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1. AGENCY USE ONLY (Leave blank)		2. REPORT DATE March 1993	3. REPORT TYPE AND DATES COVERED THESIS/DISSEMINATION	
4. TITLE AND SUBTITLE Schemata versus Dichotomous Constructs as Organizational System in Memory			5. FUNDING NUMBERS	
6. AUTHOR(S) David L. Van Brunt				
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) AFIT Student Attending: Memphis State University			8. PERFORMING ORGANIZATION REPORT NUMBER AFIT/CI/CIA-93-098	
9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES) DEPARTMENT OF THE AIR FORCE AFIT/CI 2950 P STREET WRIGHT-PATTERSON AFB OH 45433-7765			10. SPONSORING / MONITORING AGENCY REPORT NUMBER	
11. SUPPLEMENTARY NOTES				
12a. DISTRIBUTION / AVAILABILITY STATEMENT Approved for Public Release IAW 190-1 Distribution Unlimited MICHAEL M. BRICKER, SMSgt, USAF Chief Administration			12b. DISTRIBUTION CODE	
13. ABSTRACT (Maximum 200 words)				
14. SUBJECT TERMS			15. NUMBER OF PAGES 33	
			16. PRICE CODE	
17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT	

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AUG 6 1993
S e D93-18106

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Schemata versus Dichotomous Constructs as Organizational Systems in Memory

David L. Van Brunt, William Marks, Robert A. Neimeyer, and Ken White

Memphis State University

March 8, 1993

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RUNNING HEAD: SCHEMATA VS. DICHOTOMOUS CONSTRUCTS

Abstract

The nature of representational systems in memory was studied using a categorical form of the repertory grid and a perceptual identification task. Forty undergraduate psychology students completed a computer-administered repertory grid in which they provided attribute words to the names of 15 people (elements) familiar to them. They then categorically assigned the words to each element based on applicability. A computerized perceptual identification task was administered one week later to investigate priming effects. Conditions containing element-relevant, element-opposite words and subject-generated neutral trait words were compared, with baseline priming effects measured through the comparison of non-generated words to which the subject received prior exposure, and novel irrelevant words. This design enabled a direct comparison of schema theory and personal construct theory, with each carrying unique predictions for outcome. While both theories expected significantly greater recall of element-relevant words when compared to element-neutral, irrelevant, and previously seen words, the dichotomy corollary of personal construct theory additionally predicted priming effects for element-opposite words. Results indicated significant priming effects for element-relevant and element-opposite words when compared to element-neutral words or other controls.

Schemata versus Dichotomous Constructs as Organizational Systems in Memory

One step toward understanding the organization of memory about self and others is to find an experimental situation that effectively pits two theoretical predictions against one another so that only one can effectively explain the outcome. Such a comparison is possible in the cases of personal construct theory, which states that units of memory take the form of bipolar constructs, and schema theory, which states that knowledge is stored categorically with schema-relevant information grouped together.

George Kelly's (1955) personal construct theory states in its dichotomy corollary that a person's cognitive system is composed of a finite number of dichotomous constructs. A construct contains two contrasting poles (e.g., brave vs. cowardly, trustworthy vs. deceitful), and provides a way to interpret a selected range of events. A person forms dichotomous constructs through life experience, and uses them to classify and interpret events. In so doing, it is emphasized that "the differences [between selected items] are just as relevant as the likenesses" (Kelly, p. 63). This corollary, especially when used in reference to knowledge about others, has been investigated in recent years. Rychlak (1992) has summarized several studies that examine the notion of what he called *oppositonality*. *Oppositonality* was defined as occurring when one targeted item in a bipolar relation delimits and hence enters into the definition of the other item in the relationship, and vice versa. An example would be that *dark* is the absence of *light*. Thus the less light something is, the more dark it is.

One example of research testing oppositionality in memory was done by Slife, Stoneman, and Rychlak (1990). They tested the dichotomy corollary using an incidental learning task, in which subjects completed an evaluative task involving the comparison of a predicating (or priming) word to a list of words that were either relevant, opposite, or irrelevant to the predicating word. When unexpectedly asked to recall as many words as possible, subjects recalled significantly more of the opposite and relevant words than irrelevant words. These results suggest that dichotomous constructs were active units of memory, since personal construct theory states that both poles of a construct would be activated in memory when one pole is activated. It is this feature that sets personal construct theory apart from schema theory.

Schema theory is based on similarity rather than opposition. Alba and Hasher (1983) described this notion as follows:

What is unique is the prediction made about the memory representation that is the product of interpretation. A single integrated memory representation is thought to be created from whatever accurate information is selected, whatever interpretations are drawn, and whatever general knowledge exists that is *relevant* to the stimulus. Thus, individual ideas exist only as a part of a complex semantic whole. (p. 210, italics added).

Therefore, according to schema theory, units in memory are grouped by similarity, or relevance. However, the role of contrasting meanings as a part of the encoding process is not included in existing schema theories. The presence of schemata has been thoroughly researched, and the theory of schemata has received widespread

support (for reviews see Fiske & Linville, 1990; Alba & Hasher, 1983; and Casson, 1983).

