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Depth of Processing Versus Oppositional Context in Word Recall: A New Look at the Findings of "Hyde and Jenkins" as Viewed by "Craik and Lockhart"

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The interpretation given by Craik and Lockhart (1972) of the findings by Hyde and Jenkins (1969) involving supposed depth of incidental-task processing on subsequent word recall is brought into question by the tenets of logical learning theory. It is shown that Craik and Lockhart overlooked the possible role of oppositionality in this research. An alternative explanation relying on an oppositional context and predication is offered. Two experiments (combining 270 subjects) present evidence supporting the hypothesis that oppositionality in an incidental task facilitates subsequent word recall ($p < .001$). In both experiments, the importance of taking a subject's meaningful understanding of the task instruction into consideration is highlighted. The discussion contrasts Boolean "binary" disjunction with the logic of oppositionality. It is shown how oppositionality allows us to conceptualize a testable theory of human agency.

This paper presents two experiments designed to contrast the theoretical explanation of Craik and Lockhart (1972, p. 667) for the Hyde and Jenkins (1969) findings with an alternative formulation of these findings drawn from the tenets of logical learning theory [LLT] (Rychlak, 1981, 1986, 1988a, chps. 7–9). Fundamental to LLT is the assumption that human beings are predicating organisms. By *predication* is meant the *logical process of affirming, denying, or qualifying broader patterns of meaning in relation to narrower or targeted patterns of meaning*. For example, when we frame the belief that "Alice is reliable," we are taking a wider range of meaning (*reliability*) within which we construe and thereby lend meaning to a narrower range of meaning (*Alice*). This logical process can be modeled through use of Euler circles, in which

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case the smaller circle labeled "Alice" would be framed within and therefore take meaning from the larger circle, labeled "reliable people," or some such attribution (i.e., other people besides Alice are reliable).

Oppositionality is intrinsic to the predicational process, because any time that we categorize a targeted meaning (*Alice*) by another framing meaning (*reliability*), we necessarily (i.e., by definition) delimit or imply the meaning of the "non-category" lying outside the broader circle—in this case, unreliability or unreliable people. Thus, were we to frame the smaller circle labeled "Alice" outside the larger circle of "reliability" we would immediately express the belief that "Alice is unreliable." The predicating intellect must ever "take a position" on the alternative meanings under processing because these meanings necessarily point to their contradiction, negation, contrast, or contrary possibility—which are various ways of referring to oppositionality in meaning expression.

This broader oppositional context of meaning (i.e., inside vs. outside the categorizing circle) is always present in any cognitive organization, and it provides an important rationale for LLT's claim that human beings have agency or the capacity to change the grounds for the sake of which they are predicating their lives (Rychlak, 1988a, p. 445; see also Rychlak, Barnard, Williams, and Wollman, 1989). Yet, as we shall spell out below, in the Craik and Lockhart theoretical analysis of the Hyde and Jenkins research, there is no recognition of the central role that oppositionality may have played in the latter findings. This failure to take oppositionality seriously is not limited to Craik and Lockhart, of course. We will return to this question in the discussion, for we believe that overlooking the influence of oppositionality in cognitive research has been widespread.

The Craik and Lockhart "depth" analysis of Hyde and Jenkins has received wide coverage in textbooks on cognitive psychology, virtually making it into a modern classic (e.g., Anderson, 1985, pp. 170, 171; Bransford, 1979, pp. 77–79; Howard, 1983, pp. 144, 146, 153; Mandler, 1985, p. 103; Stillings et al., 1987, pp. 77–78). We decided to confront this widely discussed theory with the LLT point of view by replicating Hyde and Jenkins while taking into account the theoretical analysis of Craik and Lockhart. We begin with a review of the Hyde and Jenkins research and the theoretical suggestions resulting thereby, including Craik and Lockhart's "depth" position, move to a critique of this latter position in light of an alternative "oppositional context" explanation suggested by LLT, and then proceed to the experimental test of the conflicting outlooks.

The Hyde and Jenkins Experiment

Hyde and Jenkins (1969) were interested in the effect that an incidental task would have on memory organization and subsequent recall. They had

subjects perform in three experimental groups, all of whom heard the same electronically recorded 24 words presented in the same order. In a "recall only" group, subjects were told to listen to the words with the expectation that they would be asked to recall them later. An "incidental group" was asked to perform certain tasks with these words but no mention was made of a subsequent recall. And, an "incidental + recall" group of subjects was both given these preliminary tasks and told that they would have to recall the words.

The dependent variable was therefore the number of words recalled for all conditions (clustering was also studied because certain of these words were known from previous research to be highly associated). There were three incidental task-instructions given to subjects in different conditions: one asked subjects to estimate the number of letters in a word, a second asked them to estimate the number of times the letter "e" was used in a word, and a third asked subjects to rate each word for pleasantness-unpleasantness. Hyde and Jenkins found that the pleasant-unpleasant incidental task led to a significantly greater recall of the words than either of the letter-counting tasks. The "recall only" group of subjects performed at about the same level as the subjects in the pleasant-unpleasant condition. Telling subjects that they would be asked to recall words *did not* lead to a greater recall.

Hyde and Jenkins' explanation of the findings followed Tulving's (1966) suggestion that it is the traces of the words themselves that are stored together which serve to facilitate organization in recall. Hyde and Jenkins knew that their words were highly associated, for they were used in previous research as 12 pairs of primary associates (Jenkins, Mink, and Russell, 1958). Hence, they concluded that when the words were "activated" by the recall instruction, "If the associates are strongly related semantically (and we know they are), this assures that common structures are activated in the task. . . . On the other hand, when words are used by *Ss* as a collection of symbols devoid of meaning (at least as far as the task is concerned), the common structures are not activated and the recall is unorganized" (Hyde and Jenkins, 1969, p. 480).

