ENCOUNTERING AN ALIEN CULTURE

Lee S. Sproull

Sara Kiesler

David Zubrow

Carnegie-Mellon University

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ABSTRACT

Today many people have their first sustained encounter with computing on college campuses. Three general models are commonly used to predict and understand these encounters--based on technical capabilities, instructional practices, and individual abilities. The technical model focusses on hardware and software and assumes that better machines will lead to better experiences. The instructional model assumes that better courses will lead to better experiences. And the individual model assumes that more able students will have better experiences. All three of these models are too limited because they fail to recognize the social, organizational, and cultural context within which encounters with computing occur. Introducing novices to computing is more than simply providing a machine and teaching a set of skills for using it. It is also introducing a new culture. Novices learn cultural lessons as well as technical ones. And the nature of those cultural lessons does much to determine novices' attitudes toward computing and their willingness to pursue it further.

We propose a model for how novices encounter the culture of computing derived from work on the cultural experiences of anthropologists, Peace Corps volunteers, foreign service professionals, new MBA's and corporate executives posted abroad. From the perspective of a novice, the encountering processes are reality shock, confusion, and behavioral and cognitive control attempts. Successful control attempts produce a willingness to undergo further socialization--thereby creating what we term potential cultural recruits. Unsuccessful control attempts produce anger and withdrawal--characteristics of potential cultural dropouts.

Results of a two-pact empirical study are presented. In the first part 250 novices compared their freshman computer science course to their other courses (English, social science, and mathematics) by using a fixed-response questionnaire. This part of the study was designed to see if all college courses were alienating, i.e., if college itself is the alien culture. In fact, computer science looked very

different from the other courses. Reality shock and confusion were higher; control attempts were less often successful; fewer potential cultural recruits were produced.

In the second part of the study, 25 (of the original 250) novices were interviewed in depth about their encounters with computing. They revealed at least four factors contributing to reality shock: time, the terminal room, actually working on the computer, and course-related factors such as lectures and exams. For example, one said,

> If a computer program is due that week, then the computer sign-up times range all over my entire schedule. I have to arrange everything else around that computer time. If I get computer time at 6:00, then I have to have everything else arranged around that. It just rearranges everything. If you work from 11:00 until 3:00 or from 1:00 until 2:00 or however you work, it arranges your time. It just totally redoes your schedule.

Another said,

> I feel like I'm in 1984, cells right next to each other. It's like Russia. You've got to just get as many people as you can, crammed in there...They're all white. And all they have are computer information on them. Maybe they could have a picture of Picasso. Anything just to break the monotony...All you see are computer geeks and computers and the xerox machines and white on the walls...

And a third said,

> I sat down at this computer and started hitting the buttons and it started making all this noise and people kept looking at me. I didn't know what I was doing. I didn't even know if it was on.

Almost all students reported feeling out of control as a result of ignorance, system crashes, and unhelpful "experts." One said,

> It's frightening when everyone else is around you just typing in as fast as they can, and you don't even know what to do.E5

A second said,

> I was almost finished with a program and it crashed. I didn't have a save. I didn't put save one. I had to start over. It was heartbreaking.O15

And a third said,

> I was on the computer and something happened. I didn't know what was going on. I saw a guy sitting over there who looked like a real hacker. So I asked him, and he got up, and he started doing all of this stuff with my account without telling me what he was doing.

> He started messing around, 'You need this. Let's see, I'll give you this file.' It's like, what are you doing? He wouldn't tell me.W23.

They all learned cultural lessons about the social organization of computing, the computer as cultural artifact, and the effects of computers on themselves and society. For example,

> Looking back, I'm really not afraid of computers, but I'm going to try to stay away from computers. I know I shouldn't, because it's probably the thing of the future. But I'm really kind of leery to get into any type of computing again.C3

This cultural learning, we think, will magnify differential outcomes of individual performance. Dropouts will become estranged from an important culture within the society while recruits will become enthusiastic participants. The experiences that novices have therefore are important not only to themselves but also to the future character of the culture itself.

INTRODUCTION

As computers become more important and ubiquitous, more and more nontechnical people encounter them. Early encounters with computers were the province of scientists and engineers. By all accounts these experiences were arduous but exhilarating as powerful new technologies were discovered and explored (e.g., McCorduck, 1979). Today the technical revolution is far from over but a new social revolution has just begun. Some commentators believe that the computer will transform the lives not just of scientists and engineers but of all people (Hiltz & Turoff, 1978; Davis, 1982). Although no sensible person is willing to predict the exact nature of that transformation, one feature is that more and more nontechnical people are coming to interact directly with computers. The settings in which these encounters take place include the home (Rogers, Daley, and Wu, 1982), elementary and secondary schools (Taylor, 1980), and the workplace (Zuboff, 1982; Engleberger, 1980; Case, Johnson, and Rogers, 1982). An important encountering setting today is college campuses, where nontechnical students are taking programming courses and using computers in other courses in ways that only a few years ago were reserved for science and engineering students. Indeed colleges are beginning to require nontechnical students to demonstrate some computing competence. For example, Harvard requires all students to be able to write a computer program as a requirement for graduation. Some colleges are instituting requirements that all nontechnical students take a programming course. Others are requiring all students to purchase computers.

Previous investigations of initial encounters with computing have typically employed one of two perspectives: human factors and instructional. Analyses using a human factors perspective usually investigate the relative ease or difficulty with which new users learn particular computer operations as a function of equipment or software variables (e.g., Bury et al., 1982; Black and Moran, 1982). Often these users are not new to computing itself, but rather are simply new to the particular operations being studies (e.g., Schneider et al., 1982; DeYoung, Kampen, and Tolpolski, 1982). Analyses using an instructional perspective usually measure the accuracy with which people learn certain material, perhaps as a function of alternative instructional techniques (e.g., Taylor, 1980). In neither of these

perspectives does the investigator consider what the new person learns about such issues as:

- the context in which computing occurs
- available status positions for those who compute
- the kinds of people who compute
- the social organization of computing
- the values placed on computing.

These are cultural lessons. In employing a cultural perspective, we assume the existence of an on-going culture in which computing equipment and software are particular artifacts. What we investigate is how new persons--in this case, college students--encounter this culture, and what lessons they learn both about it and about themselves in relation to it.

In this paper we use a cultural perspective to try to understand people's initial encounters with computing. The effort is a first step in developing a general cultural analysis of computing. We begin by exploring some of the ways in which computing is embedded in a larger social order and suggest some of the ways in which it will be alien to newcomers. We then draw upon work in organizational socialization to suggest how newcomers will respond to it. We then present a two-part study that investigates initial encounters with computing within one organization. The results of this study reveal that newcomers can indeed learn very powerful cultural lessons about computing. Based on these results we suggest some organizational implications for introducing people to new technology and consider how a cultural perspective helps us understand this problem.

COMPUTING AS CULTURE

Cultural Context

Certain kinds of organizations tend to foster the development of a computing culture that touches all who encounter it. They include research, development, and engineering divisions within the computer industry itself and college campuses. These organizations have several features in

common that foster cultural development. One is that computers are used for many different purposes. On a typical college campus, for example, the same machine or machines may be used for research, administration, accounting, teaching, and text processing. Thus these machines tend to have operating systems and programming tools that make them relatively easy to use. Second, because these machines serve many purposes, many kinds of people have access to them. And furthermore, this access is relatively direct. That is, people have their own accounts; there need be no intermediaries between them and the machine. Third, many of the people with direct access are relatively smart, young, and they don't have enough to do. That is, they are students. They have few family or economic responsibilities, flexible schedules, and the stamina to stay up all night. Fourth, these organizations tend to be less bureaucratic and formal than most government, commercial or manufacturing settings. In these cases, where smart understimulated people have direct access to flexible machine in non-bureaucratic settings, the culture of computing is nurtured and can flourish.

Why? This doesn't follow.