Despite its usefulness as an explanatory framework, schema theory remains open to examination and refinement. Though the theory has obtained support in the literature mentioned above, the findings of those studies are also easily accommodated by the tenets of personal construct theory. The reverse, however, is not true. Schema theory does not accommodate the results of research supporting the oppositionality of personal construct theory. For the purpose of this study, the issue of contrast is the primary difference to be tested between the two theories.

Millis and Neimeyer (1990) examined oppositionality in memory with their comparison of propositions to dichotomous constructs. In doing so they used subjects' speed at making lexical decisions to determine if words that were opposites to a prime's characteristics (opposing construct poles) and words that were not opposites (propositions) would receive similar response times compared to neutral control words. Thus their research compared propositions (i.e., *this person is kind*) to dichotomous constructs (i.e., *this person is kind, not cruel*) as basic units of memory. It may be more accurate to describe these as units of *meaning* within memory, since both propositions and constructs contain both an object and some definition of the object. Their results indicated oppositional processes. However, they addressed oppositionality as a function of memory structure rather than procedure, and addressed this structure at the level of units of memory. The current study broadens the scope of memory research on oppositionality by addressing schemata and constructs as *representational systems* in memory, and by examining each representational system in a manner that will

separate it from both bias by subjects' own retrieval processes, and from other known memory and recall phenomena (i.e., repetition priming, generation effects). Addressing the former requires the use of a different type of memory test than those commonly used in recent years. Addressing the latter involves the introduction of new control conditions in addition to the ones used by Slife, Stoneman, and Rychlak (1990) and Millis and Neimeyer (1990). Each will be discussed in turn.

Slife, Stoneman, and Rychlak (1990) used an incidental free recall memory task in their examination of oppositionality. A test of free recall as used by Slife et al. is known as an explicit test of memory. It is defined as an explicit test because subjects pay explicit attention to a study or learning event. Conscious and willful reference is made to the context of information presentation. Recently, however, implicit measures of memory have become more widely used. Roediger (1990) has suggested that the use of implicit measures of retention assess priming from past experience on tasks that do not require conscious recollection of recent experiences for their performance. Richardson-Klavehn and Bjork (1988) defined implicit memory tasks as those that involve no reference to an event in the subject's personal history (unlike explicit tasks) but are nonetheless influenced by such events. Richardson-Klavehn and Bjork indicated that such tasks require the subject to demonstrate conceptual, factual, lexical, perceptual, or procedural knowledge, or to make an affective or cognitive judgment that would be influenced by the encoded material. Priming for information in an implicit task causes a change in performance resulting from the presentation of information related to test stimuli. The advantage of testing memory representation in this manner includes the

elimination of possible confounds caused by subject expectations, rehearsal strategies, or conscious episodic recall processes.

Millis and Neimeyer (1990) compared dichotomous constructs to propositions using the implicit measure of a lexical decision task. Subjects were "primed" for a particular construct or proposition by being shown the first names of people that had been used on a rating grid. Following each priming, they were administered a lexical decision task in which their response time for identifying the target word as being a real word or a nonword was used as the dependent variable. The lexical decision task employed by Millis and Neimeyer is one of many possible implicit tests of memory. There has been recent discussion, however, on the variability of performance between different implicit measures of memory (Roediger, 1990). Although implicit tasks are generally considered data-driven (relying primarily on physical features of encoded events) and explicit tasks are conceptually driven (relying on mental reconstructions of the study episode, and including information about the context of encoded events), more recent evidence indicates that there is a continuum of sensitivity along these different forms of processing (Schwartz, 1989).

The perceptual identification task is a different implicit measure of retention. Perceptual identification requires the subject to identify a stimulus word following a brief visual exposure to that word. The word is presented to the subject at a duration below the visual threshold for identification (i.e., presented faster than conscious reading ability can accommodate). When asked to identify the word, the subject takes a "guess," which is more likely than chance to be correct if the word has been successfully primed. If a word is primed, it is already slightly closer to

consciousness and is therefore more likely to be identified (Jacoby, 1983). If different types of information are presented, the type of information that shows priming effects gives an indication of what aspects of encoded events are most active in memory.

The task of priming for constructs or schemata in perceptual identification is a blend of conceptually driven and data driven operations. The task is conceptually driven in the sense that primes serve as contextual cues. More specifically, the constructs or schema attributes are generated within the context of a particular element or character, and are retrieved within the same context when the element name is used as a prime. For example, when thinking of a friend, a subject might generate the attribute word "outgoing". During the test, the subject would be primed with the friend's name, reactivating the contexts of the original impression formation as well as the generation event (providing the attribute word). The perceptual identification task is data driven because subjects are asked to identify stimuli to which they have had prior exposure, and the unique graphical characteristics of the word may serve to drive recall. In the example, above, the word "outgoing" has two descenders (features that extend below the line of text, like the lower portion of the letter "g") which fall in the center and again at the end of the word. Perception of this graphic cue narrows the range of possible correct responses, and aids identification.