The Craik and Lockhart "Depth of Processing" Explanation

It remained for Craik and Lockhart (1972) to bring the Hyde and Jenkins research into a theoretical framework based upon a concept of processing "depth." This depth notion had been employed by cognitive researchers even before Craik and Lockhart advanced their theory. For example, Bobrow and Bower (1969) reported a study in which subjects were asked to read a series of sentences, such as "The cow chased the rubber ball." Some subjects were asked to check on the spelling of certain words in the sentence, such as "ball." Others were asked what meaning was intended in the use of the word

"ball"—a "dance" or a "round object." Later, without being prepared to do so, subjects were given the first significant word (*cow*) of each sentence and asked to recall the second (*ball*). It was found that subjects who had looked for misspellings recalled the second word only 18% of the time, whereas those who had answered questions about the word meaning recalled the second word 49% of the time. Bobrow and Bower suggested that the latter subjects had performed a "deeper" processing on the sentences than subjects who merely checked the spelling of words. Hence, thanks to this depth of processing a greater recall was made possible.

This concept of a "depth" in processing was later defined by Craik and Lockhart (1972) as involving a "greater degree of semantic or cognitive analysis" (p. 675). How does this semantic (i.e., meaning-) enrichment take place? Craik and Lockhart suggest that ". . . after a word is recognized it may trigger associations, images or stories on the basis of the subject's past experience with the word" (*ibid.*). This triggering of associations is equated with Tulving and Madigan's (1970) phrase "elaborative encoding." Craik and Lockhart are aware of the research evidence suggesting that elaborative encoding is not necessarily hierarchical, as is implied in the concept of "depth" (Macnamara, 1972; Savin and Bever, 1970). It would be just as appropriate to describe elaborative encoding as a "spread" or "elaboration" of encoding. It is the triggering of increasingly complex associated ties between the words that matters.

Modern cognitive textbooks, such as Anderson (1985, p. 170) or Stillings et al. (1987, pp. 77–78), suggest that a better term for depth or levels of processing is "elaboration." Craik and Lockhart (1972) actually used the phrase "elaboration encoding" as synonymous with depth (see p. 675). In their own words, they admitted that: "'spread' of encoding might be a more accurate description [of encoding], but the term 'depth' will be retained as it conveys the flavor of our argument" (*ibid.*, p. 676). It seems clear that they wished to convey a hierarchical or "levels of significance" flavor to the encoding process, so they retained the "depth" notion quite intentionally. In today's single level, "spreading activation" form of theorizing a hierarchical arrangement is less relevant. Of course, even in single-level spreading or elaborating conceptions of encoding, no special role is given to oppositionality. So far as the question of oppositionality in human cognition is concerned, this dispute over depth versus elaboration is a distinction without a difference.

Craik and Lockhart suggest that in organizing word materials for memory the subject begins with the more superficial aspects of a perception, such as the slanting lines of the letters in word recognition. But as this analysis moves from the superficial appearance of a word to the elaborating associations of memory traces in a network, the likelihood of recalling this word increases. As they sum up their view: "we suggest that trace persistence is a function of depth of

analysis, with deeper levels of analysis associated with more elaborate, longer lasting, and stronger traces. Since the organism is normally concerned only with the extraction of meaning from the stimuli, it is advantageous to store the products of such deep analyses, but there is usually no need to store the products of preliminary analyses" (*ibid.*, p. 675). To round out their account, Craik and Lockhart postulate a "flexible central processor" which functions at various levels to keep words in consciousness through rehearsal at a fixed rate, or, at a deeper level, to connect with learned cognitive structures that contribute semantically to the words under processing (*ibid.*, p. 679).

The "Oppositional Context" Explanation

The writers find the Craik and Lockhart explanation of Hyde and Jenkins' research wanting on two counts: (1) It does not take into consideration the semantic influence of the experimental instruction as understood and fulfilled by the subjects "in the task." (2) It fails to recognize the heuristic benefit of oppositionality as an *intrinsic process* in meaningfully organizing the words for recall.

There is a semantic component overlooked in Craik and Lockhart's analysis that is confined to the presumed organization of words in cognition. Craik and Lockhart do not consider the introspectively-framed predications of the subjects, who must direct their performance in light of their understanding of the experimental instructions. We are reminded here of the Jones and Nisbett (1971) finding that one's understanding of a behavioral event depends upon whether one takes the perspective of an observer or an actor in a situation. Craik and Lockhart have taken the theoretical perspective of extraspective observers in the experimental situation. In line with our first criticism, we take the introspective perspective of the actor. Subjects who are asked to "count letters" in words need not construe this task as having a semantic or word-meaning aspect to it. The thrust of the instruction concerns "letters" and not "words."

It would be possible to administer a string of letters without word quality to subjects and have the same "e" instructions used by Hyde and Jenkins apply. If a word or a string of letters without word quality lacked an "e" the subject would probably dismiss such an item's relevance immediately, which surely cannot facilitate recall (only 8 of the 24 words used by Hyde and Jenkins actually contained the letter "e"). The other instructions, to learn a list of words, or to judge the pleasantness or unpleasantness of a word, demand that the subject consider the meaning of every such item presented. This results in an uncontrolled bias favoring the "non-e" instructions if the criterion is to be *all* words recalled, both "e" and "non-e." The proper test for recall in an e-counting task would seem to be the number of words recalled

that had an "e" in them across experimental conditions. In this case, we would be taking the subject's introspectively framed task predication into account (see Experiment II, below).

Rather than postulating two separate processes—one deep and one shallow—it seems more parsimonious to suggest that there is only one process at work, but two different tasks under predication by the subjects in question. We must begin our analysis of the process that is getting underway even before there is a triggering of associated word networks. Furthermore, if there is actually a "depth" component to the processing of word meanings, then it should be possible to demonstrate empirically that a more complex semantic context (hence "deeper" processing) in the incidental task will lead to greater subsequent word recall (see Experiment I, below).

