The present investigation was aimed at studying the effects of individual differences in the personality dimension of extraversion-introversion, elaboration of encoding and time delay on retrieval of information. On the basis of related literature, relevant hypotheses were formulated regarding the effects of personality, elaboration of encoding and time delay and their interactions. The findings of the present investigation are discussed in the light of those hypotheses and related theories and researches as follows:

**Personality and Memory**

On the basis of Eysenck's (1967, 1973) theory of personality and related findings, it was hypothesized that extraverts would show more retention on immediate recall while the introverts would show more retention on long-term recall. The present study tested retention at two intervals, i.e. immediate (0-hour delay) and delayed (24-hour delay). On the basis of the above hypothesis, it was postulated that there will be no overall significant difference between the two personality groups because of counterbalancing in retention performance due to effects of two retention intervals. The results of the present study revealed that personality had no overall significant effect on retention performance. Thus the above finding is in accordance with Eysenck's personality theory and related memory theory. This finding does not nullify the importance of the personality dimension of extraversion-introversion because the above results are based on two retention-intervals, i.e.,
immediate and delayed and it is obvious from the results that both of these retention intervals do interact differently with two personality groups, i.e., extraverts show more retention on immediate recall while the introverts show more retention on delayed recall. Thus, it is obvious that it depends on the length of retention as to which personality group will show more retention scores and which one less retention score. This issue will be discussed further in interaction between personality and time delay.

**Elaboration of Encoding and Memory.**

On the basis of the revised model of levels of processing (Craik and Tulving, 1975) and related memory research, it was hypothesized that the retention would be more in the more elaborated condition as compared to the less elaborated condition. The same pattern of results was obtained in the present investigation. It was found that elaboration of encoding had a significant positive effect on retention performance. The retention scores, in the present study, are less for the less elaboration level and more for the more elaboration level. It is because elaboration of encoding relates and organizes the items to deeper levels and it also leads to deeper analysis of each level (Craik and Tulving, 1975). It is also because the memory code may be thought of as a group of attributes of features from numerous dimensions (Graf and Mandler, 1984; Nelson, 1979). Similarly, it is also because elaborate processing makes items distinguished and discriminable from other
items (Eysenck, M. 1979; Jacoby and Craik, 1979). It also increases the number of associative pathways between proposition in a memory trace and thus improves recall performance through direct retrieval (Anderson, 1983). In the present case, half of the Ss were required to classify the similes in good, moderate and poor categories. This was a more elaborated condition because the Ss could classify each simile in many ways such as meaning, function, structure etc. In the less elaborated condition, the Ss were required to classify each simile into animate or inanimate categories. This was a less elaborated condition because in this condition the Ss had to classify each simile on the basis of only one desired factor, i.e., whether the words involved in the simile were animate or inanimate by nature. Thus, it may be concluded that elaboration of encoding is an important aspect in memory. Hence it may be suggested that more elaborated instructions to the Ss will lead to more deeper retention which will last longer.

Time Delay and Memory

It was hypothesized that retention performance would decrease with time delay. The results of the present study confirm the above hypothesis. These results may be explained in the light of interference theory of forgetting. Whenever we perceive an event physiological correlates of this experience called memory traces are said to be formed in the nervous system. A popular notion of forgetting is that these traces spontaneously decay and disintegrate over time. Evidence to
test this notion, however, is difficult to attain. The results of the present study also hold that retention performance decreases over time.

The interference theory does not use time as an explanation but stresses that it is what we do between initial perception and later recalling that is crucial. According to this theory forgetting occurs because of the interference between memory traces from old learning and new learning. Accordingly, the longer the time-delay the more the interference and consequently more the forgetting and less the retention performance (McGeoch, 1942; Postman et al., 1968). It may be concluded that interference occurs over time and leads to forgetting, i.e., lesser retention performance over time delay.

**Personality X Elaboration and Memory:**

It was found that the interaction effect between personality and elaboration of encoding regarding retention performance was non-significant. However, at less elaboration level, the extraverts showed more retention performance than the introverts but there was a reversal at more elaboration level. It may be because introverts are less able than extraverts to utilize extra-processing resources at less elaboration level. However, at more elaboration level, they utilize the extra processing resources and hence lead to better retention performance than the extraverts. Introverts show weak retention performance than extraverts at less elaboration level. Also because under high arousal, processing is focussed only on dominant sources of information (Broadent, 1971). It is also because arousal leads to increased use of the articulatory loop (Jadkeley and Hitch, 1974).
at more elaboration level and introverts are cortically more aroused than extraverts (Eysenck, 1967, 1973).