While remaining sensitive to stored information, the perceptual identification test is more conservative from a subject's perspective than lexical decision because of the increased difficulty in finding a correct or acceptable response. In lexical decision there two possible answers, either yes or no, but reaction time is used as

the dependent measure. With perceptual identification, however, the correct answer could be any word within the subject's vocabulary. Thus the dependent variable is simply accuracy of identification. If any particular word type is primed, it will be identified at a level greater than chance. Given the number of words in the English language, the odds are greatly against a randomly correct guess. Considering these odds, it is possible that oppositionality may not be evident using this difficult procedure.

Using the more conservative perceptual identification task, our own pilot study using 31 subjects failed to confirm the oppositionality evident from the Millis and Neimeyer (1990) results. Target words for identification were selected by the same repertory grid sort used by Millis and Neimeyer. The traditional repertory grid determines the relevance of words to a given name using a Likert type scale anchored at each end by opposing construct poles (i.e., *generous* 6 5 4 3 2 1 0 1 2 3 4 5 6 *stringy*). Neutral words were those lying in the center of scale (values of 0, 1, or 2 in either direction). Relevant words were words that were rated at extreme ends toward a given construct, and opposites were rated at the far pole. For our pilot study, a control condition of non-generated irrelevant random words was added (not to be confused with the neutral words, which subjects generated). With the repertory grid serving as a rating form for extracting attributes for people known to the subject, our pilot study showed priming effects for words that were relevant, opposite, *and neutral* to the priming names. However, there were confounds that may have facilitated identification on *any* of the three experimental conditions. One immediately apparent issue was the presence of simple repetition priming. Repetition priming is defined as the facilitated performance on a test due to prior

exposure to the test material (Forster & Davis, 1984). If one set of words received more attention than another, the attended set would have an increased identifiability. In Millis and Neimeyer and our study, stimulus words drawn from the repertory grid received more attention than control words due to multiple exposure during the completion of the repertory grid. The increased "study" across conditions would easily explain how both relevant and opposite words could receive priming, but it would also cause increased priming in the neutral condition. Although Millis and Neimeyer did not see priming effects in the neutral condition, our pilot study (which used the same operational definition of neutral) did.

According to Yorke (1989, 1992) and our pilot study, neutral items generated in the fashion described above may not actually be neutral in the sense intended; namely, that neutral is the same as "does not apply." Yorke proposed that a rating of zero on the repertory grid could have one of 14 possible meanings, some of which are described below. Only one of the possible meanings can be considered "neutral" in the fashion of "not applicable." With all potential meanings for any midpoint rating combined into the neutral condition, many of the alleged neutrals may have been no different from the relevants or the opposites. An example would be if a person rated a friend at the midpoint on a scale from *energetic* to *lethargic* when the friend was in fact manic depressive. In this case, both poles can be considered relevant depending on the time of evaluation. Similarly, a person may rate a friend at the midpoint on a scale ranging from *obsequious* to *aggressive* if their friend was more appropriately described as *assertive*, which is construed by the rater as opposite to either concept. The situation is further complicated when two poles to a construct are generated in one

context, then applied in another. In the example above, *obsequious* to *aggressive* may seem like an appropriate contrast in the context of one set of names, but the contrast pole of *selfish* may be more appropriate when thinking of someone else on the grid. In this case, the rater is forced to make a decision outside of the range of convenience of the supplied construct. Yorke (1989) would describe this as a situation involving a bent construct, one in which more than one contrast pole is possible. Given all of these possibilities, either personal construct theory *or* schema theory could explain a priming effect in the neutral condition. As defined in our pilot study and Millis and Neimeyer (1990), the neutral condition may have been nothing other than a combination of words meeting the criteria of the other two conditions, making it probabilistically equal to the mean of those conditions. Although the data did not show it to be exactly so, Figure 1 shows this to be the trend in our pilot data. What is needed to test the two theories of interest, then, is a truly neutral condition.

Insert Figure 1 about here

In order to be truly neutral, a construct must be something that simply does not apply to the person being evaluated: a quality the person does not possess. Unfortunately, the Likert scale repertory grid does not give subjects the freedom to choose this option. Anchored at each end by opposite words, subjects are forced to make a value rating where at times none is appropriate. The result is a midpoint with multiple potential meanings, introducing a possible confound into the data. Suppose a subject is asked to think of a person, then rate that person on a scale of

generous 6 5 4 3 2 1 0 1 2 3 4 5 6 thrifty. A rating of "0" could mean: a) the person possesses a perfect balance between generosity and thriftiness; b) the person is generous at times and thrifty at others; c) the person has never been considered along this dimension; or d) the person possesses neither characteristic. The various meanings cannot be distinguished using the traditional grid. Using a categorical version of the repertory grid, however, avoids this problem.