This takes us to our second grounds for questioning a depth analysis. The incidental tasks used by Hyde and Jenkins were not equivalent in that one of them relied upon oppositionality. Linguists have for some time stressed that opposition is one of the most important principles governing the organization of language (Lyons, 1977, p. 271; Richards, 1967, p. 10; Trier, 1931). As noted above, cognitive research has not given special consideration to the heuristic benefits of oppositionality. It is our contention that an *oppositional context* is one of the most stable semantic structures in cognition, lending a broadly meaningful setting within which a word can be targeted for meaning enrichment. This lending of meaning is what we have described above as the logical process of *predication.*

In a context like "pleasant–unpleasant" we have one comparison word (pleasant) delimiting hence literally entering into the meaning of the other comparison word (unpleasant). Any targeted word (such as "decisive") framed within the oppositional context established by the comparison words must be judged by the cognizing individual and then situated at one end or the other of this mutually defining range of meaning—or, at some point in between the bipolarity. The cognizer must "take a position" in a well-defined, broad context. This is akin to framing a small circle labeled "decisive" by a broader circle labeled "pleasant" or "unpleasant." Both of the latter meanings will necessarily enrich the targeted word (decisive), of course, because that is how predication and oppositionality function in the over-all process known as logic (see above). We might also say that the broader context (pleasant–unpleasant) lends meaning to the targeted word (decisive), as in the sense of moving from the genus to the species in a logical sequence. Meaning is logically extended from the former to the latter. Another example of this type of logical extension is the flow of meaning from (broad) premises to (specific) conclusions in syllogistic reasoning.

When we evaluate "decisive" in terms of the comparison words "pleasant–unpleasant" we are, in effect, predicating its meaning by a well-organized,

clear, oppositional context. Such a context is more likely to facilitate recall of this word than a two-word context lacking the intrinsic organization of oppositionality. Doubling the context dimensions within which a word like "decisive" is to be predicated (e.g., common–unpleasant) merely leads to a complexity of meaning that detracts from the efficiency of such memory organization—which then diminishes recall.

It might be argued that in the experimental instruction to count the number of "e" letters there is an implicit oppositionality because there is the "e" word and the "non-e" word (opposite comparison word) for the subject to consider. However, the experimental instructions did not make this distinction clear. That is, a subject could have proceeded on the assumption that *all* of the words had "more or less" of the targeted "e" letters. It would strengthen our predicational thesis if it could be shown that by encouraging subjects first to mentally distinguish between "e" words and "non-e" words—before counting the number of "e" letters in the former words—a recall of "e" words would be facilitated! We shall return to this point in Experiment II, below.

Experiment I

Hypotheses

1. Subjects whose preliminary incidental task involves judging a target word in light of opposite comparison words will subsequently recall more of the target words than subjects whose incidental task does not involve such oppositionality. This hypothesis will hold even when the same comparison words of the oppositional task are used as a rearranged, non-oppositional task within which the target words are to be judged.

2. Alerting subjects that they will be asked to recall the target words will not affect the findings in support of hypothesis 1.

3. Subjects in a control condition which does not include a preliminary incidental task, but who are asked to memorize the target words, will perform at roughly the same level as subjects who have been asked to perform in the oppositional incidental task.

Rationale. Hypothesis 1 predicts that a target word like "decisive" which is judged initially in an oppositional context such as "pleasant–unpleasant" will be more likely to be recalled than if it were judged in the context of "pleasant–unimportant" or if it were assessed for the number of "e" letters, or the total letters that it contained. Hypotheses 2 and 3 are based on the findings of Hyde and Jenkins (1969). The experimental design calls for nine "between groups" of subjects to judge 24 target words in an incidental task according to the following instructions:

(1) three oppositional tasks: pleasant–unpleasant, important–unimportant, and common–uncommon (these conditions should result in the highest levels of recall).

(2) three non-oppositional tasks: pleasant–unimportant, important–uncommon, and common–unpleasant. These are simply recombinations of the same comparison words used in the oppositional tasks, such that each dimensional end appears.

(3) three letter-counting tasks: number of total letters per word, number of "e" letters per word, and the combination of total letters plus number of "e" letters per word.

If "depth" of processing is the crucial variable in the recall of words, then a combination such as pleasant–unimportant should be even "deeper" than the comparatively limited oppositional task of pleasant–unpleasant. That is, according to Craik and Lockhart's theory, in order to process a target word in terms of the comparison words "pleasant" and "unimportant" there would have to be a triggering of two entirely different semantic complexes. One of these complexes would presumably associate to "pleasant" (which would be elaborated by "unpleasant" among other associated words) and the other to "unimportant" (which would be elaborated by "important" among other associated words).

The larger associative network would surely enhance recall of the target words when contrasted with the triggering of a smaller oppositional matrice like pleasant–unpleasant. Conditions which "double" the semantic context (i.e., pleasant–unimportant, important–uncommon, common–unpleasant) are by definition "deeper" in meaning and will therefore lead to the greatest recall in the word-memory task. The LLT position, on the other hand, predicts that the conditions relying solely on oppositionality (i.e., pleasant–unpleasant, important–unimportant, common–uncommon) will lead to the greatest recall in the word-memory task. This will occur because of the clear and stable predicational organization afforded by oppositionality.