What are the characteristics of this culture? Every culture has values and norms, a status hierarchy, membership signs and boundaries to distinguish members from non-members, language, and artifacts (Gamst and Norbeck, 1976). Although their specifics will differ from campus to campus, some of the general features of the culture of computing are quite widely shared. The culture is an adolescent one. Pranks, tricks, and games are benignly tolerated when not actually encouraged. People are often impolite and irreverent. Mild larceny is also tolerated, if not encouraged, through faking accounts, stealing time, copying proprietary software, and breaking codes. The culture is individualistic and idiosyncratic. Social cooperation or coordination is rarely necessary. There is competition to write the best, fastest, biggest program or to build the best, fastest, smallest hardware. The status hierarchy is revealed through assigning people to such categories as wizards, wheels, hackers, users, and losers. True members of the culture can be found at the terminal room or computer center at all hours of the day and night.

Despite its rapid intrusion into many areas of life, computing currently is not just something new. It is also strange. In terms of spatial and temporal characteristics, controllability, and nature of

feedback, computing is unlike other technologies. For example, consider a college student encountering a time-sharing system and some of the ways in which academic computing differs from all other course work. Computing differs in time and space characteristics from other academic activities. Whereas in other courses students are free to choose the time and space that suit them best to do their homework, students of computing are tied to a terminal room and a time at which a terminal is available. Computing also differs in reliability and controllability. When a student is reading a history book, the page never goes blank. When a student is writing a paper, if his pencil breaks he can sharpen it. But computer tools are not under a student's control. Computing also differs in speed and nature of feedback. If a student is doing a physics assignment, the first wrong digit he writes on the page does not generate an immediate cascade of error messages. In other courses, a student may stop after his exertions and imagine that the essay is good enough, or that he has worked enough math problems to demonstrate competence. In computing, there is no stopping until the program works--it either does or it doesn't.[1]

In order for a novice actually to use a computer system, he must make his way through a host of arbitrary conventions that are totally unrelated to the science or theory of computing. Hence new students are thrown into a sea of syntax, I/O devices, priority classes, programs, and system quirks with no conceptual life vest to keep them afloat. The stylized nature of person/computer interaction can be particularly alienating to these students. All new disciplines involve learning conventions, but it is humiliating to be at the mercy of so many seemingly trivial arbitrary ones. These problems are compounded because computing is a scarce resource on every college campus; thus students can be forced to wait long periods of time just to gain access to the potentially frustrating machine.

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[1]The advent of microcomputers for wide use in organizations will resolve some problems of access and reliability, but problems associated with lack of controllability and poor feedback will remain serious. For example, with some exceptions (Logo, Visicalc) microcomputer software is generally written by computer programmers as though for computer programmers. It is hard to understand (a command like "initiate alternation of document" is not unusual). It is often rude (as in the message, "SYNTAX ERROR. PROGRAM TERMINATING!!"). Generally, software tends to emphasize machine efficiency at the expense of human effectiveness.

As strange as these experiences may be, their strangeness is exacerbated by the fact that they occur within a social context in which other people are quite at home. This embedding of computing in the larger life of the organization distinguishes students' computing encounters with those of say, the physics laboratory. While the physics laboratory may also lead students to feel out of control, it is a very sheltered and isolated environment apart from the real business of physics or anything else. By contrast, the newly computing student must compete for terminal time and cycles with administrators who are managing accounting, secretaries who are typing manuscripts, faculty members who are doing research, students who are doing assignments, and hackers.

Hackers are an identifiable subculture on many college campuses.

- They share (or sometimes argue passionately about) certain values about good and bad machines, software, programming practices, and systems.
- They can be found, voluntarily, at the computer all hours of the day and night.
- They use an esoteric vocabulary for both technical and nontechnical purposes.
- They are differentiated from non-members by special names and behaviors.

The "hacker's dictionary" documents the subculture's esoteric vocabulary. Some dictionary entries are displayed in Figure 1. Note that these entries illustrate something about values (what is or is not a "crock" or a "hack"), roles ("bagbiter," "hacker," "user"), and behaviors (to "flame," to "change one's phase").

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Insert Figure 1 about here

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Encountering Processes.

One learns a culture through socialization into it. Van Maanen and Schein (1979: 211) describe organizational socialization as the "process by which an individual acquires the social knowledge and skills necessary to assume an organizational role." In the case of computing, the organizational role is that of "computer user." But the role transcends the particular organization in that having once acquired that role in any organization one then occupies a different status in all subsequent organizations.

If the culture is an alien one, as we suggest for computing, then socialization will occur under conditions of strangeness. Strangeness or unfamiliarity means that the novice's habitual and therefore efficient models and means for learning will be neither useful nor appropriate.[2] That is, novices must learn how to learn as well as what to learn. They must develop new ways of assimilating information and a new framework for it. They must learn how to recognize and interpret cues, and whom to rely upon as informants. They must learn how to organize new bits and pieces of knowledge into coherent theories of behavior. In these processes the novice brings capabilities, prior experiences, and expectations to the new setting.

It is the interaction between the novice and the setting that provides the occasion for socialization into the culture. Figure 2 provides a hypothetical diagram of this process. Its major features are reality shock, confusion, control attempts, and socialization outcomes. Three out of four of these features (all but confusion) represent an interaction between the person and the setting.

Insert Figure 2 About Here

The initial interaction inevitably produces reality shock for the novice during the early days in a new job or in a new culture. Reality shock is composed of changes, contrasts, and surprises (Louis, 1980). Changes are simply objective differences from the novice's prior situation, for example in title, workload, compensation, location, food preferences, social customs, and even facial expressions. Contrasts are differences in what is subjectively salient from that in the novice's former situation, for example in images of surroundings, pace, ethos and language (e.g., Smalley, 1963). Both changes and contrasts can be anticipated by the novice preparing to enter a new culture. Indeed, through

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[2]The terminology of socialization is awkward in the computer case. In the socialization literature, a person who has not yet experienced socialization attempts is called a novice (or sometimes a recruit, rookie, or new person). In the computing culture, a person who has had enough contact with computers to have done well in one or two computing courses may still be called a novice, to differentiate him from an expert. The person who has not yet experienced computing at all is called a non-user. (With its connotations of "non-person," the label of non-user demonstrates something about the nature of status differentiation within the culture.) We will follow the socialization convention and use novice to mean what the computing culture would refer to as non-user.

anticipatory socialization (Merton and Rossi, 1968), a novice can ease his transition to a new culture. Surprises, on the other hand, are unanticipated differences between expectations and reality. For example, technical assistants and management personnel sent overseas often experience role ambiguity and loss of personal status that are not at all what they anticipated (Byrnes, 1966; Higbee, 1969).

Reality shock is the product of features in the culture and the novice's reactions to them. It is important to the novice because it signals that prior instrumental behaviors are no longer appropriate and new ones must be learned. It is also important because it colors the early lessons learned in the new culture. The nature of the reality shock and how it is managed by the novice and the organization do much to define the process and outcomes of socialization (David, 1971).[3]

Reality shock leads the recruit to experience confusion, both about self and the external environment (Oberg, 1966). Self confusion leads the novice to feel overwhelmed and to question aspects of his or her self-identity or self-image. These questions can be of the form, "What am I doing?" and "Do I look foolish?" or "Maybe I'm not the person I thought I was." Confusion about the external environment leads the novice to question the capabilities and motivations of those around him. These questions can be of the form, "Do those people really know what they're doing?" or "Why can't they communicate clearly?"

Given reality shock and confusion, novices will try to exert control over the situation. In attempting to control the situation (for example, by explaining surprises) the individuals try to reduce discrepancies between the current state and reference values or standards in the situation (Kanfer

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[3]There is a considerable related literature, essentially consistent with our model, on the adjustment and outcomes of professional sojourners to foreign countries, such as Peace Corps workers, students and managers. This work suggests that important determinants of adaptation and learning include such characteristics of reality shock as similarity of the host culture and friendliness of people in the culture, such characteristics of the visitor as lack of conflicting group memberships and technical training, and such characteristics of the host organization as formality (more structured experiences can shelter new persons) and decentralization (provision of protective enclaves for recruits). See Church (1982) for a recent review.

and Hagerman, 1981; Bandura, 1977; Thompson, 1981; Carver and Scheier, 1982). These attempts can entail mental activity alone, for example constructing satisfying interpretations of the confusing events. And they can also entail actions such as increased effort or talking with other people about the situation. In either case, aspects of the culture will play a part in the control attempts. They will provide sources of information for constructing interpretations and people who function as comparators or standards against which the novices can judge their behavior. If the control attempts are successful, the individual will be able to learn the values and skills necessary for the new role (i.e., to become socialized).