A categorical repertory grid involves not the value rating of elements on particular traits, but rather the assignment of traits to given elements. Within the context of a given name, subjects are shown lists of words that they generated. They are then asked to choose all words that apply to the named element. By doing the rating in split-halves, on the first time through the name list using a list of subject-generated words (emergent poles) and the second time using the respective subject-generated contrasts (contrast poles) to those words, the problematic blends discussed by Yorke (1992) can readily be identified. The blends will be the cases in which on any bipolar construct for any given element the subject selects *both* contrasting poles. Those instances in which *neither* pole is selected represent the true neutrals.

The use of a categorizing task for the repertory grid has both costs and benefits. As a cost, one loses the qualitative value of a rating. A subject may be more willing to rate someone on a negative trait if it is possible to do so to a small degree. As a benefit, one gains the ability to discriminate between true neutrals and those that were rated such because competing poles both had relevance. Since this study seeks to compare categorical conditions of word types to one another, the strength of this technique far outweighs its weakness.

Although there is a considerable literature within the constructivist tradition on the use of the repertory grid to elicit constructs, this method has not been described in the literature for schemata. One issue of concern remaining, therefore, is the use of any form of the repertory grid as a method of eliciting schemata. There are numerous studies available, however, that have used attribute words or similar stimuli for the construction of narrative concepts. One classic example of this was provided by Asch (1946). In his studies of impression formation, he presented subjects with a list of attributes (assured, talkative, cold, ironical, inquisitive, persuasive), and instructed them to form an impression of the person described and write a characterization. The subjects were able to form a unified impression. "Though he (sic) hears a sequence of discrete terms, his impression is not discrete. In some manner he shapes the separate qualities into a single, consistent view" (Asch, 1946, p. 261). The repertory grid exercise is clearly a reversal of this sequence, taking the already unified views that a person holds and extracting attributes from them. With this in mind, the repertory grid can be viewed as a valid method for obtaining both construct and schema information that pertains to people familiar to a subject.

The aim of this research is to test the theory of bipolar constructs against schema theory using a categorical version of the repertory grid and the perceptual identification task. Each theory has a clear expectation of outcome. According to schema theory there should be a definite perceptual advantage for words used to describe each individual. Once the schema of a particular person has been activated, relevant characteristic traits that pertain to that person should be primed. Non-relevant words (opposites or otherwise not relevant) should show little or no

priming effect above simple repetition priming or generation effects (enhanced performance due to subject generation of target words; see Schwartz, 1989). Fewer non-related words should be correctly named on the identification task. According to personal construct theory relevant traits as well as their polar opposites will show priming effects. A significantly greater number of relevant and opposite words will be identified correctly in comparison to unrelated words in the perceptual identification task.

Expected outcomes from each theoretical perspective are summarized in Table 1.

Insert Table 1 about here

Method

Subjects:

Subjects were 40 undergraduate general psychology students who received extra credit toward their semester grade for participation. Of those who came to both sessions to complete the procedures, 4 were unable to perform the perceptual identification test and were consequently not included in the analysis.

Apparatus:

This experiment used an IBM-PC compatible computer with software for administering a categorical form of the repertory grid, as well as the perceptual identification task using programmable stimulus display duration.

Procedure:

Session one: categorical repertory grid

Following completion of a consent form, a brief explanation of the experiment as a test of perception, personality, and emotion was given. Subjects began the first session by entering a list of 15 names of people familiar to them into the computer repertory grid program. The instructions were to provide a list containing the names of people that they both liked and disliked in order to avoid the generation of solely positive characteristics on the emergent construct poles.

Following the elicitation of names, the computer presented subjects with randomly assigned pairs of the names they had provided. Subjects were instructed to enter a one-word description of how the two people were alike (emergent pole). In the event that subjects were unable to provide a word in this manner, they were offered the option of entering the trait that made the two people different from one another. They were told that the purpose of this part of the experiment was simply to get a list of both positive and negative words that they use to describe and think of people. Subjects provided ten such words, and were then required to simply "enter the opposite" (contrast pole) to each of the words they provided.

The grid was completed by a series of categorical assignments. The computer displayed each name in turn, along with a list containing one-half of the provided words (the emergent poles, or first words provided). The opposites were not displayed concurrently to minimize comparison and maximize honest evaluation of each trait. Subjects used a mouse to select anything they considered applicable to the target name. The cut off criteria were left to each subject, with the instruction to simply "check all that apply." If a subject did not feel that a given trait word had sufficient applicability to the target name, it remained unselected. Subjects were

encouraged to be somewhat liberal in their assignment of attributes, so that the remaining non-assigned constructs could be confidently placed into a neutral condition. After completing the 15th name using the emergent pole words, the task was repeated using the contrast poles (opposites). Subjects were instructed again to simply select all that applied.

Following the rating task, subjects completed a "processing speed test" that was actually a simple word sorting task. This test was included to reinforce the cover story of the experiment as a test of information processing speed, and to provide exposure to a list of words for measurement of repetition priming effects. Subjects counted the number of vowels in 33 random words, and were then required to sort the list into alphabetical order. The exercise was timed in order to give the test face validity. Subjects were reminded that the purpose of the experiment was to see how personality was related to perceptual and information processing speed. Subjects were contracted to return in one week for the perceptual skill and speed test.