For example, when a subject frames the word "decisive" by a context of pleasant–unpleasant, important–unimportant, or common–uncommon this word's meaningful significance is being understood within a context of duality that lends it clear and distinctive meaning. The process involved here is akin to the placement of meanings either inside or outside of a Euler circle. Thus, "decisive" would be framed—that is, predicated—by one meaning (pleasant, important, common) even as the directly implied opposite meaning (unpleasant, unimportant, uncommon) is also actively framing (predicating) its meaning. Understanding is thereby enriched within a context of oppositionality. The "position" has been taken by the subject as to the meaning of "decisive"—whether inside or outside of the framing meaning. The semantic significance is clearly settled, enhancing cognitive organization for subsequent recall.

On the other hand, when having to decide where this word arrays in a mixed context of pleasant–unimportant or common–unpleasant, the meaning under consideration is made unclear by the very complexity of the predicating context within which it is targeted. This does not enhance the subject's meaningful understanding, which adversely affects subsequent recall. The problem here is not unlike the increasing overextension found when conjunctive categories are multiplied (Chater, Lyon, and Myers, 1990; Hampton, 1988). Depth or elaboration is not facilitative of cognitive functioning unless it builds on a strong base of meaning enrichment, which is another way of referring to predication/opposition. In a predicational model, meaning is more important than sheer frequency of associative ties.

Subjects

One hundred and ninety undergraduate students attending an urban university were randomly assigned to one of ten experimental conditions. Sexes were evenly distributed within these conditions. Subjects participated in order to fulfill the requirements of their introductory psychology course, and the usual informed consent and debriefing procedures were followed.

Procedure

The procedure followed is a modification of the Hyde and Jenkins (1969) design. All subjects listened to the same tape recording of 28 "target" words, with a 2.5 second interval between word presentations. The first two and last two words heard by subjects were simply "fillers," to counteract the effects of primacy and recency on memory. Hence, the crucial list for the memory task was the *24 target words* arrayed between the fillers. The words employed in the present experiment were taken from Anderson's (1968) norms for personality-trait words. These words are equated for meaningfulness, and the ratings for likability range from a low of 26 (*liar*) to a high of 573 (*sincere*). Words for the present experiment were selected from the medium range of likability; some examples from the range employed are (likability rating in parenthesis): *religious* (387), *idealistic* (384), *cautious* (334), *blunt* (287), and *rash* (186).

Before the subject listened to the 24 words, she or he was prepared according to one of nine incidental–task or one control–group instruction. Instructions were printed on a sheet of paper that was distributed to subjects. Answer sheets for the recording of target words recalled were provided. Subjects were tested in small groups ranging from five to eight participants each. The experimenter reviewed the instructions with the subjects and also administered a trial list of eight words preliminary to the experimental list of 24 words. Every precaution was taken to ensure that a subject understood the

nature of the task before the experimental word list was presented. The ten experimental instructions were as follows:

(1) *Pleasant–Unpleasant*: subject was asked to strike a mark through a three-inch line separating "pleasant" from "unpleasant" depending upon how closely the word meaning in question approximated one or the other of these meanings.

(2) *Important–Unimportant*: same as (1), using these different comparison words.

(3) *Common–Uncommon*: same as (1), using these different comparison words.

(4) *Pleasant–Unimportant*: subject was asked to draw an "X" in a space on the answer sheet if the word meaning in question was both pleasant and unimportant. If it was not *both* pleasant and unimportant subject was asked to record a zero.

(5) *Common–Unpleasant*: same as (4), using these different comparison words.

(6) *Important–Uncommon*: same as (4), using these different comparison words.

(7) *E Counting*: subject was asked to estimate the number of "e" letters for each word and to record these in a space provided on the answer sheet. Twenty of the 24 experimental words had between one and three "e" letters.[1]

(8) *Letter Counting*: subject was asked to estimate the number of letters for each word and to record these in a space provided on the answer sheet.

(9) *E + Letter Counting*: subject was asked to place a check mark on the answer sheet if the word in question had at least one "e" and contained 10 or more letters. Ten of the words on the experimental list fulfilled this requirement.

(10) *Control*: subject was asked to listen to the words and concentrate, for upon completion of the list he or she would be asked to recall as many of the words as possible.

Instructions (1) through (9) had 20 subjects (10 males, 10 females) performing in each. Half of these subjects in each condition (equally divided by sex) were instructed that they *would* be asked to recall the words under presentation. The other half of the subjects in a condition (equally divided by sex) were *not* told that a recall of the words would be asked of them. Only ten subjects performed under the Control (10) instructions, because these subjects (5 males, 5 females) were necessarily told to expect a recall task. Hence, the *N* for this experiment is 190 subjects (95 females, 95 males).

To summarize the procedure: subjects were randomly assigned to small groups in which one of 10 instructions was administered (see above)—nine of

[1]We will follow the practice of using a capital letter (E) when referring to experimental conditions and a lower-case letter (e) when referring to the specific contents of a condition.

these were *experimental conditions* in which an incidental task was administered and one was a *control condition* lacking an incidental task. All subjects then listened to the 24 experimental words in the same order. Half of the subjects in the experimental conditions were told that they would have to recall the words and half were not so forewarned. Subjects did *not* have to recall how they had predicated (classified) the words according to the nine experimental instructions (the incidental task). Subjects in the experimental conditions simply had to recall as many of the words as possible without considering whether they had found these word meanings pleasant, important, common, and so forth. Control subjects were told that they would have to recall the words. Recalled words were written down and later scored for accuracy.

Results

The dependent variable of this experiment was the number of correct words recalled. A factorial analysis of variance was run on these data, having the characteristics of a 2 (sex) X 2 (told, not told) X 9 (experimental instruction); all variables are between conditions. A main effect was found for sex, with females ($M = 6.19$, $SD = 2.37$) outperforming males ($M = 5.56$, $SD = 2.28$) in the recall of words ($F = 2.70$, $df = 1, 162$, $p < .05$). There were no significant interactions between sex and the other between conditions. There was no main effect for told/not told (F = less than unity, N. S.), but incidental task instruction and told/not told did interact significantly ($F = 2.05$, $df = 8, 162$, $p < .05$).