The simple effects of personality at less and more elaboration levels was found to be non-significant but the simple effects of elaboration for both personality groups was found to be significant. This finding leads to the conclusion that locus of interaction effect between personality and elaboration of encoding for retention performance rests on elaboration of encoding.

**Personality X Time Delay and Memory**

It was hypothesized that there will be a significant interaction between extraversion-introversion and retention interval in the manner that extraverts would show more retention in immediate recall while the introverts would show more retention in delayed recall. The results of the present study confirm this recall hypothesis since it was found that at the immediate recall level extraverts showed more retention score than introverts while there was a reversal at the delayed recall level. Further, recall performance of the extraverts decreased significantly with time delay, however, the recall performance of the introverts increased with time delay but non-significantly. Hence, there was a significant forgetting in the extraverts with time delay but there was no forgetting in the introverts due to time delay. It was because high arousal impairs immediate recall (upto approximately twenty minutes after acquisition but facilitates long-term recall (Kleinsmith and Kaplan, 1963) and introverts are more cortically aroused than extraverts.
There is a fairly consistent evidence in support of this finding (Howarth and Eysenck, 1968; McLean, 1968; Opollot, 1970; Skhanthakumari, 1965). These results may also be explained in terms of Walker's (1958) action-decrement theory. According to this theory, high arousal produces a longer-lasting active memory trace, leading to enhanced consolidation and long-term memory. However, during the consolidation period there is a transient inhibition of retrieval (called 'action-decrement') which protects the trace from disruption. The results of the present study are thus exactly in accordance with Walker's theory.

The simple effects of personality at immediate as well as delayed level of retention-testing were found to be significant. It meant that the two personality groups differed significantly at both levels of retention-testing intervals as per accordance with the hypothesis. Hence, it may be concluded that the locus of interaction due to personality was at both retention-intervals, but it was more on the delayed level of retention testing since the significance of difference was more at that level. However, simple effect of time-delay was not found to be significant for introverts which meant that there is more or less the same recall performance of the introverts at both levels of retention interval. However, simple effect of time-delay for extraverts was found to be significant which meant that there was a significant forgetting in extraverts due to time delay. Hence, locus of interaction effect for
time delay was due to extraverts and not due to introverts. In support of the above finding there is ample evidence from a study for information in prose by Wilding (1984) in which he found that the short-term memory performance was not related to extraversion but long-term performance declined as extraversion increased.

**Elaboration X Time delay and Memory**

It was hypothesized that retention would be enhanced under more elaboration and hence would lead to less forgetting than the less elaboration condition. However, the results showed that there was no significant interaction in this regard but the pattern of results was similar as was hypothesized. It was because more elaboration leads to the deeper level of processing and the more the deeper level of processing the lesser the forgetting is (Craik and Lockhart, 1972; Craik and Tulving, 1975). It was also because elaborate processing makes items distinctive or discriminable from other items and that the increased distinctiveness aids retrieval (Eysenck, M.W., 1979; Jacoby and Craik, 1979). It was also because an analysis of several attributes of an item leads to better retention than lesser number of attributes (Battig, 1979; Battig and Winstein, 1977), and more elaboration leads to deeper levels of processing and hence to the analysis of more attributes of every item than the less elaboration condition and thus to lesser forgetting due to time delay.

The simple effect of elaboration for retention at immediate as well as delayed level were found to be significant.
This finding leads to no significant interaction effect between elaboration of encoding and time delay. However, the simple effect of time delay for retention was found to be significant at less elaboration but it was non-significant at more elaboration level. This finding leads to the conclusion that the locus of interaction for retention between elaboration and time delay may be due to more elaboration. Hence, there is no significant difference in retention score for two time delay groups at more elaboration level but at less elaboration level, there was a significant difference in forgetting due to time-delay.