During the interim, the computer program sorted the grid into a series of prime-target pairs to be used in the perceptual identification test. Words that the subjects checked as applicable to a given name were considered "relevant" to that name. Unselected words whose opposites were selected in the context of the same name were considered "opposite" to that name. Cases in which both a word and its opposite were selected as applicable to the same name were considered potential blends as defined by Yorke (1992) and were disqualified from being eligible prime-target pairs. In cases where *neither* pole was selected as applicable to a given name, *either* word was considered "neutral" to the name.

The perceptual identification test was constructed using 15 relevant, 15 opposite, and 15 neutral prime-target pairs. In addition, 33 random nouns different from the 33 sorted words were paired randomly with names from each subject's grid and included in the perceptual identification test. The purpose for using these additional words was threefold. First, they provided a baseline for identification. They provided referent conditions to determine if words that were primed by either repetition or generation would be more identifiable than random words. In a sense, it was a measure of perceptual skill. Second, it allowed for the determination of whether priming effects caused by schematic or construct activity were greater than that caused by repetition priming. Third, they served as distractors to prevent subjects from guessing the source of the target words (the grid). Keeping the subject blind to the source of target words was essential in discouraging a guessing strategy of simply saying what was put on the grid, and to ensure that the perceptual identification exercise remained an implicit one. Reference to the "study period" would by definition make the task explicit. All prime-target pairs were then put into random order for the perceptual identification test.

Session two: perceptual identification

Following the week-long delay period, subjects returned for the perceptual identification test. They were first given a pretest for identification to determine the appropriate speed for the stimulus onset asynchrony. For the pretest, subjects were primed using the names of celebrities (e.g., Michael Jackson, Captain Kangaroo), and the target words were random nouns (e.g., pacific, gun). Subjects were given the correct answer after they attempted each trial, for the purpose of discouraging a

relevant bias guessing strategy. Subjects were pretested with different sets of prime-target pairs at each of the 3 different speeds. The speeds used were one, two, or three video refresh cycles (approximately 17, 34, and 51 ms, respectively). The speed for the actual experimental trials was selected by matching the speed of the pretrial in which the subject received less than half but more than zero correct out of 12. This rather stringent cutoff score was used to allow for the inevitable increase in subject perceptual skill over the 111 experimental trials.

Each experimental trial consisted of the presentation of a priming name, followed by a 3 second period in which the subject was to "think about the person, and get a mental impression of what they are like." This orienting activation period was followed by a fixation period of 2 seconds during which time the subject fixated within a set of brackets in the center of the computer screen. After the fixation delay, the target word appeared in the area between the brackets and remained for a duration of one, two or three video refresh cycles (as determined by the pretest score). The word was then immediately covered by a series of X's, at which time the subject was instructed to guess the word. Accuracy of identification (number correct) was recorded as the dependent variable for each condition. Subjects were encouraged repeatedly to make guesses based on what they actually saw rather than what they felt "belonged" with the word. This instruction was given to counter the tendency displayed by all subjects to say a descriptive word as a default (often before the target word was even displayed).

Following the 111 experimental trials, subjects completed a brief questionnaire to determine if a biased guessing strategy was used. In addition, the average target word length was computed for each condition for examination as a

possible covariate with accuracy of identification. Since other potential covariates, such as familiarity with priming elements, target word desirability, and frequency of prime use were not significant in the pilot study, they were not included for analysis.

Results

Percentage accuracy scores in each condition were computed for each subject. The *a priori* assertions by each theory predicted differences between words that were generated (relevant, opposite, and neutral words) and those that were not generated and served as baselines for identification and repetition priming (irrelevant and prior exposed words). Comparisons were all made within subjects, with each subject serving as their own control.

Mean accuracy scores for each condition were .507 for the relevant condition ($SD = .266$), .478 for the opposite condition ($SD = .261$), .426 for the neutral condition ($SD = .251$), .260 for the primed condition ($SD = .186$), and .195 for the irrelevant words ($SD = .167$). A graphical representation of this can be found in Figure 2.

Insert Figure 2 about here

As recommended by Cohen and Cohen (1983), the data would need to be transformed in any analysis involving all five means, since the means of the five conditions did not share a common denominator and there was no clear majority of

observed proportions within the range of .25 to .75. (In the analysis of the *a priori* assertions below the use of transformations was unnecessary when comparing the three experimental means. Since each value shared the same denominator, the adjustment to a percentage was uniform over the range.) An arcsin transformation of the data yielded a mean of .580 for the relevant condition ($SD = .369$), .528 for the opposite condition ($SD = .321$), .471 for the neutral condition ($SD = .326$), .270 for the repetition primed condition ($SD = .201$), and .201 for the irrelevant condition ($SD = .179$). A graphical representation of the transformed means can be found in figure 3.

