JOURNAL OF EXPERIMENTAL SOCIAL PSYCHOLOGY 23, 269–284 (1987)

# Testing the Generality and Automaticity of Self-Reference Encoding with Release from Proactive Interference

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Received September 4, 1986

In three experiments the release from proactive interference paradigm was used to examine the role of the self in memory. In Experiment 1 stimuli were trait adjectives that had been previously rated for their descriptiveness of the rater or for their descriptiveness of a well-known other (Ronald Reagan). Across three trials, significant proactive interference was obtained for all adjectives (regardless of whether they described the self, Ronald Reagan, or neither). Release from proactive interference was observed only for self-rated adjectives. The interpretation of this result was clouded, however, because the trait adjectives also shifted on an evaluative dimension from Trials 1–3 to Trial 4. In Experiments 2 and 3, when the evaluative dimension was not allowed to change, no release from proactive interference was obtained. These results suggest that the involvement of a self-schema in memory is not as ubiquitous or automatic as some views have assumed. © 1987 Academic Press, Inc.

The self has been conceived in recent theoretical formulations as an articulated memory schema that guides the processing of self-relevant information (e.g., Greenwald & Pratkanis, 1984; Keenan & Baillet, 1980; Markus, 1977; Rogers, Kuiper, & Kirker, 1977). According to Markus (1977), self-schemata are cognitive generalizations about the self that are derived from both specific events and situations that involve the individual, and also from more general representations of more enduring self-attributions. In her view, "The concept of self-schema implies that information about the self in some area has been categorized or organized and that the result of this organization is a discernible pattern which may be used

The contribution of the first two authors was equal, and their order of authorship was determined by a coin flip. Mark McDaniel is now at the Department of Psychological Sciences, Purdue University. The authors thank Maria Bellalta, Kristy Heft, Fr. James Karaffa, C.S.C., Laila Mikhail, Cathy Nelson, and Kimberly Schlenker for their help in conducting this study. We also appreciate the insightful comments on an earlier version of the paper from Stan Klein and an anonymous reviewer. Please address all inquiries, including requests for reprints, to Dr. Lapsley, Department of Psychology, University of Notre Dame, Notre Dame, IN 46556.



0022-1031/87 $3.00

as a basis for future judgments, decisions, inferences, or predictions about the self" (Markus, 1977, p. 64). As such, the self-schema is thought to organize personal history, to encode and retrieve self-relevant information, and to grant privileged locations in memory to such information (Greenwald & Pratkanis, 1984)

Evidence for this view is embodied in the so-called "self-reference effect." This effect has traditionally been observed in a levels of processing paradigm where subjects are asked to recall information (e.g., trait adjectives) that had been previously presented under different orienting conditions. For example, a self-reference condition requires subjects to determine if trait adjectives are self-descriptive or not. Other frequently employed orienting tasks include a semantic task (Does XXX mean the same as YYY?), a structural task (Is the word written in capital letters?), and a phonemic task (Does XXX rhyme with YYY?). In some investigations, different (familiar or unfamiliar) persons function as referents for the orienting task. When subjects are then given an incidental memory test of the words that they had encountered under the various orienting tasks (as above), the typical finding is that self-referent words are recalled better and faster (e.g., Keenan & Baillet, 1980; Rogers et al., 1977) than are trait adjectives encountered in the other orienting conditions. The mnemonic superiority of the self-encoding tasks relative to other encoding tasks is commonly labeled the self-reference effect, and is cited by some researchers as support for the existence of an articulated self-schema that has unique psychological properties and, once activated, affords an elaborative, enriched encoding of incoming information (Greenwald, 1981; Kuiper & Rogers, 1979).

Other researchers, however, have suggested either that the self-schema does not enjoy a mnemonic advantage relative to other articulated memory schemata, or else does not convey a mnemonic advantage under all conditions. For example, the self-reference effect does not describe incidental memory for judgments of nouns (Maki & McCaul, 1985), images of the self (Karylowski & Buczek, 1984; Lord, 1980), or to anatomical self-features (Keenan & Baillet, 1980). Further, self-reference seems to vary as a function of the familiarity of the person judged, and is restricted to evaluative (and not factual) dimensions (Keenan & Baillet, 1980). Indeed, there is evidence that judgments of the evaluative character of trait words facilitates memory to about the same degree as does judging their self-descriptiveness (Ferguson, Rule, & Carlson, 1983; Friedman & Pullyblank, 1982; although see McCaul & Maki, 1984). Similarly, Bower and Gilligan (1979, p. 429) concluded that "there is nothing special about the self-schema as a mnemonic peg; any well-differentiated person will do." They argued that the self-reference effect exemplifies the principle that memory is improved by relating information to *any* well-articulated

memory structure, and that there is hence little reason to endow the self with special properties.