There was a significant main effect for the task instructions ($F = 2.73$, $df = 8, 162$, $p < .001$). Table 1 presents the Means and Standard Deviations of the words recalled by the nine incidental-task groups (10 males, 10 females per condition), arrayed from highest (most recall) to lowest (least recall).

Note in Table 1 that, true to experimental prediction (hypothesis 1), the three oppositional instructions stand at the top of the array. The Means of Table 1 were submitted to a Duncan's multiple range test, and it was found that the Pleasant–Unpleasant instruction differed significantly ($p < .05$) from the following six instructions: Pleasant–Unimportant, Letter Counting, Important–Uncommon, E Counting, E + Letter Counting, and Common–Unpleasant. The Important–Unimportant instruction differed significantly ($p < .05$) from the following two instructions: E + Letter Counting, Common–Unpleasant. The Common–Uncommon instruction failed to reach significance in the first Duncan test, but did so in the second.

That is, since there was a significant interaction between told/not told and task instruction, it was possible to array 19 subgroup Means (5 females, 5 males in each subgroup) and submit them to a Duncan test. The additional subgroup here was the Control condition (with $M = 6.80$, $SD = 2.90$). The top rank in this array was the Pleasant–Unpleasant "told" subgroup (M =

Table 1
Mean and Standard Deviation of Words Recalled, Ranked by Recall Score

INCIDENTAL TASK INSTRUCTION (20 Subjects in Each)	WORDS RECALLED Mean	Std. Dev.
Pleasant–Unpleasant	7.55	2.24
Important–Unimportant	6.65	2.25
Common–Uncommon	6.15	2.39
Pleasant–Unimportant	5.95	1.85 [a]
Letter Counting	5.60	1.79
Important–Uncommon	5.50	3.22
E Counting	5.35	2.16
E + Letter Counting	5.15	2.21 [b]
Common–Unpleasant	4.95	1.96

a = all task Means at or below this point are significantly different from Pleasant–Unpleasant ($p < .05$).

b = this task Mean and the one below it are significantly different from Important–Unimportant ($p < .05$).

8.00) and the bottom rank was the E Counting "told" subgroup (M = 3.90). As suggested in this finding, there was no noticeable pattern for "told" to be superior to the "not told" instruction among the 19 subgroups. The top two scores and the bottom two scores were both "told" subgroups.

The second highest score in the subgroup ranking was the Important–Unimportant "told" subgroup (M = 7.60) followed by the Pleasant–Unpleasant "not told" (M = 7.10), the Control subgroup (M = 6.80), and the Common–Uncommon "told" subgroup (M = 6.60). All of these subgroups differed significantly ($p < .05$) from between one and 11 of the non-oppositional subgroups. The Control subgroup differed significantly from two non-oppositional instructions: Common–Unpleasant "told" and E Counting "told." In no case did a non-oppositional arrangement of comparison words result in a significantly greater level of word recall than an oppositional arrangement. Thus, the results of the subgroup comparisons are consistent with the findings of Table 1.

Conclusion

All three experimental hypotheses have been validated. The first and most important hypothesis has been clearly supported. Oppositionality has proven to be a strong heuristic structure in organizing memory for words. All of the

oppositional instructions reflected at least some higher performances over the two Duncan analyses, in comparison to the non-oppositional instructions. None of the non-oppositional instructions reflected superiority in recall over any of the other experimental conditions, oppositional or non-oppositional! The told/not told condition did interact with the nine experimental conditions, but there was no consistent pattern of findings to suggest that anticipating recall can be counted on to facilitate such recall (hypothesis 2). This cross-validates Hyde and Jenkins (1969), as does the fact that the control instructions resulted in a level of word recall approximating our oppositional instructions (hypothesis 3).

Experiment II

Hypotheses

1. Subjects who are asked in an incidental task to count the number of "e" letters in a list of target words will subsequently recall fewer over-all words—i.e., those with, plus those without, a letter "e"—than subjects who are given an oppositional task instruction, or simply told to recall as many words as possible.

2. Subjects who are asked in an incidental task to count the number of "e" letters in a list of target words will recall *proportionately* more words with a letter "e" in them than will subjects who have been given an oppositional instruction, or simply told to recall as many target words as possible.

3. Subjects who are asked in an incidental task to first divide the target words into opposite "e" words and "non-e" words will subsequently recall proportionately more "e" words than subjects who are simply asked to count the number of "e" letters in words without making the preliminary division into opposites.

Rationale. Hypothesis 1 is simply a predicted cross-validation of the findings noted in Experiment I, as well as in the Hyde and Jenkins (1969) experiment. Hypothesis 2 picks up on our suggestion in the introduction (refer above) that it is the subject's predication of the task (via the understanding of experimental instructions) that determines what will be recalled. Thus, even though a subject who has been instructed to count "e" letters will recall fewer target words than a subject in an oppositional or control condition (hypothesis 1), the former subject should be expected to have a proportionately higher number of "e" words in his or her recall list than the latter subject. This orientation to "e" words is what the experiment "is about" for the former subject (see our comments in the introduction on this point). We could not really test this hypothesis in Experiment I because all but four of

the words used there had one or more "e" letters. In Experiment II we decided to array a list in which only half of the target words contained an "e." This would make a proportion or percentage scoring more tenable and enable us to test hypotheses 2 and 3.

Hypothesis 3 brings oppositionality into the task of counting "e" letters. It is predicted that if we can first get our subjects to divide the words into opposites—those *with* "e" letters and those *without* "e" letters—*before* they count the number of "e" letters, we should enhance the recall of "e" words. This employment of an oppositional context in the realm of "e" counting is presumed to be identical to the use of this context in a pleasant–unpleasant incidental task. We will not enhance recall of "non-e" words in this case because, as noted in the introduction, subjects will be likely to dismiss a target word lacking an "e" once this determination is made. The predication being affirmed by the subject involves counting "e" letters, and words without this characteristic are logically taken to be a non-target.