 Insert Figure 3 about here

A within subjects multivariate analysis of variance of the five transformed conditions indicated significant differences between conditions with $F(4,140) = 32.60$, $p < .001$. Effects were visible for simple repetition priming, with the primed condition showing greater identification than the random irrelevant condition with $t(35) = 4.53$, $p < .001$. Additionally, a generation effect was evident in the mean of all three subject generated conditions pooled ($M = .470$, $SD = .245$) compared to the non-generated conditions ($M = .228$, $SD = .171$) with $t(35) = -7.31$, $p < .001$. Neither gender nor subject hypothesis guessing (as measured by a post-experiment questionnaire) interacted with identification, with $F(2,68) = 1.07$ n.s. and $F(4,66) = .12$ n.s., respectively. Given the *a priori* hypotheses mentioned above, a oneway repeated measures analysis of variance using the within subjects error was run with specified contrasts to determine the differences among the three

subject-generated experimental conditions. The omnibus F indicated differences between the three conditions with $F(2,70) = 6.0636$, $p < .01$. There were no significant differences between the relevants and opposites, with $t(70) = -1.230$, $p > .05$. However, there were significant differences between the relevant and neutral conditions and the opposite and neutral conditions, with $t(70) = -3.437$, $p < .01$ and $t(70) = -2.206$, $p < .05$ respectively.

In the above analysis, the data were analyzed on a confirmatory basis. An alternative, more conservative approach would be to treat all analyses as exploratory. A oneway repeated measures analysis of variance using the five transformed means and the within subjects error term was done using Fisher's LSD range test to determine where differences existed between conditions. The transformations involved in this method of analysis increased variance and resulted in lower F values. In fact, this analysis did not detect priming effects for repetition priming (irrelevant = primed) at the .05 level, nor did it detect a difference between the neutral and opposite conditions as was the case in the previous analysis. Homogeneous subsets were irrelevant and primed, neutral and opposite, and opposite and relevant. The relevant condition showed significantly greater identification than the neutral condition at the .05 level.

Discussion

The results of this study indicate the presence of priming effects on the perceptual identification task. Simple repetition priming was evident, as well as an effect for subject generation of words, indicating that this was a valid memory measure. The results mentioned above further indicate that the priming effects seen by the priming of schemata or constructs occurred in addition to repetition priming

and generation effects, since in both analyses the neutral subject-generated words were identified less well than the relevant subject-generated words, and in the first analysis they were identified less often than opposite words as well.

The results of our primary analysis support the presence of oppositional processes in representational systems of memory. However, the results must be interpreted cautiously. In the case of our second analysis, if one ignores the *a priori* hypotheses, oppositionality is no longer strongly supported. The trends are still in the predicted direction, however, with the opposites falling into homogeneous subsets with both relevants and neutrals. This pattern more closely resembles the predictions of the "weaker case" supporting oppositionality seen in Table 1. The danger of Type II error exists in the more conservative analysis, however, as evidenced by the failure to detect the well-documented effect of repetition priming (Richardson-Klavehn & Bjork, 1988; Forster & Davis, 1984). It is possible that given more statistical power, the differences would become more evident and the opposites' identification scores would be homogenous with the relevant words, as evident in the first analysis.

One alternative hypothesis remaining to explain our data is that oppositionality is occurring in addition to schematic processes. There is little doubt that when given a word or concept, related items come to mind. This is evident not only in the abundance of support received for schema theory in the years since its introduction, but in everyday experience as well. Many of the subjects in this experiment, when frustrated by the difficulty in identifying the rapidly presented words, would naturally default to a schema-biased guessing strategy. In one example, a subject was presented with the name "George Bush" in a pretest, and

responded "president" seconds before the target word was even presented. Albeit to a lesser degree, the opposite sometimes occurred. Some subjects responded to names by guessing the opposite to how they had rated that name. Often they would clarify to the experimenter that they really didn't feel that way about the person, but that they felt obliged to "go with what [they] saw." Although subjects most often adopted a guessing strategy of providing prime-relevant information, the presence of prime-opposite responses supports the idea that at some level an oppositional process is occurring. It is noteworthy that each of the words provided by subjects had multiple possible "opposites" as determined by the context. This experiment, as any, contained multiple levels of context that could have contributed to the results. One might argue, therefore, that the construct systems measured here operated within a specific schematic framework.

As designed, each trial occurred within the unique and specific context of the name of a person familiar to the subject. Despite this heterogeneity, however, there was also one noted homogeneity of context that carried across all trials in all conditions. The context of the experimental setting may also have served as cue for recall, or as a priming agent. From the schematist perspective, one may argue that the creation of opposites during the grid procedure created a context for opposition that was reactivated when the subject returned for the second session. If this were the case, one might see the obtained pattern of results as evidence of a single schema being activated (context of experimental procedure) with several smaller schemata (name-target) within. The activation of the former could potentially influence the outcome of the latter. The above experiment is unable to separate such

possibilities, however, and further modification of the experimental method would be required to see if such a process is occurring.

