

LIBRARY
OF THE
MASSACHUSETTS INSTITUTE
OF TECHNOLOGY

JAN 9

LIBRARY

WORKING PAPER
ALFRED P. SLOAN SCHOOL OF MANAGEMENT

COGNITIVE CHARACTERISTICS AND
THE PERCEIVED IMPORTANCE OF INFORMATION

Jerry Dermer

618-72

October, 1972

MASSACHUSETTS
INSTITUTE OF TECHNOLOGY
50 MEMORIAL DRIVE
CAMBRIDGE, MASSACHUSETTS 02139



MASS. INST. TECH.
DEC 7 1972
DEWEY LIBRARY

COGNITIVE CHARACTERISTICS AND
THE PERCEIVED IMPORTANCE OF INFORMATION

Jerry Dermer

618-72

October, 1972

100-2
100-2
100-2

RECEIVED
JAN 9 1973
M. I. T. LIBRARIES

Recently, several accounting studies have made use of concepts and relationships from the field of cognitive psychology. For example, Ijiri, Jaedicke and Knight employed the notion of functional fixation to describe an individual's adaptiveness to a change in accounting process.¹ Similarly, Livingstone referred to learning sets in explaining why some utilities were slow in adjusting to accounting changes.² In addition, Revsine employed the conceptual abstractness construct to speculate on its possible moderating effects in an experimental situation,³ and on its significance with respect to information overload.⁴ Yet, despite this interest in relationships between cognitive factors and information usage, little empirical study has been done of the role that cognitive factors may play in accounting.

Of particular interest to accountants is the possibility that the cognitive characteristics of an information user may affect his perception of what information is important and hence, may affect how information influences his ultimate behavior. There is considerable support in the psychological literature on human information processing for the existence of such relationships. For example, Schroder et al⁵ cited three studies of game playing by teams whose members differ in their level of conceptual abstractness. Driver⁶ related the source of the information used in playing a game to the conceptual structures of the team members and found that cognitively simpler subjects relied more heavily on information handed down by an external authority. Similarly, Terhune and Kennedy⁷ reported that teams whose members were complex showed more reliance on conceptual information than did simple subjects who preferred concrete

data. Tuckman⁸ investigated the amount of information used and found that conceptually complex groups were more likely to seek out information which was not immediately available in their environment than were simple groups. Consistent with this result is the finding of Long and Ziller⁹ that an open-minded, non-dogmatic person is likely to seek more information than a dogmatic person. Based on these results, it appears that information usage is an idiosyncratic or subjectively determined process and that relationships do exist between an individual's cognitive makeup and the amount and type of the information he perceives to be relevant. Thus these relationships are of potential significance to accounting researchers. However, because much of the psychological research on information processing has been performed in the laboratory, in a non-administrative context, and using students as subjects, the applicability of these results to the situations accountants are concerned with is subject to question.

This paper describes a field study in which the applicability of some of these findings to the administrative information system domain was investigated. The objective of the study was to determine if the cognitive characteristics of a manager affect his perceptions of what information is important to performing his job role.¹⁰

Intolerance of Ambiguity

The cognitive characteristic selected for investigation in this study was the level of an individual's intolerance of ambiguity.¹¹ Its

selection was motivated by the fact that it is conceptually related to both dogmatism and integrative complexity,¹² which were the cognitive variables employed in the psychological studies of information processing cited above, and also is a variable of potential significance to accountants in its own right.

Ambiguity is defined as uncertainty of meaning and ambiguous situations are those which cannot be adequately structured or categorized by an individual.¹³ Situations which are completely new, give rise to many cues, or which possess contradictory cues are categorized as being ambiguous. Intolerance of ambiguity is an implied need to avoid undefined or misinterpretable stimuli. Thus, individuals intolerant of ambiguity perceive ambiguous situations as a source of threat and behave in a manner to reduce this threat. Although intolerance of ambiguity has been associated with cognitive rigidity, the two can be distinguished. Rigidity is a structural characteristic of the individual which manifests itself in certain modes of response irrespective of the phenomenon being dealt with. Intolerance of ambiguity, on the other hand, is believed to be a content characteristic which manifests itself in the way particular phenomena are evaluated.¹⁴