If the control attempts are not successful, anger or withdrawal will arise (Carver, Blaney, and Scheier, 1979; Brockner, 1979). Anger leads to intransigence--active rejection of the values of the socializing or enculturating agents (Goffman, 1961). Intransigence guarantees that the novice will remain an outsider but it allows the novice to maintain a positive self image. The intransigent novice might say, "These people are so crazy that only an idiot would want to act like them." Withdrawal also precludes positive socialization, but does not contribute to a positive self image. The withdrawing novice might say, "I'm no good at this and there's no sense in trying."

In summary, we have suggested that characteristics of the situation and the novice interact to produce reality shock. If computing does represent an alien culture, then we would expect that novices' first computing encounters would engender high reality shock caused by changes in amount of work, kind of work, place of work, timing of work, and surprises (differences between expectations and reality). Reality shock leads to confusion. We would expect that novices would be confused about their own capability and roles and that of the experts in their environment.[4] The most likely responses to reality shock and confusion are attempts to exert control by using resources in the cultural setting. These resources might include other students or teachers who provide ideas and

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[4]Novice reality shock can be positive as well as negative and novice confusion can be quite legitimate. Like the case of the emperor's new clothes, naive outsiders can be in a good position to identify unsatisfactory aspects of a new situation because they have not yet been coopted into tolerating its idiosyncrasies or inadequacies.

behavioral examples of control responses. If control attempts are successful, the person has gained the potential of becoming further socialized and a cultural recruit. If control attempts are unsuccessful, anger or withdrawal will ensue and the person is likely to become a cultural dropout.

Our model assumes implicitly that people normally have good self-esteem, but that it is linked to different patterns of abilities. In all cultures people are socialized into the cultural norms specifying which abilities should be possessed. Difficulty or anxiety attached to learning these abilities is neither unusual nor inconsistent with successful socialization. But when the interaction of cultural features and individual ability lead novices to perform foolishly or poorly on tasks considered important in the culture, and if they are entrapped into the continuing performance of these tasks, they may suffer a continuing decrement in self-esteem. And they will learn a series of negative lessons about the culture and its members as well.

In organizations, most novices will ultimately come to terms with the culture of computing. At an elementary level they will learn to work with computers, and some will become experts. But if the above framework is meaningful, novices will also learn much more in their initial encounters with computing. They will develop an image of "the computer," of the social organization surrounding it, and of their own relationship to the culture. For the organization, these understandings are probably more important than any technical details of writing or using programs that can be conveyed to its non-technical people in an introductory encounter.

OVERVIEW OF EMPIRICAL WORK

Purpose

In the spring of 1982, we conducted a two-part study to explore the cultural perspective on computing and some hypotheses derived from the model described in Figure 2. In part one, we conducted a survey of non-technical college students to explore how their first encounters with computing might have differed from their first encounters with college generally (Feldman and Newcomb, 1969). We used these comparative questionnaire data to test the prediction that reality

shock and confusion will be stronger in computer programming courses than in other courses, and that there will be more control attempts and more failures of control attempts in computer programming courses than in other courses. Thus:

1. For nontechnical students, the computer programming course will be different from, and will violate expectations of, college work to a greater degree than other courses. This reality shock will be experienced as confusion about self and the environment.

2. In encountering the computing course students will attempt control. Students will exert more control attempts in computer programming courses than they will in other courses by, for example, seeking out others and seeking explanations.

3. Control attempts may be constructive in that they lead to correct information and self-affirming attributions and academic success. Students in computer programming courses will have more difficulty finding constructive ways to exert control; they will exert more unconstructive control; and they will experience more unsuccessful outcomes as indicated by withdrawal and anger.

Part two of the study used interview data to explore these processes. We asked a group of non-technical students to talk with us about their initial experiences with computing to see if their descriptions revealed elements of the process we have described above and diagrammed in Figure 2. In addition, we were interested in whether the students' descriptions would reveal aspects of the culture of computing, its alien nature, and the cultural lessons learned that were not measured in the survey.

Setting

The empirical work reported below was conducted in the liberal arts college of a private university in the northeast. Total university enrollment is 5400; undergraduate enrollment is 3900; undergraduate enrollment in the liberal arts college is 800. The liberal arts college prides itself on offering both a broad education and training in general professional skills. As the catalog points out, "It is this professional dimension which distinguishes [our] liberal/professional education from traditional liberal arts programs."

Computing is important on this campus. Currently 83% of the student body has a computing

ıcc nt; the average weekly computer use per student is 1.3 hours. Almost every issue of the weekly student newspaper has at least one story about computers and computing. The same is true for the monthly faculty/staff newspaper. The undergraduate catalog devotes over six times as much attention to the computer center as it does to the library (100 lines for the computer center; 16 for the library). The importance of computing on campus is reflected in the liberal arts college in several ways. Every liberal arts student is required to take an introductory programming course (usually PASCAL) in his or her freshman year. Other required freshman courses also make use of the computer. Students in sections of the introductory philosophy course do logic problems on the computer. In the western civilization course, all students use the computer to analyze grievances from the time of the French Revolution. Many instructors in freshman writing encourage their students to use computer text editing and document preparation facilities to prepare their papers. Popular majors in this college include business, technical writing, and information systems, all of which entail substantial additional work with computers. The top administrators of the college and university value computing highly and express their positive opinions about computing frequently.

It is within this setting that we investigated the experiences of freshmen enrolling in the fall of 1981 with computing.

PART ONE

Method and Analysis

In order to compare computing to other kinds of college experiences, we administered a fixed-response questionnaire to 268 liberal arts freshmen during their required social science class in the spring of 1982. (This represents 95% of the freshman class.) Students were asked to assess one of their English, social science, mathematics, and computer science (computer programming) courses on a number of dimensions using the scale:

1 = false; not at all true

2 = neither true nor false

3 = true or very true of this course

The dependent variables were reality shock, confusion, control attempts, and outcomes (academic success, anger, and withdrawal). These conceptual factors were measured using the questionnaire items listed in Table 1. We selected the sample of items arbitrarily, according to their face validity and statistical correlation with other items in the factor.[5] As this was an exploratory study, the items were meant to sample the conceptual dimensions from Figure 2, but not necessarily comprehensively.

Statistical comparisons were made across courses to evaluate how similarly the students rated each course. These comparisons were conducted using repeated measures analyses of variance and *t* tests comparing courses and items within each factor. A "true or very true" response was set equal to "1" and any other response was set equal to "0". (When comparisons are made such that 1 = false or very false, 2 = neither true nor false, and 3 = true or very true, then the findings are stronger statistically but harder to interpret.)

Results

The findings are based upon the responses of the 208 students who answered questions about one course in each of the four categories of courses we listed (English, social science, mathematics, computer programming). This represents an evaluation mainly of 12 courses (three in each category), all of which are basic level. The typical student in our sample was enrolled in a computer programming course at the time of the survey (nearly the end of second semester, freshman year), and was also enrolled in a literature course, an interdisciplinary social science course, and in calculus.

Approximately 60 students were excluded from the analysis because they had not yet taken a

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[5]Item analysis was performed to evaluate the degree to which each item was related to the conceptual factor it was intended to reflect. This evaluation involved correlating each item with the sum of other items in the same category for all of the courses (Nunnally, 1967). The results of this analysis are contained in Appendix 1. In the analysis, 6 items of the original 45 were found to be statistically unrelated to the factors they were intended to measure and are not used in this report. The exclusion of these items (which are listed in the appendix) does not alter the statistical findings or conclusions of the study.

computing course (a few others were not freshmen or had not taken a course in one of the other categories). This introduces bias in our sample; however, we believe it is a bias that works against our hypotheses. According to some of the students in question, they postpone computer science because they have heard it is "terrible" and they want to have the summer (or the following year) to concentrate on it. Hence the students not included in the analyses are likely to be especially negative about the computing course.