From a constructivist perspective, even the above argument may not discredit the idea of oppositional processes. If an experimental context for the providing of opposites was indeed activated, this process would still be occurring at a rapid rate, below conscious control. Considering the speed of the task, this oppositionality would need to occur almost at the perceptual level, and may even be occurring at such a level as to serve as kind of perceptual filter. Whether or not it was activated by a schematic context becomes immaterial if the oppositionality occurs naturally by whatever schemata we routinely activate in day to day living. The only way to test this, however, would be to recreate the experiment; while somehow shielding subjects from the formation of an "oppositional process" schema. An experiment such as this one would require the subjects' belief that the second session was an entirely different experiment. The argument for oppositionality as a routine process would remain supported if results were comparable in this latter scenario.

One last idea to consider is the possibility of individual differences in cognitive styles. Though the aggregated data here indicate oppositionality within our experimental context, it is possible that some members of the subject sample were operating wholly on a schematic system. This study found no interaction with gender or with the presence of a correct hypothesis guess, but perhaps other unmeasured variables would show significance. Until other common factors or alternative explanations can be supported, however, the presence of oppositional processes seen both in our data and those of others addressing oppositionality

cannot be easily dismissed. Oppositionality deserves serious consideration in future theory development.

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Table 1. Contrasting theoretical predictions of accuracy scores in perceptual identification for words under five conditions.

Theory	Prediction
Schema Theory	$R > (O = N) > P > I$
Construct Theory (strong case)	$(R = O) > N > P > I$
Construct Theory (weaker case)	$R > O > N > P > I$

Note: R = words that are relevant to, or descriptive of the primed element;

O = words that are opposite to the description of the primed element (rated on the opposite construct pole);

N = words generated by the subject that are neutral, or unrelated to the primed element (as determined by the subject on a rating task);

P = words to which the subject has received prior exposure, but did not generate. These words are a control for repetition priming;

I = random nouns used as baseline for perceptual identification.

Figure 1.

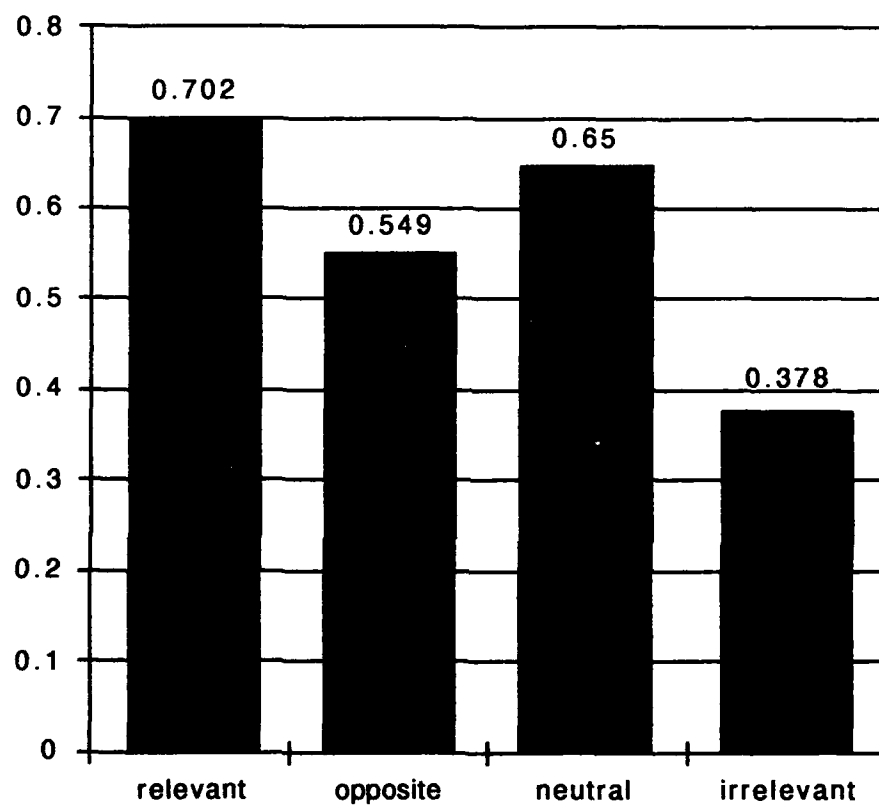


Figure 2.