An individual must evaluate information in order to cope with and adapt to his environment.¹⁵ His orientation or predisposition to the ambiguity in the environment may affect how he evaluates this information. One way the level of ambiguity tolerance may differentiate individuals is in the amount of information they prefer. Those intolerant of ambiguity, being more troubled by inconsistency than their ambiguity-tolerant counterparts, may attempt to resolve ambiguous situations by collecting more

information. A familiar example of this is the student who is continually seeking more details about his assignment requirements. Another way individuals intolerant of ambiguity attempt to reduce the threats inherent in ambiguous situations by manifesting a preference for readily interpretable stimuli. Thus, when evaluating the importance of information, they may tend to judge factual data (e.g., expressed by numbers) to be more important than abstract or conceptual data. A common example of this is the student who insists on a mark rather than a qualitative evaluation. Thus the predisposition of an individual toward ambiguous situations, i.e., his level of ambiguity tolerance, may be a determinant of the amount and type of information he perceives to be important. To test this possibility the following hypotheses are advanced.

HYPOTHESES

H-1 Ambiguous situations are those characterized by insufficient cues and an individual intolerant of ambiguity will behave in a manner to reduce the threat of such situations. The amount of information available to an individual can be assumed to be indicative of the number of cues present. Thus, individuals intolerant of ambiguity will tend to prefer more information than those tolerant of ambiguity.

H-2 Individuals intolerant of ambiguity manifest a preference for readily interpretable stimuli. Thus, individual intolerant of ambiguity will tend to judge as important information which is well defined, familiar and certain.

METHOD

Subjects

Subjects were sales supervisors, district sales managers, and regional sales managers of a large integrated oil company who were selected because of their familiarity with one of the two district sales managers jobs used as focal roles in this experiment. In all, 44 subjects with a mean age of 40.0 years participated, exactly half of whom were university graduates.

Instruments and Design

In preliminary consultations with a representative sample of sales managers in each of the two jobs, a number of aspects related to their jobs were discussed and recorded. These included, for example, next year's advertising budget, current office space requirements, customer attitudes to sales promotions, and last year's gallonage. Each of these aspects was then classified according to each of three schemes which have proved helpful in understanding information systems. These classifications were: 1) according to whether the aspect was under the direct control of the company or whether it was external to the company and hence only indirectly controllable. These categories were termed internal and external; 2) according to whether the item was measurable in financial terms, that is, in terms of dollars; in behavioral terms which apply to aspects such as attitudes, motivation, job satisfaction, customer satisfaction, etc.; or in operational terms, that is, in terms of other units such as pounds, feet, gallons, or in terms of qualitative judgements such as cleanliness; 3) according to a time dimension

depending on whether the time of the item pertained to the future or involved either current or past events.

Since each aspect was classified according to scope, type of measurement and time dimension, there were twelve possible classifications for each item. For example, an item could be external, financial and current (e.g., recent consumer expenditures on gasoline) or internal, behavioral and future (e.g., anticipated motivation of salesmen), etc. For each of the 12 categories, 6 job aspects were selected yielding a total of 72 items. The items were modified until they could be classified by three managers not participating in the study according to the above scheme with a 95% accuracy.

The items were printed on 1-1/2" x 2-1/2" cards which were numbered randomly and a deck of these cards was used in the experiment as follows. Subjects were presented with the deck and a questionnaire in which to record their results. One page of the questionnaire had a diagram of a nine column, normal shaped histogram marked off into 72 equal squares (see Figure 1). Subjects were instructed to look through the deck thoroughly and then to sort the cards into a distribution identical to that in the diagram using as the criterion the importance of the items to them, assuming that they were required to perform the manager's job and would perform it as they believe it should be performed. When the sort was completed, the subjects recorded their sorts on the diagram to ensure that the required distribution was generated. Subjects were then asked how many of the 72 items of information they considered to be of little importance to the manager and to record this number.

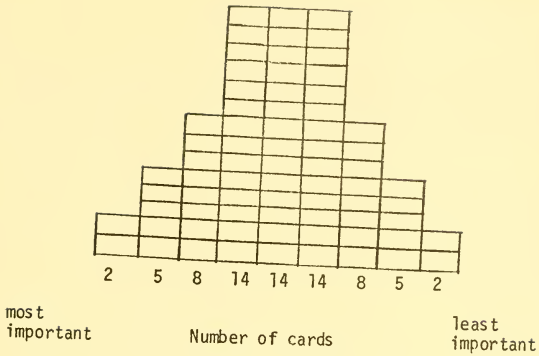


Figure 1 Required Distribution of Cards
(not actual scale used)

FIGURE 1 ABOUT HERE

A second questionnaire containing a battery of cognitive tests was then administered.¹⁶ The intolerance of ambiguity measure was one of these cognitive tests.

