater responsibility, and greater insecurity regarding long-term success in undermanned settings could offset the healthy qualities, and in fact the present study found no significant manning effects on the subjective reports of subjects. It is conceivable that more extreme differences among setting occupants (e.g., normal adults vs. chronic psychiatric patients) would help clarify this issue by showing that undermanning can be

psychologically positive *or* negative depending on the occupant's competence and emotional vulnerability.

No study lacks weaknesses, and the major limitation in this case is the degree of generalizability to settings outside the laboratory, particularly with respect to the composition of occupant groups, the brief duration of each setting performance, and the manipulation of competence. Generalizability from one setting to another depends on the extent to which the two share important features, and in this connection it should be noted that many natural settings (e.g., gas stations, supermarkets, bus and subway stops, etc.) are also of short duration and involve strangers. Only introductory psychology students were available in adequate numbers for 76 (including pilot) independent performances of the setting, and they were also appropriate for the task used. The implications of manipulating perceived or expected competence rather than actual skill depend on the relative importance of occupants' beliefs about themselves and each other versus what each is actually capable of doing on the task. In a short-term setting involving strangers, expectation seems to be potentially as important as actual skill. Nevertheless, some of the dependent variables, particularly verbal behavior and subjective responses, may have been restricted by these experimental features, and future work should examine settings of longer duration where occupants know each other and where they actually differ in important personal characteristics.

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