Subjects

Eighty undergraduate students were randomly assigned to one of four experimental conditions. Sexes were evenly distributed within these conditions. Subjects participated in order to fulfill the requirements of their introductory psychology course, and the usual informed consent and debriefing procedures were followed.

Procedure

The experimental design was similar to that of Experiment I, except that now the 24 target words used for recall were divided into 12 "e" words (e.g., *precise, agreeable, lonely*) and 12 "non-e" words (e.g., *bashful, romantic, foolish*). All words were taken from the middle ranges of meaningfulness in the Anderson (1968) norms. Words were recorded on an audio tape as in Experiment I, but the time between word presentation was extended to 4 seconds (Hyde and Jenkins [1969, p. 477] found that a 2 versus 4 second interval did not affect their findings). Twenty subjects (evenly divided by sex) were randomly assigned to one of four incidental tasks, given the following respective experimental instructions:

(1) *Pleasant–Unpleasant*: identical to Experiment I.

(2) *Control*: identical to Experiment I.

(3) *E Counting, Non-Oppositional*: identical to Experiment I. That is, subjects recorded in a single space for each word the number of "e" letters it contained. No preliminary separation of words into "e" words and "non-e" words was encouraged.

(4) *E Counting, Oppositional*: in this instruction, before a subject was told to count the number of "e" letters in the words, he/she was asked *first* to decide whether a word had or did not have an "e" in it, and *then* to estimate the number of "e" letters. On the answer sheet there were *two* underlined spaces for recording an answer: one labeled an "e" word and the other a "non-e" word. Subjects placed an "X" or a "0" in the "non-e" word space when this was proper. And, in the "e" word space they recorded the number of "e" letters the word in question contained.

Half of the subjects in each of the above incidental task groups were told that they would have to recall the target words being judged, and half were not told. This represents a change in the use of Control subjects from Experiment I, where all were told that they would have to recall the words being presented. In the present study, Control subjects who were not told about the recall ahead were simply instructed that the experimenter would "talk more about the words" with the subjects after they had been presented.

Results

There were two dependent variables in this experiment.

(1) *Raw Score*: the absolute number of target words recalled, combining both "e" words and "non-e" words. (2) *Percentage Score*: the number of "e" words recalled divided by the total number of recalled "e" words plus the number of recalled "non-e" words. The percentage score gives us the proportion of recalled target words that contained an "e" in them.

A factorial analysis of variance was run on the Raw Score data, having the characteristics of a 2 (sex) X 2 (told, not told) X 4 (experimental instruction). A main effect for experimental instruction was found ($F = 7.19$, $df = 3, 65$, $p < .001$). There were no other main effects or interactions found in this analysis. A Duncan test established that both the Pleasant–Unpleasant ($M = 8.05$, $SD = 2.76$) and the Control ($M = 6.95$, $SD = 2.98$) conditions were significantly higher in target-word recall than the E Counting, Non-Oppositional ($M = 5.35$, $SD = 1.60$) and the E Counting, Oppositional ($M = 4.85$, $SD = 1.94$) conditions ($p < .05$). This finding supports hypothesis 1.

The percentage scores were entered into a factorial analysis of variance having the characteristics of a 2 (sex) X 2 (told, not told) X 4 (experimental instruction). Once again, a main effect was found for experimental instruction ($F = 7.86$, $df = 3, 65$, $p < .001$), but no other main effects or interactions emerged in the data. In this case, however, there is quite a different rank ordering of Means. The Duncan test establishes that the E Counting, Oppositional condition ($M = 61.55$, $df = 23.95$) is significantly greater than *all of the other conditions* ($p < .05$ or greater): E Counting, Non-Oppositional ($M = 48.25$, $SD = 17.34$), Pleasant–Unpleasant ($M = 40.30$, $SD = 15.78$), and

Control (M = 35.40, SD = 13.66). Also, the E Counting, Non-Oppositional recall level is significantly higher than the Control condition ($p < .05$).

Conclusion

All three experimental hypotheses have been supported. The evidence is in line with our contention that what the subject does in an experimental task situation depends upon his or her predication of the task at hand. The task predication acts as an intention, and the subject's intentions are crucial in any learning effort. Sheer repetition of a verbal task without subject's intention to learn does *not* result in effective recall (Glanzer and Meinzer, 1967; Tulving, 1966). But, as reflected in the control groups of both our experiments, the evidence suggests that an intention to learn prompts the subject to organize the material in some personally meaningful fashion.

There is a possible criticism of the design of Experiment II. Since the subjects in the E Counting, Oppositional condition made two judgments concerning the words—i.e., deciding on the "e" versus "non-e" characteristic of the words as well as the number of "e" letters present in the word—it could be argued that this led to the better recall of these subjects. Traditional mechanistic explanations of learning place great emphasis on linear measures such as "processing time" or "encoding time." Have we confounded encoding time with encoding condition in Experiment II? Our reply is that if this possibility is true it is all the more surprising that subjects in the E Counting, Oppositional condition should have recalled the *fewest* words of all four experimental conditions. It strikes us that the criticism holds most plausibly for the raw-score measure, where one would expect that a group given two passes through the words (more "encoding" time) should have recalled more of them than groups receiving only one pass. But our findings clearly demonstrate that only when we look at the "e" words do we find subjects in the E Counting, Oppositional condition excelling.