Because of the geographical dispersion of the subjects involved, the procedure was designed to be as self-checking as possible and was completed without the experimenter present. Only one of the subjects contacted improperly completed the procedure.

Intolerance of Ambiguity

The questionnaire developed by Budner¹⁷ was used. This consists of sixteen statements involving three kinds of ambiguity (i.e., situations characterized by novelty, complexity, or insolubility), and four kinds of possible responses (repression and denial, anxiety and discomfort, destructive behavior, and avoidance behavior). Typical statements are: "I would like to live in a foreign country for a while"; "There is really no such thing as a problem that can't be solved"; "A good teacher is one that makes you wonder about your way of looking at things." Scoring is accomplished by using a 7 point scale, assigning seven to a strong agreement, one to a strong disagreement, and so on, and then adding across all items. Negatively worded statements, of which there are eight, are scored in the reverse direction. A high score on this measure is interpreted to mean that ambiguous situations are threatening. The scale has been shown to be free of such problems as acquiescence and social desirability and its results have been validated through cor-

relation with other intolerance of ambiguity scales, rankings of individuals on the basis of short autobiographies and peer ratings. The reliability of the scale is .85 (test-retest) and .60 (Cronbach's alpha).¹⁸

RESULTS

The 72 items sorted by each subject were scored from 9 to 1 in order of importance, the most important items receiving a score of 9. Thus, if a card was placed in the extreme left-hand column of the histogram by a respondent, it would receive a score of 9; if placed in the extreme right-hand column a score of one. These data were then used to test the hypotheses as follows:

H-1: Intolerance of ambiguity and the amount of information perceived to be important.

This hypothesis was tested by correlating the number of items a subject believed to be unimportant with the intolerance of ambiguity measure. The correlation is $-.33$ which is significant at the $p < .05$ level. The hypothesis is supported.

H-2: Intolerance of ambiguity and the types of information perceived to be important.

This hypothesis was tested by first computing a summed score for the 36 elements classified as future, for the 36 classified as external, for the 24 classified as financial, and for the 24 classified as behavioral, and then correlating each summed score with the intolerance of ambiguity measure. These results are presented in Table I.

Table I
Correlation of Importance of Information
With Ambiguity Tolerance
n = 44

Type of Information

| | |
|---------------------------------|-------|
| Future | -.27+ |
| External | .06 |
| Financial | .05 |
| Behavioral | -.25+ |
| Current Internal Non Behavioral | .31* |
| Internal Behavioral | -.32* |
| Current Internal Financial | .27+ |

+ $p < .10$

* $p < .05$

TABLE I ABOUT HERE

As is seen from Table 1, the correlation of intolerance of ambiguity with the future and with the behavioral data are both in the direction expected, i.e., negative, and are significant at a probability $< .10$. The external and financial classifications, however, do not correlate significantly with the ambiguity measure. H-2 is thus only partially supported.

To further test the significance of differences in importance, scores were computed for classifications termed current internal non-behavioral, made up of current internal financial and current internal operational, and internal behavioral, made up of current internal behavioral and future internal behavioral. The correlation of these two summed scores and of current internal financial information with the intolerance of ambiguity measure is also presented in Table I. As is expected, the current internal non-behavioral information and the internal behavioral information correlate with the ambiguity measure in the directions expected and are significant at the probability $< .05$ level. The correlation of the current internal financial classification with ambiguity is significant at the $p < .10$ level. These results are interpreted as indicating further support for H-2.

DISCUSSION

One of the strongest relationships found in this study was the negative correlation between ambiguity tolerance and the amount of information perceived to be important. This relationship is of interest

in two respects. First, one part of the research by Schroder et al¹⁹ into how environmental complexity affects information processing relates to the effects of information input load. Hypotheses were advanced and tested leading up to a theory that information processing efficiency rises as input load increases, reaches a maximum and then declines as input loads become excessive, i.e., an inverted U-shaped function. Schroder et al have thus established that there exists a specific level of input load at which information processing is optimal.