**Personality X Elaboration of Encoding X Time Delay and Memory**

It was found that the interaction effect due to personality elaboration of encoding and time delay was found to be significant. It meant that the various two way interactions in the present study were not the same at the two levels of the third variable. The results showed that the interaction between personality and elaboration for retention score was found to be significant at immediate level but it was not at the delayed level of retention testing. It was because the retention performance of introverts was less than extraverts at less elaboration but at more elaboration level, their retention performance was greater than the extraverts. Further this interaction effect was robust on immediate level but was not on delayed level.

The interaction of personality and time delay for
retention performance was significant at less elaboration level but it was non-significant at more elaboration level. It was because this interaction was only effective at less elaboration. Further, due to more elaboration, this interaction effect was lost because more elaboration leads to better retention-performance at the delayed level also. Similarly, more elaboration improves the retention performance of introverts whereas less elaboration improves the retention performance of the extraverts.

The interaction effect between elaboration and time-delay for retention-scores for introverts was not significant but for extraverts it was significant. It was because introverts' performance increases with time-delay at both levels of elaboration. However, extraverts' performance decreases with time-delay, but the decrease at less elaboration is more than at more elaboration. The simple, simple main effects of personality at less elaborated, immediate recall level as well as less elaborated, delayed recall level were found to be significant. However, at more elaborated, immediate recall level, the simple, simple main effects of personality were not found to be significant, but at more elaborated, delayed recall level, it was found to be significant. Thus, the locus of interaction lies on the more elaborated in immediate recall condition because only in this condition the two personality groups do not differ significantly, while in all the remaining combinations, the two personality groups differ significantly.

The simple, simple main effects of elaboration of encoding
were found to be significant for all the possible combinations, i.e., for introverts at the immediate recall level, for introverts at the delayed recall level, for extraverts at the immediate recall level and for extraverts at the delayed recall level. It meant that the three-way interaction was not due to elaboration of encoding because the two elaboration groups differed significantly for their retention-performances in every possible combination.

The simple, simple main effects of time-delay were not found to be significant for introverts at less as well as more elaboration level of encoding. However, the simple, simple main effect of time delay for extraverts at less elaboration was found to be significant. However, it was found to be non-significant at more elaboration level. Thus the locus of interaction due to time delay lies on extraverts at less elaboration level, since extraverts show significantly decreased retention performance at less elaboration level due to time delay and the effect of time-delay was non-significant in the remaining combinations.

Concluding Remarks

The present study has wide implications in the areas of cognitive and applied psychology. It points out that there are individual differences in retention due to differences in personality especially at the delayed retention intervals. It was found that extraverts do forget significantly over a delay of
24 hours. However, introverts show an improvement in the performance following 24 hour delay but there was not a significant difference between their retention performances at the two time-delay levels. Hence, a question arises what one should do to improve the delayed retention performance of the extraverts. The present study demonstrates that time delay has no significant effect on the extraverts at more elaboration condition (Table 17). Hence the present study suggests that more elaborated strategies should be used in learning situations so that more or less, no forgetting may occur. The present study approves this suggestion in other ways also. First, it shows that more elaboration leads to more retention (Table 13) because more elaboration leads to deeper level of processing and hence to less forgetting. Further, we must not overlook the possibility that some items of information that appear to have forgotten may never have really been stored in the first place. It takes some time for information to get into the long-term memory, and it is customary to talk of this time as the time needed for the 'consolidation of memory' (Deutsch and Deutsch, 1966; Miller and Marlin, 1979). New information which a person seemingly experiences, does not always get stored in the long-term memory (Bourne, Jr. et al., 1986). In this regard, the present study shows that in less elaboration condition, there is less retention performance even at immediate level of testing. It may be a case of failure to store the information. Hence, the present study suggests that for storage of information in long-term memory, the more
elaboration condition may be an essential requirement, more or less, in most, if not in all cases.

The present study suggests a few guidelines for further research in this area. Firstly, more levels of all the variables in the present study may be investigated in the present paradigm so that a trend analysis of these variables may be made. Secondly, the interaction of time-delay and elaboration of encoding for retention-performance may also be investigated along with other individual differences, such as intelligence, achievement strivings, anxiety, field-dependence or field-independence, age etc. Thirdly, the present paradigm must be investigated with other retrieval measures, since retention scores vary with the nature of retrieval measure. Fourthly, the present paradigm may be investigated with short and long lists of similes, more or less similar, common and different varieties of similes.