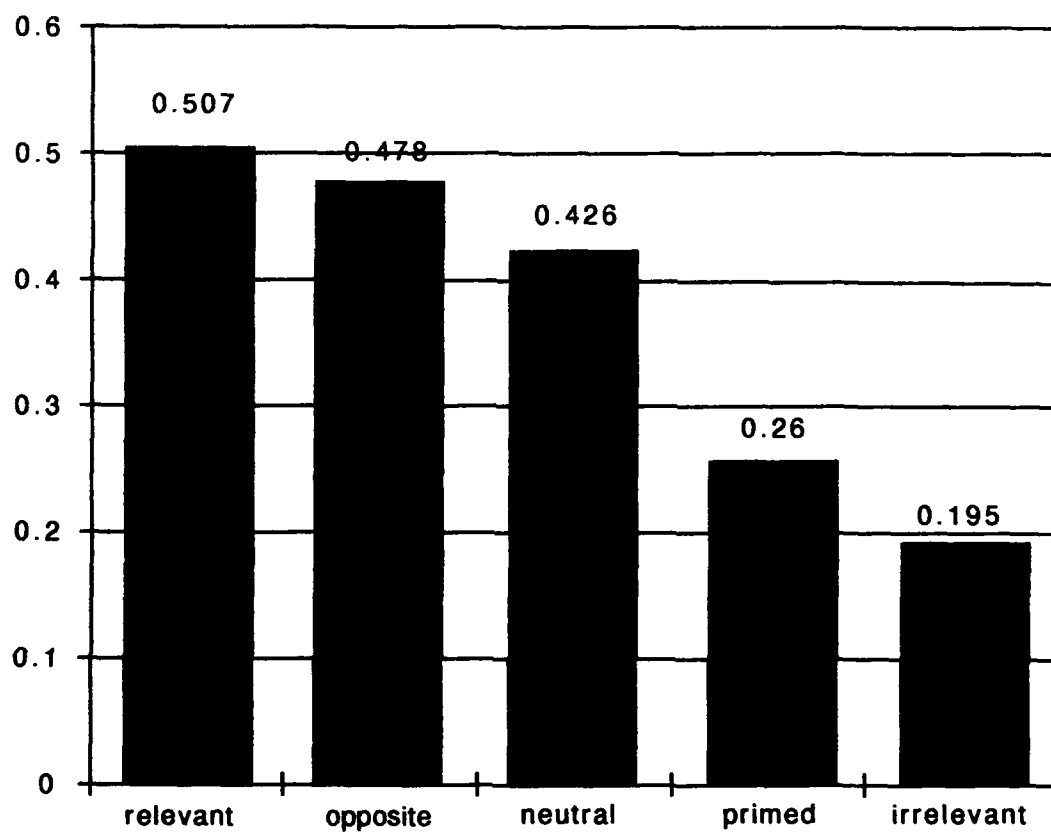


Figure 3.

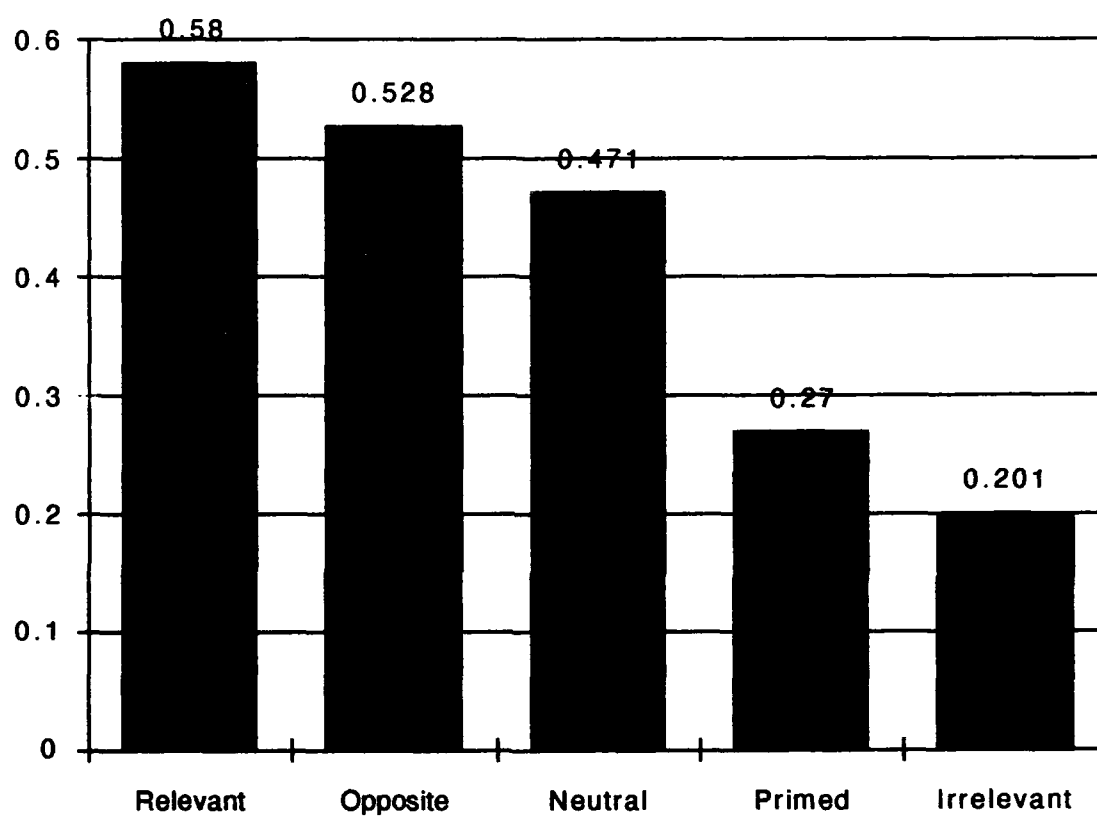


Figure Captions

Figure 1. Mean percentage for accuracy of identification in four conditions of perceptual identification (pilot study).

Figure 2. Mean percentage for accuracy of identification in five conditions.

Figure 3. Transformed accuracy scores for identification in five conditions.