One aspect of Schroder et al's studies related to the amount of information requested by teams playing a game. The researchers found some evidence that as information input was increased up to and beyond the optimal point, conceptually concrete subjects indicated that they preferred more information than did conceptually abstract ones. However, both groups, in fact, wanted more information and it was only beyond the optimal processing point that the amount of information desired by the concrete subjects was found to be significantly greater than that wanted by the abstract subjects. The correlation between amounts of information preferred and ambiguity tolerance found in this study can be interpreted as further support for the hypothesis that conceptually concrete individuals prefer more information than do more abstract ones.²¹ However, while Schroder et al attribute their finding to the fact that concrete individuals are less sensitive to or aware of detrimental increases in load,²² the explanation offered here is based on their intolerance of ambiguity.

The findings of Schroder et al and the results of this study,

however, are inconsistent with those reported by Tuckman²³ and by Long and Ziller.²⁴ It is possible that Tuckman's finding that conceptually abstract individuals seek out more information relates more to their preferences for particular kinds of information rather than to the amount of information preferred. This study provides no support for this speculation, however, because the relationship between the amount and kinds of information preferred was not investigated. The conflicting results of Long and Ziller (that the non-dogmatic individual prefers more information) can be interpreted to indicate that job related information impinges little on an administrative decision-maker's belief system and thus is not related to dogmatism. This interpretation is supported by the finding that cognitive functioning differs in different domains.²⁵ Long and Ziller attribute their result to the fact that a dogmatic person is likely to protect the information he already has in order to maintain his belief system. However, it is possible that if additional information is confirming rather than discrepant, dogmatic individuals may tend to request more information.²⁶ But only further empirical tests will resolve these issues. Such inconsistencies, however, indicate that the relationship between conceptual abstractness and the amount of information preferred is not independent of the characteristics of the information involved or of the context in which it is to be used. Therefore they should serve to caution against the unqualified application of psychological findings in accounting contexts.

The second interesting aspect of this result is that it focuses attention on the need to establish the relationship between the amount of information preferred and the amount at which an individual functions

best. Schroder et al's research suggests that the optimal level of processing occurs at identical input loads for both concrete and abstract individuals.²⁷ However, their results and the results of this study indicate that if asked how much information they prefer, these two types of individuals would respond differently. Thus these studies reveal that not only do concrete and abstract individuals prefer more information than they can process optimally but that the two also differ in the amounts of information they prefer.²⁸ This indicates that further study is required to determine the exact relationships among cognitive characteristics of information users, the amount of information they prefer and the amount of information they require to maximize performance²⁹ and that this is a research area worthy of the attention of accounting researchers.

As far as the relationship between an individual's level of ambiguity tolerance and the types of information he perceives to be important is concerned, the results of greatest interest to accountants relate to financial information. It was found that individual intolerant of ambiguity do rate current internal financial information higher in importance ($p < .10$). With respect to information of a financial character in general, however, there does not appear to be a significant biasing effect. Similarly, there are no differential effects of ambiguity tolerance on the perceived importance of information classified as external to the control of the firm. However, as expected, it does appear that the uncertainty or misinterpretability inherent in future ($p < .10$) and behavioral ($p < .10$) data does differentially affect the importance attached to these types of information. Classifying these data more specifically, the avoidance of ambiguous information is further indicated by the higher rating attached to current internal non-behavioral

($p < .05$) and the lower rating of internal behavioral ($p < .05$) information.

Since information of a general financial character did not correlate significantly with intolerance of ambiguity, it appears that the latter does not affect the perceived importance of financial data in general. The significantly higher rating of current internal financial information thus appeared to be due primarily to the other dimensions of this classification, rather than its financial character.

The results of this study thus indicate that accounting studies examining the effects that alternative types of information provision have on decision making behavior can be influenced by the cognitive characteristics of the participants. In particular, it appears that different levels of importance may be attached to information solely because it relates to a future as opposed to a current period or to behavioral as opposed to non-behavioral aspects of operations. Therefore, if the effects of variations in accounting variables are to be isolated, care must be taken to avoid confounding these with the effects of individual differences.

These results also indicate that the utility of a particular type of information cannot be effectively evaluated apart from the users of that information. There may be little point in providing financial forecast data or human resource accounting data to administrators whose cognitive makeup is such that they will tend to ignore it. This does not mean that the information may not be of use to others, however, just

that it may not be of use to these particular individuals. It is to the accountant's advantage to be able to recognize this before he designs an information system. Studies such as this one can provide him a basis for so doing.