Computing versus Other Courses. Table 1 presents the percentages of students who answered "true or very true" to questions about each course. These data indicate that students' experiences with computing are quite different from their encounters with other disciplines. This finding and the more detailed results described in Table 1 are statistically significant according to repeated measures analyses of variance (which are summarized in Appendix 2) and *t* tests discussed below.

For the three items related to reality shock, an average 79% of the students answered "true or very true" for computing. In contrast, the average for the other three courses ranged from 20% to 27%. Confusion also was greater in the computing course, with three of the five variables having values at least three times the averages of the other courses. (The second most confusing course was English, which belies the idea that non-technical students are generally more confused by quantitative courses.)

Insert Table 1 about here

The control attempts that we investigated were talking with others about the course and making causal attributions about their good and poor performance in the course. Generally, more students in computer programming talked with others about the course. More than in other courses, they talked with friends, past students in the course, and counselors. The item, "class members help one another" yielded a 71% true response in computing, but averaged only 47% in the other courses.

Overall, fewer students in the computing course made constructive attributions of performance (the greatest number were in English and mathematics). On three out of six positive attribution items,

computing was lowest. Although students in computing just as frequently claimed to desire understanding and to be motivated as they did in other courses, they tended not to attribute their good performance to their ability. In addition, they made more unconstructive attributions. The data suggest that, when they were explaining their performance in their computing course, students externalized their successes and internalized their failures. Especially significant are the relatively high frequencies of, "When I did well it was because I had good luck" and "When I did poorly it was because I had poor ability."

The outcomes of the students' encounters with computing and other freshman courses, as reflected in our survey, were mixed. There were no overall statistical differences across courses in the percentages of students who indicated that academic success was being or had been achieved. Mathematics scored highest overall in numbers of students saying they performed "better than I expected." Social science was most frequently given credit for "acquiring knowledge." Computer science was most frequently cited for "learning valuable skills." On the other hand, the percentages of students who experienced anger and withdrawal were much greater in the computer programming course than in other courses. Students in computing were very angry, as much as four times more frequently than in the other courses. They also withdrew more--41% said they wanted to "do just enough to get by" in computing versus an average of 14% in the other courses.

Comparing computer science to mathematics (usually calculus) tells us something about whether the problems students had with computing were due to its quantitative nature. Table 2 shows, contrary to that idea, that computing was a more shocking and confusing experience than mathematics was, that it precipitated more talking to others as well as more unconstructive attributions, and that negative outcomes--anger and withdrawal--were significantly higher.

Insert Table 2 about here

Some effects of background. We investigated the influence of previous experience with computing and of gender on responses to the courses. Fewer students who had taken a previous course in

computing (probably a high school course) experienced reality shock ($F = 3.0$, $p < .05$), but there were no other differences attributable to prior experience.

Gender differences were found for reality shock, confusion and talking with others. Thus, male students were more likely to experience reality shock in courses than were female students ($F = 4.34$, $p < .05$). However, female students were more confused by computer programming whereas the male students were more confused by mathematics, social science, and English ($F = 2.88$, $p < .05$). Consistent with these results, female students were more likely to talk with others about their computer programming course whereas the male students were more likely to talk with others about their courses in mathematics, social science and English ($F = 4.94$, $p < .01$).

Classification of Students by Outcomes. Ultimately, the students in our sample will demonstrate their capacity and willingness for further socialization through their involvement in more computing courses or work using computing beyond their freshman year. We thought it would be interesting, however, to classify students as potential cultural recruits or dropouts according to their answers on the survey, and to compare the resulting distributions for each course. This analysis is presented in Table 3, and as may be seen, it is not inconsistent with our prediction that computer programming will produce more cultural dropouts and fewer cultural recruits than other freshman courses will. By our count, over one-third of the students in computer programming were potential cultural dropouts in that they reported no academic success at all (i.e., none of the three items were checked as true). Only 8% of the students were potential cultural recruits who reported at least one academic success item as true and no anger or withdrawal. By contrast, the percentages of potential cultural recruits in other courses was much higher and, in those courses, potential recruits were a higher percentage than were potential dropouts.

Insert Table 3 about here.

PART TWO

Method

Twenty-five students were randomly selected from the 280-member freshman class of the liberal arts college and sent a letter inviting them to talk with us about their experience with computing. An appointment was arranged by telephone for an interview at a convenient time. This procedure yielded 23 interview subjects (two could not be found). Each interview, consisting of twenty-nine open-ended questions and lasting about half an hour, was conducted by one of three trained interviewers during two three-day periods in the spring of 1982. The questions (in addition to general background questions) centered on students' expectations about computing, their experiences with it, and their evaluation of it.[6] All interviews were tape recorded and tape transcriptions were entered into computer files for purposes of content analysis (Sproull and Sproull, 1982).

The data reported below are of two types: frequency data that suggest trends and direct quotations from students that illustrate the nature of those trends. Because of the open ended nature of many of the questions, it is not always appropriate to use the question as the unit of analysis in reporting frequencies; groups of questions, or even the interview as a whole, is sometimes the more appropriate unit. Unless otherwise noted, the quotations illustrate dominant or modal responses. At a minimum, the data demonstrate the existence of the phenomena we are interested in. More usefully, we believe, they can be viewed as a first step in specifying the determinants and consequences of the process of encountering an alien culture.

The Sample

The sample consisted of 13 males and 11 females. The two factors that predominated in their decision to come to this college were its general reputation (59%) and its liberal/professional and

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[6]For example: "Describe your first encounter with the computer [here]." "Where do (did) you do your computer work?" "Please describe some occasion when you felt especially proud (unusually discouraged) about something that happened to you in relation to the computer." (Copies of the full instruments used in this research are available from the authors.)

business majors (36%). Almost all of the students framed at least one of their principle objectives for this year in terms of grades (86%). But their stance toward grades was sharply differentiated: 54% said they want to "do well"; 41% said they want to "pass":

> I just wanted to pass. That's my major goal.!9

> My goal has been to get a 3.0 or above.O15[7]

An additional important objective is intellectual growth with 64% of the sample mentioning learning and discovering interests. Going into business (64%) or to professional school (34%) are the most prevalent post-graduation plans.

Half the students had some experience with computing before coming to the university; 36% had a course in high school. (This proportion is higher than that for the freshman class as a whole. The questionnaire revealed that only 25% of the class had had a high school computing course.) No student believed that his/her high school experience was directly relevant to computing at college; half of them acknowledged that it gave them some general familiarity.

Two-thirds of the sample (68%) took a computer science course (PASCAL) during their freshman year. (This compares with 77% for the freshman class as a whole.) Students who had taken a high school course were more likely to take computing during their freshman year than were those who had no previous course. Students whose academic goal was to do well were no more or less likely to take computing during their freshman year than were those whose goal was to pass. For students who took computing, this course was their first major encounter with computing. It figured heavily in all of their comments about computing, as we shall see below. All of the remaining students had at least some direct encounter with computing during the year as in, for example: using a document formatting program to prepare a change of address letter, participating in a psychology experiment in which stimulus materials were presented on a computer terminal, doing logic problems in their philosophy course, and testing hypotheses about the French Revolution in their history course.

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[7]Alphanumeric codes after quotations are student identifiers.

Prominent in student descriptions of their experiences were comments about how different computing is from other things they are used to and how it makes them feel out of control. These students did not dwell on how they attempted to regain control, but they did reveal some interesting lessons they learned as a result of their attempts.

Results

Describing their Experience. Four elements predominated in students' descriptions of their experiences with computing: time, the terminal room, actually working on the computer, and course-related factors such as lectures, homework, and exams. We view these perceptions as components of reality shock for these students.

Many students (68%) reported computing to be much more time-consuming than they had expected. They reported having to spend long hours at the computer center, often late at night, and having to schedule the rest of their life around the availability of computer time. As one student said,

> If a computer program is due that week, then the computer sign-up times range all over my entire schedule. I have to arrange everything else around that computer time. If I get computer time at 6:00, then I have to have everything else arranged around that. It just rearranges everything. If you work from 11:00 until 3:00 or from 1:00 until 2:00 or however you work, it arranges your time. It just totally re-does your schedule.P16

This student also believes that the time constraints are unique to computing. She continued,

> It's not like another class where you can take books someplace. You can't lift a terminal up and take it anywhere.P16

Another student explained that late at night is the only time for uninterrupted work.