Oppositionality is a bipolar dimension of meaningfulness (Rychlak, 1966), and we see its heuristic benefits occurring in Experiment II. Subjects counting "e" letters were not very efficient in total recall (i. e., combining letters with and without the letter "e"), because they intended such a simple organization, one that is not well-suited to memory. We do not know what the subjects used as a heuristic in the control condition, but the pleasant–unpleasant organization definitely facilitated recall. Indeed, when we ask subjects in control conditions what they employ as a heuristic they frequently give oppositionalities as grounds for recall, such as whether they like or dislike the meanings of the words they are trying to memorize (which is a reflection of affective assessment: see Discussion section, below). The clear superiority of oppositionality as a heuristic is revealed in the E Counting, Oppositional task

of Experiment II. This is not to deny that there are other relevant memorial organizers besides oppositionality that might be consistent with the elaboration or depth metaphor of Craik and Lockhart. But obviously an important type of such organization is being overlooked in cognitive science today.

Discussion

The evidence of both experiments indicates that a major form of organization in memory is oppositionality. We have no support in these findings for the view that "depth" of elaborations beyond an oppositional context facilitates word recall. The concept of elaboration has lost adherents in recent years because of what critics refer to as its circularity. We believe that it is certainly an unclear conception, one that seems to be a poor substitute for the concepts of meaning or meaningfulness. Cognitive theorists also use the phrase "spread of activation" which is another substitute for the idea of an increasing range of meaning (Anderson and Bower, 1973). What can this "spreading" through an "associative network" refer to? Is this a physical process of electrical impulses traversing neurons? If so, then it should in principle be observable and traceable with the proper physical instrumentation. If not, then we are dealing in a metaphorical allusion, which in turn is subject to logical analysis in terms of predication (see Lakoff, 1987, for an example of such metaphorical analysis).

The most successful predicating context in the present research was clearly the Pleasant–Unpleasant instruction. Since it has been found in considerable research (see Rychlak, 1988a, chap. 9) that liked or pleasant items are learned more readily than disliked or unpleasant items (i.e., when subjects are normal in personal adjustment; see below), it might appear that the findings have been contaminated with this factor. There are two problems with this explanation of the findings. First of all, it requires that we make dubious equations, such as equating "pleasant" with "important" or "common." The proponents of LLT have found considerable evidence to suggest that any one person might view *either* end of the "Important–Unimportant" or "Common–Uncommon" dimensions as more pleasant than the other. Note in Table 1 that "Important–Uncommon" ranked low, and "Common–Unpleasant" ranked lowest of all the experimental groups. If "common" was to be equated with "pleasant" then "Common–Unpleasant" should surely have attained a higher ranking.

Second, even if it were true that the pleasantness of the materials (words) are what accounted for the findings, we are left with the theoretical challenge of explaining what it is about such affective assessments that result in the improved recall. We hold that it is the oppositional nature of affective assessments, such as like–dislike or pleasant–unpleasant, that facilitates the recall of meaningful items. Precisely which end of this oppositional dimen-

sion will be extended in the task at hand depends on the subject's predication of this task from the outset. Thus, in line with LLT, if the subjects under investigation are well adjusted, who presumably frame their ongoing circumstances positively, then it is likely that their affective learning styles will reflect better recall of pleasant than unpleasant materials (Rychlak, 1966, 1975; Rychlak, Williams, and Bugaj, 1986). On the other hand, when the subjects are maladjusted (schizophrenics, manic depressives) or normally adjusted with negative self images, in which case a negative predication of life circumstances predominates, we have shown that *unpleasant* materials are recalled more readily than pleasant materials (Rychlak, Carlsen, and Dunning, 1974; Rychlak, McKee, Schneider, and Abramson, 1971).

The typical theoretical strategy today in cognitive psychology is to analogize empirical findings on human beings to a computer's hardware apparatus. Craik and Lockhart's interpretation of semantics as involving a "triggering" of associations is a case in point (see above). Such triggering seems to be the cause and the resultant meanings (semantics) under associative processing, the effects. The problem with such associationistic explanations is that they rely ultimately on a "frequency of contact" explanation and *not* on semantics. Semantics cannot really be triggered, unless we mean by this "logically suggested, deduced, implied," etc. But meanings are not triggered into action like the flipping of a light switch illuminates a room. The computer is literally triggered into processing action, of course, and it "knows" no meaning/information in its basic hardware whatsoever (Shannon and Weaver, 1962, pp. 3; 99). On the other hand, in a predicational process—which is logical rather than mechanical—meaning is the cause and not the effect of what is taking place. Logic has necessary or "automatic" features, but it cannot be said to be a mechanism. Logic begins and ends in meaning. It makes no sense to speak of predication unless meaning is involved.

A recurring embarrassment for associative network theorists is the fact that opposites are supposedly "distantly arrayed" in the network because they presumably relate to different nodal complexes, quite removed from each other (see Wyer and Carlston, 1979, for a theory of this ilk). Yet, we have known for some time now that in controlled association tasks the average reaction time is shorter and there is less variation in response to words that have opposites (i.e., antonyms) than to those that do not (see, e.g., Karwoski and Schachter, 1948). This finding would suggest that opposites are *closely* related in the network. Network theorists view such nodal meaning as a singularity, attached to some other nodal meaning as if apposite (i.e., side by side) items had been connected by two lines. Thus, in a pairing such as pleasant–unpleasant the assumption is made that there is a path going from the former "to" the latter, and an entirely different path going in the reverse direction (see Wyer and Carlston, 1979, pp. 72–73). Logical learning theory, on the other hand, con-

tends that oppositionality is *not* mere apposition, and hence there is only *one* pathway of meaningfulness uniting "pleasant" to "unpleasant." There is a basic difference here in how *disjunction* (i.e., the creation of alternatives) is to be understood.