While this study has demonstrated that individual differences do affect perceptions of information importance, it has not, however, indicated how significant such differences are. For example, do these effects only influence judgements of information importance when two types of information are otherwise equivalent? Or, if one type of information is "in reality" more important to a particular goal, are individual difference effects still of significant strength to cause judgements to be biased. In addition, little is known of the distribution of the level of ambiguity tolerance in a population of information users and hence if the variation among them is significant. Thus, while this paper has provided some evidence useful in deciding how significant the cognitive characteristics of users of information can be, it is clear the subject warrants further study.

SUMMARY

The objective of this study was to determine if an individual's intolerance of ambiguity affected the amount and type of information he perceives to be important in performing his job. Forty-four sales managers from a large integrated petroleum company participated in the study. Data were collected by having the subjects sort 72 items of information according to importance and then complete a questionnaire

containing a measure of intolerance of ambiguity.

It was found that individuals intolerant of ambiguity indicate a preference for more information, and information to which more certainty can be attached than do their ambiguity tolerant colleagues. Based on these results, it appears that the intolerance of ambiguity trait should be considered by accounting researchers in studies where a time dimension differentiates the information provided or behavioral data are included. The study also indicates the need to examine the relationship between the amount of information preferred by an individual and the amount at which his processing of information is optimized.

FOOTNOTES AND REFERENCES

1. Y. Ijiri, R.K. Jaedicke and K.E. Knight, "The Effects of Accounting Alternatives on Management Decisions," in R.K. Jaedicke, Y. Ijiri and O. Nelson (Eds.), Research in Accounting Measurement, American Accounting Association, 1966, pp. 186-199.
2. J. L. Livingstone, "A Behavioral Study of Tax Allocation in Electric Utility Regulation," The Accounting Review, Vol. 42, No. 3, July 1967, pp. 544-552.
3. Lawrence Revsine, "Change in Budgetary Pressure and Its Impact on Supervisory Behavior: Comment," Journal of Accounting Research, (Autumn, 1970), pp. 90-92.
4. Lawrence Revsine, "Data Expansion and Conceptual Structure," The Accounting Review, Vol. 42, No. 1, October 1970, pp. 704-11
5. H.M. Schroder, M.J. Driver and S. Streufert, Human Information Processing, Toronto: Holt, Rinehart and Winston, 1967.
6. M.J. Driver, "The Relationship Between Abstractness of Conceptual Functioning and Group Performance in a Complex Decision Making Environment," unpublished Master's Thesis, Princeton University, 1960.
7. K.W. Terhune and J.L. Kennedy, "Exploratory Analyses of Research and Development Game," O.N.R. Technical Report No. 3, Princeton University, 1963.
8. B.W. Tuckman, "Personality Structure, Group Composition and Group Functioning," Sociometry, 1964, Vol. 27, pp. 469-487.
9. B.H. Long and R.C. Ziller, "Dogmatism and Predecisional Information Search," Journal of Applied Psychology, 1965, Vol. 49, pp. 376-378.
10. This investigation thus diverges from the research strategy proposed by Hofstede and Kinard who argue that the pertinent questions to ask are not those that relate individual differences to behavior but rather how choices relate to the way information is presented. They argue further that research questions should be deliberately framed so as to reveal the existence of universal tendencies across substantial individual differences. See T.R. Hofstede and J.C. Kinard, "A Strategy for Behavioral Accounting Research," The Accounting Review, Vol. 45, No. 1, pp. 38-54 (Jan., 1970). But while we would agree with the desirability of uncovering relationships of universal applicability, research of this variety performed thus far has generally yielded inconclusive results. See for example W.J. Bruns, Jr., "Inventory Valuation and Management Decisions," The Accounting Review, Vol. 40,