> Last semester more than a couple times I got up at four o'clock to go to the computer room so you could get on the terminal and not be crowded out because there're so many people there.R18

Of the 8 students who did not find the time demands of computing remarkable, 4 had had no course experience with computing, 3 still acknowledged having to schedule around the computer, and 1 had a terminal in his room. As he said:

> It can't influence too much because I have the terminal in my room. Any time I feel like just sitting down and doing my homework, type it in, get it saved, I can do it like that. So it breaks up the monotony a lot, but I really don't have to schedule my time around it so much.H8

But this student is the exception. Late hours, long hours, and constrained scheduling characterize most students' encounters with computing and constitute one component of reality shock. The terminal room itself is a second component of reality shock. Most students (77%) find it somehow unpleasant, with the major complaints being about crowding and lack of privacy.

> There's so many people who want to use them. There're enough terminals but it's just that there's rush hours and you just can't get on at all and then it will crash during that time and it takes even longer because people will wait for it to come back up. Plus privacy. It's kind of crowded and you can't set your books down cause there's not enough space between terminals.I9

Another student (whose only encounter with computing was typing a letter on a terminal in the Computer Science department) said about the terminal room:

> I was surprised, really surprised at the people set up along the benches. There's no privacy. Where I was [in the Computer Science department], they had little stalls for each terminal. I thought that was a much better idea, just because I would think that working at a bench like that would be really distracting. It reminded me of a horse at a trough.X24

Four students had no complaints about the terminal room, but an equal number had extremely negative reactions. One student said:

> I feel like I'm in 1984, cells right next to each other. It's like Russia. You've got to just get as many people as you can, crammed in there....They're all white. And all they have are computer information on them. Maybe they could have a picture of Picasso. Anything just to break the monotony....All you see are computer geeks and computers and the xerox machines and white on the walls....Q17

Only 6 students had used a terminal anywhere other than the main terminal room. They all appreciated the quiet and privacy of terminal rooms in other campus buildings. One student occasionally worked in a fraternity house:

> I was there until 4 o'clock in the morning. It was nice because the guys....I had a little tape on. There weren't all these people around bugging you....It was just nice to be away from everything and everybody.K11

The terminal room, the place in which many of the encounters with computing occur, contributes to reality shock. Most of this contribution comes from what are perceived to be objectively unpleasant conditions (crowding, noise, lack of privacy). For a small number of students, the objective conditions also give rise to negative emotional reactions.

Working on the computer itself produces a third component of reality shock. A striking instance of

this is seen in how students described their first encounter with the computer at college. For example:

> I sat down at this computer and started hitting the buttons and it started making all this noise and people kept looking at me. I didn't know what I was doing. I didn't even know if it was on.C3

And another student said,

> And the first time it's like, "Wow, a computer! I've never used one of these before. I wonder how it works?....You didn't know what you were doing. I mean, you knew because the teacher told you what to do but you were just like, 'Oh, well, I type this, then I type that and I hope it works. Here goes....'R18

The fourth major component of student descriptions of their experiences with computing is course work--lectures, assignments, exams. During the fall semester computing course, students' final grade was based on a five-hour programming exam--the mastery exam--taken at the end of the semester. Although programming assignments were offered as homework, they were optional. During the spring semester, homework was mandatory and the mastery exam carried less weight.

Students' perceptions of the lectures had two features relevant to reality shock. The first had to do with their content; the second, with their relationship to homework and exams. A small number of students had expected the lectures would include more emphasis on the range of computer functions and applications. As one said:

> I did not expect I'd have to write out programs. I expected [to learn] here's how to use it to our advantage with economics and all sorts of fun courses like that.Q17

And another,

> I didn't think it was going to be something to learn how to program a computer. I thought it was going to be teaching us how to use the computer.P16

But more students were surprised that the lectures seemed to have very little to do with writing programs or the mastery exam.

> I think that the lectures really should be based more on the programs and more on the assumption that people really don't have that much experience yet. Because I know a lot of times the lecturers just kind of went off and nobody understood them.B2

Another student said,

> I get the feeling from my computing teacher that he's just telling me half the story. That's all he is telling me because when I get to the computer I still don't know what I'm doing, even after listening to him in class....He explains procedures and functions and major things but he doesn't show us how to write a program.L12

Apparently there is a common tension in introductory programming courses between the principles of programming and the specifics of any programming assignment; it is common for professors to want to teach general principles and for students to want to be taught specific techniques.[8] For the students in our sample, this tension manifests itself in beliefs that the lectures are irrelevant or not helpful. Three-quarters (73%) of the students who had taken or were taking a computing course evaluated the lectures negatively.

The fact that all (for fall semester) or a large part (for spring semester) of the student's final grade was based on a mastery exam was clearly an important way in which students were surprised by this course. Two-thirds (67%) of the students with course experience commented negatively on this feature of the course.

> That was the biggest change, when they told you everything was based on this one big final. All of a sudden, all of the pressure was on that one five hour test.M13

This student went on to contrast this feature with past experience.

> I don't think anyone in high school has experienced anything for five hours [except] the S.A.T. You have a five hour test and a final and a computer. I just wonder if that scared people off in the beginning.M13

Reactions to Their Experience. Students described several ways that they feel out of control in their encounters with computing. Seventy-seven percent of the students reported such an experience. One common catalyst is ignorance:

> It's frightening when everyone else is around you just typing in as fast as they can, and you don't even know what to do.E5

Another is system crashes:

> I was almost finished with a program and it crashed. I didn't have a save. I didn't put save on. I had to start over. It was heartbreaking.O15

And a third is experts whose "help" simply emphasizes these students' fragile positions:

> I was on the computer and something happened. I didn't know what was going on. I saw a guy sitting over there who looked like a real hacker. So I asked him, and he got up, and he started doing all of this stuff with my account without telling me what he was doing. He started messing around, 'You need this. Let's see, I'll give you this file.' It's like, what are you doing? He wouldn't tell me.W23

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[8]We are grateful for this observation to Rob Kling, Department of Computer Science, U.C. Irvine.

These experiences appear to be engendered in part by students' comparing themselves with others more expert than they and in part by feeling victimized by others as well as by the machine.

In attempting to gain control over their situation, all but one of the students who had taken computing experienced some success. One-third were proud of their performance on the mastery; two-thirds were proud of getting a program to run, often after a great deal of work.

> I was just euphoric. I was just...I was so glad. I remember that night I went running home and there were some kids in my room. I was just going crazy and they didn't know what for. It was probably just the most basic program, but I was just so psyched-up that I couldn't sit still.C3

Over half the students who hadn't yet taken a computing course also had found occasion for pride in an encounter with computing. The student who used text editing to type a letter thought it looked "very nice" (X24). One student took pride in logging in without help (N14). Another was proud of error free output in a history assignment:

> It took me 20 minutes one night not to do a program but to get data from a program and run it. It came right out with no errors. It was perfect. I thought I did a good job.O15

Students also found occasion for discouragement; 82% reported some discouragement. Of those who had taken computing, one-third mentioned their performance on the mastery; almost two-thirds mentioned difficulty with trying to get a program to run. Other students reported discouragement with system crashes and a screen that scrolled too rapidly. The most unusual discouraging experience was reported by a student who used a document preparation program named SCRIBE to produce his papers. His English professor told him not to use SCRIBE,

> ...because he had trouble reading SCRIBE. I mean that, the way it was typed, I mean just that it was so neat....He's used to the just regular typed hand work, where you expect mistakes. Like he's even got a, he had trouble reading SCRIBE.I9

On the whole, particularly for those students who took a computing course, the negative experiences outweighed the positive ones. The combination of long hours, an unpleasant terminal room, confusing interactions with the machine, seemingly irrelevant lectures, a difficult mastery exam, discouraging times, and feeling out of control was oppressive.