Computer modeling follows the mathematical assumptions of a Boolean algebra, where disjunction means "either-or, but not both," so that the sum-total of events x and y would be $x + y$ excluding those cases that would be *both* x and y (Reese, 1980, p. 64). This "hard" interpretation of disjunction, fundamental to the binary logic of the computer, is why the network theorist finds it necessary to postulate *separate* pathways joining opposite meanings. Computers never "reason" oppositionally and hence a computer analogue cannot embrace oppositionality (Rychlak, 1991). By accepting oppositionality as intrinsic to predication, LLT invites a softer form of disjunction in which x and y stand apart meaningfully, but yet they are also closely allied because they intrinsically enter into each other's delimitation, thereby lending to each other's definition (the case of "both x and y"). Returning to our Euler-circles model, we always have the encircling meaning delimited by the non-circle meaning, and vice versa. This is why we find such strong associations taking place between opposite word meanings.

Lack of appreciation for this matter of intrinsic oppositionality has resulted in psychologists failing to understand what was at work in their data. For example, using words with either strong or weak associations to each other, McCullers (1965) was surprised to find *less* associative interference in a paired-associates task for his strong than his weak pairs. He had expected the reverse finding, but when we look at his pairs we find that two-thirds of his strongly associated words were opposites (e.g., different–same) and none of his weakly associated words were opposites. Watkins and Tulving (1975) reported data in which a cueing procedure was used. The strong-cue condition was loaded with about 40% opposites (e.g., dark–light, closed–open), whereas the weak-cue condition had no such opposites included. Just as in the present research, the resultant findings are explicable in terms of the heavy role played by such oppositionality, but no mention of this fact is made in the theoretical analysis.

Countless studies in the literature refer to "strongly associated" or "highly associated" word pairings being used (including Hyde and Jenkins, 1969), without listing the actual words employed. One can only wonder how many of these investigators benefited from the heuristic properties of oppositionality without knowing it. Even when opposites are clearly central to the research design, as in Osgood's (with Suci and Tannenbaum, 1957) wide-ranging studies, no mention is made of the possibly unique role that opposition has to play in human cognition when we position words within contexts like good–bad, strong–weak, or active–passive.

The writers have had an interesting reaction to the present research findings from colleagues who are committed to the depth, elaboration, or spreading activation explanation of cognitive processing. From the latter's perspective, "oppositionality" in cognitive organization and recall is simply another variable to be taken into consideration along with many other variables such as the "distinctiveness" of the words used, their "familiarity," and so forth. There is a *process* versus *content* issue which underwrites this attitude, an attitude that effectively minimizes the role of oppositionality in human cognition.

Thus, it is the claim of LLT that oppositionality is within the very *process* of predication, even as the *contents* of this process also reflect opposition in meaning. The words "decisive–indecisive" are framed according to oppositionality, or opposite meanings. But, as we have outlined above, this is *not* what we mean by the functioning of oppositionality in the predicational process. Words are contents in this process; they can reflect duality or singularity of reference. The words "decisive–victory" are also the contents of a predicational process, though they do not reflect opposite meanings. The words are formulated contents of the predicational process, literally a creation of this process. They express (symbolize, etc.) a meaning, and that meaning can always be countered through further processing (i.e., we could negate the meaning of "decisive–victory" with a phrase like "pseudo–victory" or "empty–victory"). Such countering would reflect the oppositionality of the *process* of cognition, and not simply other words with contradictory meanings. The predicational process—encompassing oppositionality—always creates the meaning being expressed, which may be either oppositional or non-oppositional in content.

The colleagues referred to above have a different understanding of the cognitive process than does the LLT advocate. They follow a *mediation* model of explanation. On the latter model, *something formed outside a process is taken in and comes to play a role in that process that is not intrinsic to it* (Rychlak, 1988b). The process under description in the mediation model is not conceived as the immediate creator of what is to be active within it, but rather as the conveyor of that which it takes in as given and on the basis of which it proceeds. The meanings under processing are always mediate since they are never aligned or framed by the process per se, but are merely *employed* by this process. The meanings under conveyance by a mediational process are always taken in whole hog, as given meaningful units that exist in their original form even before being taken in from environmental or biological sources. The mediational process never articulates or forms such meanings.

After taking in *Alice* and *reliable*, and a few other connecting words like *is*, the mediational process can somehow combine these "freestanding" word units—functioning now as *contents*—into the sentence "Alice is reliable."

This alignment of meanings (Alice, reliable, etc.) supposedly occurs strictly on the basis of factual incidents, on unipolar inputs that have been brought into the mediating process from past experience. It is *frequency* and *contiguity* of contact that account for why a statement like "Alice is reliable" is formulated. And so it is that anything that will increase the familiarity, pronounceability, distinctiveness, elaborative richness, depth, etc., of the words (*contents*) used in such statements will increase the likelihood of a memorial retention of these words or of the statements that they make up. And all such "variables" are, in the final analysis, measurable reflections of the frequency and contiguity of past inputs—that is, *contents*—of the mediational process. Oppositionality would be consigned to the role of just one more such content measure, and, given the Boolean bias of the mediation model, a very uncertain measure at that.

The LLT advocate, on the other hand, argues that cognition is fundamentally involved with oppositionality as a reasoning process, and secondarily, as a content within that process. The evidence of the present experiments nicely supports this line of argument, and we believe that the future holds considerable promise for the study of predication and opposition in human cognition. Surely the image of humanity which results when we take predication and oppositionality seriously is vastly different than when we limit our descriptions to the quasi-engineering, mechanical formulations of the mediation model. Organisms that can think to the opposite of their inputs quite spontaneously, without additional inputs, as a further aspect of this cognitive process, can be described in agential terms, as capable of setting the grounds for the sake of which they will be determined. This matter of whether human agency is possible or not reflects the ultimate confrontation between LLT and its opponent theories relying on the mediational rather than the predicational model.

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