- No. 2, April 1965, pp. 345-357; T.R. Dyckman, "The Effects of Alternative Accounting Techniques on Certain Management Decisions," Journal of Accounting Research, Vol. 2, No. 1, Spring 1964, pp. 91-107. We are thus left to puzzle whether the variables investigated in these studies were really insignificant or if they were moderated by characteristics inherent in the test groups which were not removed by randomization. In a rather non-linear world, these are not the kinds of questions that can simply be assumed away.
11. Intolerance of ambiguity has been referenced in the accounting literature previously on a corporate level by Sorter Becker, and as a variable not of significance to accounting researchers by Hofstede and Kinard. See G.H. Sorter and S.W. Becker, "Corporate Personality as Reflected in Accounting Decisions: Some Preliminary Findings," Journal of Accounting Research, Vol. 2, No. 2, Autumn 1964, pp. 183-196 and T.R. Hofstede and J.C. Kinard, op. cit., p. 50.
 12. J.C. Vannoy, "Generality of Cognitive Complexity - Simplicity as a Personality Constraint," Journal of Personality and Social Psychology, 1965, Vol. 2, pp. 385-396.
 13. S. Budner, "Intolerance of Ambiguity as a Personality Variable," Journal of Personality, 1962, Vol. 30, pp. 29-50.
 14. H.J. Eysenck, The Psychology of Politics, London: Routledge and Kegan Paul, 1954.
 15. H.M. Schroder, et al, op. cit.
 16. These data were used to study the effects of cognitive complexity on information organization. For details see Jerry D. Dermer, "Differential Effects of Cognitive Complexity on the Organization of Management Information, Sloan School of Management Working Paper No. 615-72, M.I.T., October, 1972.
 17. S. Budner, op. cit.
 18. J.P. Robinson and P.R. Shaver, Measures of Psychological Attitudes, Ann Arbor, Michigan: Survey Research Centre, University of Michigan, 1969, pp. 318-319.
 19. H.M. Schroder, et al, op. cit.
 20. Ibid, pp. 156-157.
 21. The relationship between ambiguity tolerance and integrative complexity must be limited to a conceptual level only however because few measures have been found to correlate with the measures of integrative complexity devised by Schroder et al. See J.S. Vannoy, op. cit.
 22. H.M. Schroder, et al, op. cit., p. 158.

23. B.W. Tuckman, op. cit.
24. B.H. Long and R.C. Ziller, op. cit.
25. See J.S. Vannoy, op. cit.
26. See Also D.G. Pruitt, "Informational Requirements in Making Decisions," American Journal of Psychology, 1961, Vol. 74, pp. 433-439, and R.N. Taylor, "Risk Taking, Dogmatism, and Demographic Characteristics of Managers as Correlates of Information-Processing and Decision Making Behaviors," Proceedings, 80th Annual Convention, American Psychological Association, 1972, pp. 443-444.
27. H.M. Schroder, et al, op. cit., p. 156.
28. These results thus conflict with Miller's speculation that when supplied with the amount of information he requests, the environment within which an information processor functions is individually optimized and hence that he processes this information in a maximally abstract manner. See Henry Miller, "Environmental Complexity and Financial Reports", The Accounting Review, January, 1972, p. 34.
29. Further studies examining the relationship between the amount of information available and the amount preferred, including and excluding the cost and inconvenience of data acquisition will then be required before meaningful implications for general accounting practice can be drawn.

BASEMENT

Date Due

| | |
|-----------------------|-------------|
| NOV 10 '78 | MAY 20 1990 |
| MAY 21 78 | |
| FEB 20 79 | AUG 10 1992 |
| MAR 22 79 | MAY 7 8 |
| APR 13 79 | FEB 1 1999 |
| JUL 1 79 | FEB 1 2000 |
| AUG 13 '81 | MAY 16 2000 |
| NOV 8 '81 | NOV 8 2000 |
| MAR 20 '85 | |
| JUN 3 '86 | |
| SEP 08 1986 | |
| NOV 27 '87 | |

Lib-26-67

611-72

BASEMENT

MIT LIBRARIES
3 9080 003 701 866

612-72

MIT LIBRARIES
3 9080 003 701 833

613-72

MIT LIBRARIES
3 9080 003 670 814

614

T-J5 143 w no.614-72
Welsch, Roy E/A modification of the N
636673 D*BKS 00027754

3 9080 000 747 904

615-72

MIT LIBRARIES
3 9080 003 670 863

T-J5 143 w no.616-72
Welsch, Roy E/The variances of regres
636653 D*BKS 00027752

3 9080 000 747 854

617-72

MIT LIBRARIES
3 9080 003 701 825

618-72

MIT LIBRARIES
3 9080 003 701 874

619-72

MIT LIBRARIES
3 9080 003 701 783

622-72

MIT LIBRARIES
3 9080 003 701 924

623

HD28.M414 no.623-72
Merton, Robert/Fallacy of the log-norm
636656 D*BKS 00027750

3 9080 000 747 789

HD28.M414 no.619-72
Plovnick, Mark/Expanding professional
636663 D*BKS 00027751

3 9080 000 747 813

[620 never issued]