Cultural Learning. In the aftermath of reality shock, confusion, and control attempts, students

emerged having learned some cultural lessons. Newcomers commonly have a relatively undifferentiated view of a culture's social organization; these students were no exception. The students had only a rough idea of how the formal responsibility for computing on campus is managed. When asked to describe the major activities of the computation center, half the students had difficulty with the question. No single activity was mentioned by more than half the students. (Nine students said the computation center gives help; 5 said it maintains equipment; 3 said it writes programs.) Only two students distinguished between the computation center and the computer science department. One of these two, while admitting she had never thought of the computation center as an organization, was able to produce a helpful analogy for the computation center:

> I never thought of it as an organization. Well maybe downstairs [the machine room], like where the printout comes out, but upstairs [the terminal room] I just thought of it more like a library: a place where you use things that you can't use anywhere else. And they're there to help you with your classes. If you stretch it a little, you can think of the user consultant as a librarian, someone who advises you when you don't know what to do. But downstairs it's...My roommate used to work downstairs with the printouts. That's a whole different thing down there. That's where people work for the Computer Science Department.K11

Only one other student was able to provide an analogy for the computation center, an analogy of a very different sort:

> They have little gnomes and they sit down in the basement ...in bug hot rooms, like the devil, and mess around with students and put errors in their programs.J10

The students' perceptions of the social organization of computing at the university were dominated by a we/they distinction: there are people who are competent in and committed to computing and there is the rest of the world. From the students' perspectives, people who use the terminal room are divided into two categories: "we" who do not know what we are doing and "they" who do. "They" are also differentiated by special names, characteristics, and behaviors. Two-thirds (68%) of the students made this distinction in their comments.

Within this dichotomous view of the world, students made both positive and negative assessments of "them," although people making negative assessments outweighed those making positive ones five to one. Positively, "they" are viewed as very smart and competent:

> The amount of more intelligent people I've met down there....What I did on the computer seems so amazing to me....Then I thought that some of the people around me were doing

such more complicated things and how smart they must be.C3

Negatively, "they" are viewed as having strange personal habits and being very difficult to talk to.

> Some people just live and die with computers. They sleep there. They don't get any sleep because they sleep with computers....They can't relate to anything but the computer. They can't talk to a normal guy. Even when they talk, they talk computer language. It's like they've turned into a computer.Q17

A small number of students reported with pride occasions when they became "they" for their peers, i.e., times when they knew exactly what to do and were asked for help by their peers who were lost.

> My first program...it wasn't real tough, but everybody else was having trouble with it and I thought it was pretty easy. And I got to help everybody out so that's pretty good.L12

One student described how logging-in the first time was a little difficult but,

> I heard other people say they didn't even know they were supposed to control-C. They were just waiting for the computer to do something. I didn't have that problem.I9

In addition to learning the rudiments of role and subculture differentiation, students began to learn about the computer itself as a cultural artifact. This learning took the form of being able to use terminology properly, understanding that there are multiple computer functions and uses (and that this generality is valued), and not anthropomorphizing the computer. Employing terminology in their conversation is a sign of cultural learning. For example, one student, in describing an occasion that made him feel proud, said,

> I would say the first time I had a program actually work on the computer. It had taken some work to get through all the debugging. I call it debugging now. It's just correcting errors....A1

Some students demonstrated an understanding that there are multiple computer uses by distinguishing writing programs from using tools:

> It depends if I think about programming or if I think about using a computer. I don't like programming too much but when it comes to using a computer like the Minitab system that manipulates stuff for you, I like that kind of stuff where you use the computer to do stuff for you. But I don't like programming the computer to do the stuff.K11

Complexity in thinking about computers was, however, not typical of these students; only five students exhibited some sense of differentiated function in their comments about computers. Some students still anthropomorphized the machine. Five students said something like the following:

> I mean, sometimes I feel like the computer is out after me. You know, everybody gets that feeling that the computer's after them sometimes.Q17

Personal Outcomes. In forming their overall assessment of the effects of computers and computing, students distinguished between effects on themselves and effects on society. They are impressed with the capability and versatility of computers for society as a whole, believing they are the "wave of the future" (J10). But they were less positive about the effects of computers on themselves personally. In assessing the effects of the computer on their activities as students, 13 students listed more negative effects, 6 students listed more positive effects, 2 students listed equal numbers of positive and negative effects. One student who characterized the entire experience as "a fight," exemplifies an outcome of anger.

> The whole fact that you have to fight to get on, you--the whole computer theory, everything about computing here is a fight to do it. It's something you don't want to do and you have to fight to get in there to do it. And you have to fight to sit down and do it. And you have to fight the system to stay up. And you have to fight your program to make it work. And the whole time you're fighting the clock.J10

Another student, exemplifying withdrawal, said:

> Looking back, I'm really not afraid of computers, but I'm going to try to stay away from computers. I know I shouldn't, because it's probably the thing of the future. But I'm really kind of leery to get into any type of computing again.C3

This student of course does not speak for all freshmen. An opposite, but less common, view was offered by another student, who exemplifies success in her willingness for further socialization. When she learned that she would have to do a history assignment on the computer the semester following her computing course, she said,

> I was glad that we were doing it on the computer. I don't know why. I just thought, 'Oh neat, we get to use the computer again.'K11

DISCUSSION

We speculated that novice encounters with computing could be interpreted through considering computing as culture rather than simply as tool. In a series of open-ended interviews novices revealed reactions to computing which seem to have been influenced in part by the social order surrounding computing: by the attitudes and behaviors of people who are good at it, by the management of computing resources, and by the general perceived importance of computing in

society and the organization. They also revealed different ways of trying to cope with the strangeness of computing, each associated with more or less success. We believe these interviews reveal reasons for the differences found in the first part of our study. There is nothing in the way electrons flow, operating systems work, or PASCAL procedures are written that explains the reactions to computing and computer science courses we discovered. We believe they are explained, instead, by novice attempts to operate in and make sense of an alien culture.

The data are limited to one organization, one group of novices, and one point in time. Obvious next steps include investigating other kinds of novices in the same setting, for example, new secretaries; other responses, for example, observed changes in work performance; other settings, such as industrial and commercial organizations. Systematic work is lacking in these areas. There is some evidence that novices experience disaffection with computing in work organizations (Zuboff, 1982), but there has been no investigation from a cultural perspective. If a cultural perspective has merit, then research should be carried out to discover how reality shock and confusion may be altered in degree and kind within particular organizational settings.

It is not clear, of course, that all organizations prefer to minimize stress for novices or even to produce high percentages of cultural recruits. Some successful organizations have high turnover among newcomers; some use turnover as a way of selecting or reinforcing desirable organizational skills, beliefs or values. On the other hand, many organizations, especially educational institutions, place a high value on positive newcomer socialization. Organizations which introduce computers for purely instrumental purposes would probably also value positive socialization. For both of these kinds of organizations, our data suggest some starting points for research on how to introduce novices to an aspect of organizational life that is both culturally and technologically strange. One might investigate ways to reduce novices' initial information overload by, for example, experimenting with beginner's documentation and providing mental models for the technology and the social organization. Although there is some controversy about the usefulness of analogies and simple models in helping people learn about computing (Foss, Rosson, and Smith, 1982; Halasz and Moran,

1982), they may be functional for the newcomer to this world. They might reduce feelings of intellectual helplessness and reduce misattention to distracting symptoms by providing simple explanations of common computer behavior. Another is intervening in the expert status hierarchy to create norms for helping novices. Our data suggest that, not only are such norms lacking (e.g., teachers' lectures unrelated to student task requirements; infrequency of help reported given by user consultants), but that some experts see novice failure as a way of affirming their superior standards (one sees this in, for instance, the hacker dictionary). There are better ways to achieve respect and differentiation in the culture. There is a difference between the difficulty of intellectual labor required to learn and the "stupidity" novices find in incomprehensible tasks. The first teaches respect for disciplined thinking whereas the second teaches helplessness and intransigence.

People who know how rapidly computing technology is changing may claim that this research studies a non-problem in that soon the particular artifacts present in our study will be replaced by different computer systems. It is true that computer systems are always changing, but that things will get better does not relieve us of the responsibility to understand them as they are today. This is not to deny that computers may serve long-term educational and organizational goals. The point is that whatever computer systems we happen to have now do result in short-run problems and it is precisely about the short run that organizations express concern. Indeed the questions that we ask about culture, socialization, and control are independent of any particular computer system and are more tied to particular organizational settings.

How does the concept of culture illuminate the analysis of what others characterize as a technical, instructional, or individual problem? First, it calls attention to the social order surrounding any technology and suggests that this is the source of much variation in how people respond to the technology within any organizational setting. For example, if one were to analyze the introduction of other new technologies--perhaps quality circles or robots today or PPBS in the late sixties--one should consider how the mass media, experts, and those who make a living selling such tools contribute to the ways managers organize initial novice encounters with them. A cultural analysis

also explains the importance of symbolic and physical aspects of organizational life--such as language, stories, heroes, time, and space--that are often ignored in other analyses. In our model, cultural symbols and cultural aspects of the physical setting contribute to the encountering process, to reality shock and control attempts. Thus they are not just signals of culture but they are determinants of novice reactions to the culture. This point might be made also about professional socialization (Becker et al., 1961; Davis, 1968). Initial cultural encounters can turn people who are not already committed to a profession into recruits or dropouts. And cultural "carriers" such as experts can serve to indoctrinate or to confuse the innocent and keep out petitioners. Probably the major shortcoming of a cultural perspective is that the concept is diffuse. It is not yet possible to specify, for example, how big a dose is required to constitute a real cultural encounter. In the case of the work reported in this paper, seven months inside an organization which values computing highly and a required course were certainly sufficient. But they are sufficient on empirical, not theoretical, grounds.

It is not clear why an organization which places a high value on computing would not take steps to counteract its alien aspects. A certain utopian blindness to problems may be in the nature of rapid technological change. Suppose organizational proponents of change bring both the technology and its culture into the organization with enthusiasm. If their points of view are held tenaciously, facts (such as difficulties in using or learning the technology) will serve chiefly as stepping stones for more elaborate rationalizations (Boguslaw, 1965:60-64). An alternative explanation is that most of the proponents are managers who lack complex understanding of the technology. This inadequate mental context leads to an uncritical attitude and an inability to integrate the technology with other organizational values. Thirdly, insufficient attention may be paid to the plight of new recruits because resources are limited; devoting resources to neophytes would not be conducive to attaining more important objectives, such as cultivating the "expert" subculture of computer professionals and scientists. More generally, computing resources and support mechanisms would be expected to serve the best-established interests in the organization rather than the interests of newcomers and others with small power (Danziger et al., 1982:221-232). Any or all of these three critical situations--

fixed organizational beliefs, lack of information, and intentional neglect--furnish the conditions for organizational unresponsiveness to alien aspects of the computing culture.

This work highlights a nice irony in the case of the one organization we studied. This organization values computing quite highly. But in their enthusiasm for computing, its managers and experts have created situations in which it is hard for novices to be enthusiastic. Like the overzealous tour guide who forces his charges to climb endless sets of steps for the perfect view, to eat sheep's eyeballs for the perfect culinary experience, and to sit through a five-hour native poetry reading, this organization may be producing more cultural dropouts than recruits.

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Figure 1. ENTRIES FROM THE HACKER DICTIONARY

- CHOMP: v. To lose; to chew on something of which more was bitten off than one can. Probably related to gnashing of teeth. See BAGBITER. A hand gesture commonly accompanies this, consisting of the four fingers held together as if in a mitten or hand puppet, and the fingers and thumb open and close rapidly to illustrate a biting action. The gesture alone means CHOMP CHOMP (see Verb Doubling).

- CROCK: n. An awkward feature or programming technique that ought to be made cleaner. Example: to use small integers to represent error codes without the program interpreting them to the user is a crock.

- FLAME: 1. v. To speak incessantly and/or rabidly on some relatively uninteresting subject or with a patently ridiculous attitude.

- HACKER: Originally, someone who makes furniture with an axe. 1. n. A person who is good at programming quickly. Not everything a hacker produces is a hack. 2. An expert at a particular program, example: "A SAIL hacker". 3. A malicious or inquisitive meddler who tries to discover information by poking around. Hence "keyword hacker," "network hacker."

- PHASE: (of people) n. The phase of one's waking-sleeping schedule with respect to the standard 24-hour cycle. This is a useful concept among people who often work at night according to no fixed schedule. It is not uncommon to change one's phase by as much as six hours/day on a regular basis. "What's your phase?" "I've been getting in about 8 PM lately, but I'm going to work around to the day schedule by Friday."

- USER: Basically, there are two classes of people who work with a program: there are implementors (hackers) and users (losers). The users are looked down on by hackers to a mild degree because they don't understand the full ramifications of the system in all its glory. (A few users who do are known as real winners.) It is true that users ask questions (of necessity). Very often they are annoying or downright stupid.

Figure 2. MODEL OF CULTURAL ENCOUNTER

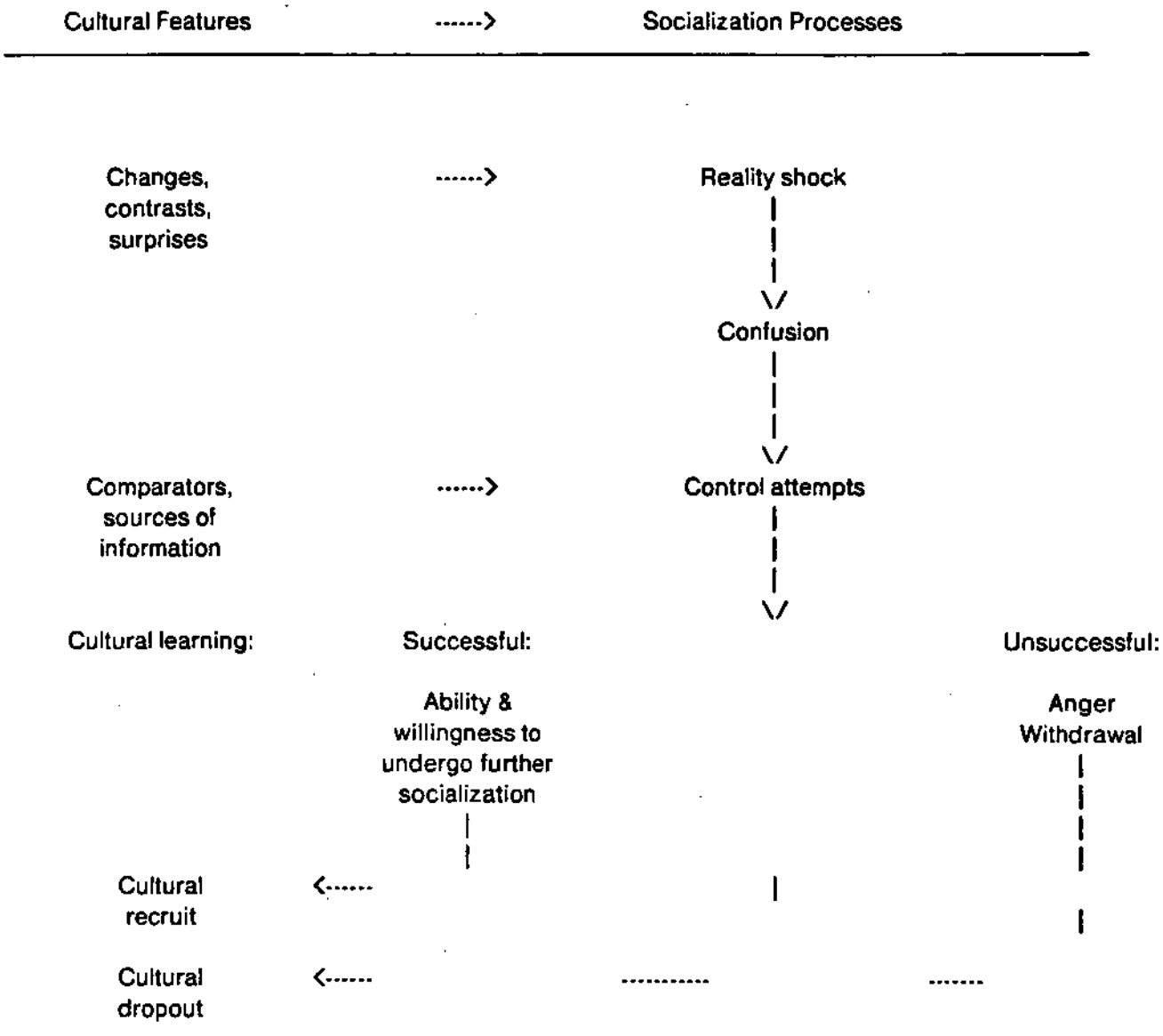

Table 1.
PERCENTAGE OF STUDENTS ANSWERING "TRUE OR VERY TRUE"
TO QUESTIONNAIRE ITEMS, BY COURSE

Questions about Socialization Processes	My English Course	My Social Science Course	My Mathematics Course	My Computer Science Course
Reality Shock				
This course:				
Takes more time than I expected	28	19	17	78
Very different from other courses	22	40	19	82
My work habits in the course are very different	20	23	23	76
Confusion				
I feel I don't know what I am doing	11	8	20	59
I worry that I might look foolish	9	4	6	20
The course has a clear division of tasks	44	65	48	44
I feel like a different person when I am in class	14	11	12	24
I feel overwhelmed by the work	23	13	17	76
Control Attempts:				
Talking to People				
I talk to friends about this course	68	66	61	87
I talk to my instructor	60	33	28	59
I talk to students who took the course in the past	38	45	41	70
I talk to other faculty about this course	9	5	9	21
I have talked to a counselor about this course	17	10	17	43
Class members help one another	32	52	57	71
Constructive Attribution				
I am highly motivated	29	28	29	24
I really want to understand	64	68	78	65
When I do (did) well it is (was) because I worked hard	72	69	65	72
When I do (did) well it is (was) because I had good ability	57	47	59	30
When I do (did) well it is (was) because the instructor was good	42	50	34	16
When I do (did) poorly it is (was) because I didn't work hard	52	50	51	44
Unconstructive Attribution				
When I do (did) well it is (was) because I had good luck	32	27	27	41
When I do (did) well it is (was) because the task was easy	26	30	40	27
When I do (did) poorly it is (was) because poor ability	18	13	24	37

Outcomes:				
Academic Success				
My performance is better than I expected	19	15	27	21
I am learning valuable skills	36	44	46	50
I am acquiring knowledge	66	77	71	56
Anger				
I get the feeling my instructors don't know what they're doing	16	11	33	59
This course makes me angry	27	15	28	72
I complain	40	25	40	79
Withdrawal				
I want to do just enough to get by	16	10	16	41

Note. Repeated measures (Courses X Items) analyses of variance were performed on these data. All course main effects were significant at $p = .05$ or better (F's ranged from 3.6 to 123, *df*'s = 3 and 276 to 312). Degrees of freedom varied because subjects who did not answer an item for four courses were dropped. A few course by item interactions were significant. We assume this to mean that some items discriminated among courses better than others, an essentially trivial finding.

Table 2. COMPARISONS OF COMPUTING WITH MATHEMATICS AND WITH OTHER COURSES

	t	*df*
	Reality Shock	
Computing vs. Mathematics	15.60	114
Computing vs. Other Courses	16.03	101
	Confusion	
Computing vs. Mathematics	9.44	113
Computing vs. Other Courses	9.49	100
	Talking to People	
Computing vs. Mathematics	10.31	115
Computing vs. Other Courses	10.46	102
	Constructive Attribution	
Computing vs. Mathematics	-3.60	105
Computing vs. Other Courses	-2.28	92
	Unconstructive Attribution	
Computing vs. Mathematics	1.30	104
Computing vs. Other Courses	2.66	92
	Academic Success	
Computing vs. Mathematics	-1.10	113
Computing vs. Other Courses	.23	100
	Anger	
Computing vs. Mathematics	10.43	111
Computing vs. Other Courses	12.62	99
	Withdrawal	
Computing vs. Mathematics	4.95	117
Computing vs. Other Courses	4.61	104

Note. The above statistical *t* tests were performed on the data presented in Table 1. For example, the first row shows that, for the three Reality Shock items, the mean frequency of "true or very true" answers was greater when students evaluated their computer science course than when they evaluated their mathematics course. In the second row, "Other Courses" refers to the mean frequency of "true or very true" answers for English, Social Science and Mathematics. The critical value for this table is 2.10 (α=.05, k=4, *df* 60) based on the adjustment recommended by Winer (1971, p 202) for a set of comparisons sharing a common treatment (hence correlated responses).

Table 3.
CLASSIFICATION OF STUDENTS ACCORDING TO QUESTIONNAIRE RESPONSES

Courses:	Potential Dropouts: No academic success items reported	Mixed Case: One or more success, and anger/withdrawal, items reported	Potential Recruits: One or more success, and no anger/withdrawal, items reported
English	28.3%	34.0%	37.7%
Social Science	20.7%	24.5%	54.9%
Mathematics	24.3%	40.1%	35.5%
Computer Science	35.1%	56.8%	8.1%

APPENDIX 1: RELATIONSHIP OF EACH ITEM WITHIN A CONCEPTUAL FACTOR TO ALL OTHER ITEMS WITHIN THE FACTOR

FACTORS AND ITEMS	CORRELATION OF THIS ITEM WITH SUM OF OTHER ITEMS IN THE FACTOR
REALITY SHOCK	
Takes more time than I expected	.16
Very different from other courses	.35
My work habits in the course are very different	.37
CONFUSION	
I feel I don't know what I am doing	.19
I worry that I might look foolish	.26
The course has a clear division of tasks	-.20
I feel like a different person when I am in class	.14
I feel overwhelmed by the work	.37
CONTROL ATTEMPTS: TALKING TO OTHERS	
I talk to friends about this course	.29
I talk to my instructor	.25
I talk to students who took the course in the past	44
I talk to other faculty about this course	31
I have talked to a counselor about this course	26
Class members help one another	.27
CONSTRUCTIVE ATTRIBUTION	
I am highly motivated	.08
I really want to understand	.22
When I do (did) well it is (was) because I worked hard	.17
When I do (did) well it is (was) because I had good ability	.16
When I do (did) well it is (was) because the instructor was good	.21
When I do (did) poorly it is (was) because I didn't work hard	.12
UNCONSTRUCTIVE ATTRIBUTION	
When I do (did) well it is (was) because I had good luck	.26
When I do (did) well it is (was) because the task was easy	.18
When I do (did) poorly it is (was) because poor ability	.18

OUTCOMES:	
ACADEMIC SUCCESS:	
My performance is better than I expected	.17
I am learning valuable skills	.49
I am acquiring knowledge	.57
ANGER	
I get the feeling my instructors don't know what they're doing	.28
This course makes me angry	.38
I complain	.43
WITHDRAWAL	
I want to do just enough to get by	------
OTHER ITEMS	
I feel close to others in the course	
Quantity is more important than quality	
Others don't know how hard I work	
When I do (did) poorly, the task was difficult	
When I do (did) poorly, I had bad luck.	

APPENDIX 2. ANALYSES OF VARIANCE OF RESPONSES TO DIFFERENT COURSES: SIGNIFICANT EFFECTS

Component	Main Effect, Course	Main Effect, Item	Interaction, Course X Item
Reality Shock (3 items)	F=123.3 df=3,303	F=2.3 df=2,202	F=4.5 df=6,606
Confusion (5 items)	F=58.1 df=3,300	F=51.5 df=4,400	F=40.1 df=12,1200
Behavioral Control (6 items)	F=53.7 df=3,306	F=50.9 df=5,510	F=33.6 df=15,1530
Constr. Cogn. Control (6 items)	F=3.8 df=3,276	F=35.1 df=5,460	F=4.8 df=15,1380
Unstruc. Cogn. Control (3 items)	F=5.0 df=3, 276	F=4.2 df=2,184	F=4.2 df=6,552
Academic Success (3 items)	F=3.6 df=3, 300	F=104.8 df=2,200	F=5.8 df=6,600
Anger (3 items)	F=66.2 df=3,297	F=13.4 df=2,198	F=4.2 df=6,594
Withdrawal (1 item)	F=13.4 df=3,312	--------	--------