Perhaps the most serious challenge to the traditional account of the self-reference effect has been offered recently by Klein and Kihlstrom (1986). They have shown that self-referent and semantic encodings produce equivalent levels of free recall if first equated for the amount of organization they encourage. The authors argue that organization, and not elaboration or evaluation, is responsible for the mnemonic advantage of self-encoded information. They point out that the self-reference effect in the depth of processing paradigm confounds self-referent encoding and categorical organization, and that a single-factor theory based on organization is sufficient to account for many of the self-referent effects reported in the literature.

It would appear, then, that recent experimental variations have both clarified and complicated our understanding of the nature of the self-reference effect. Despite this progress toward a more refined understanding of the mnemonic role of the self-schema, the extant literature is limited by its reliance on one experimental paradigm. As Klein and Kihlstrom (1986) note, "Although it may well be that the self is a highly elaborate memory structure, the SRE [Self-Reference Effect] does not give evidence to support this conclusion, and other paradigms must be used to address this issue" (p. 36). Accordingly, the purpose of the present experiments was to further examine the role of the self-schema in memory processing using a paradigm that is novel to the self-reference literature. In particular, we employed the release from proactive interference (PI) paradigm (Wickens, 1972), which is frequently used to identify the dimensions along which stimuli are (automatically) encoded (Zechmeister & Nyberg, 1982).

We reasoned that if a self-schema is intimately involved in memory, then it should manifest itself across a variety of mnemonic tasks and contexts, especially on a task that is designed explicitly to reflect the encoding of particular attributes (in the present case, the encoding of self-related attributes). Thus, converging evidence for the role of the self in memory would be provided if one could show that self-effects obtain in a memory paradigm (release from PI) that does not utilize levels of processing orienting tasks. Alternatively, a failure to find self-effects would reinforce the view that self-schemata are not necessarily central or primary to encoding and subsequent memory processes. In addition, the release from PI paradigm permits us to address an additional issue regarding the self-reference effect, namely the automatic character of self-reference encoding. It has been suggested that the self maintains a "watching brief" for indicators of self-relevant events (Rogers, 1981), and that the self-schema automatically screens stimuli for further processing (Hull & Levy, 1979; Kuiper & Derry, 1981). Bargh (1984) using a dichotic

listening paradigm, provided some support for the automatic processing of self-relevant stimuli. The present studies provide a further test of the automaticity of self-reference processing, using a paradigm that is uniquely suited to assess such encoding (Zechmeister & Nyberg, 1982).

In a typical release from PI experiment, subjects are presented with four short-term memory trials. Each trial involves the presentation of three items, and after a brief delay (15–30 s) filled with a distracter task, recall of the items is attempted. The items for the first three trials are always similar with regard to some preselected dimension (e.g., a particular taxonomic category, modality of presentation, or syntactic case). On the fourth trial, half of the subjects receive three additional items from the preselected dimension (no-shift group), while the other half (the shift group) receives three items that reflect a shift in the critical dimension (e.g., a different taxonomic category, modality, or syntactic case). Proactive interference occurs when there is a decline in memory performance from Trials 1–3. Release from PI occurs if the shift group shows a rebound in memory performance on Trial 4 relative to the no-shift group. The amount of rebound in recall (release from PI) is taken as an index of the degree to which the dimension (along which the words were sampled) is encoded in memory. Moreover, because subjects often fail to notice the similarities among the target items (Wickens, 1970), it has been argued that release from PI reflects relatively automatic memory processes (Zechmeister & Nyberg, 1982, pp. 134, 136; Guttantag, 1985), and that the task can be thought of as a "projective" and unconscious measure of memory encoding.

In our first study, subjects were presented with triads of words that they had previously rated as being self-descriptive, not self-descriptive, descriptive of a noted public figure (Ronald Reagan), or not descriptive of the public figure. Some of the subjects (the no-shift subjects) received similarly rated words (e.g., descriptive of Ronald Reagan) for all four trials, while for other subjects (shift subjects), the words on the fourth trial were words that had been rated differently (e.g., not descriptive of Ronald Reagan) than the words encountered on Trials 1–3. We reasoned that if there were an organized, well-articulated self-schema that is centrally involved in memory, then self-features might be automatically or obligatorily encoded. If so, then a shift group receiving self-descriptive adjectives should display pronounced release from PI, especially relative to a shift group receiving adjectives that were descriptive of the public figure. On the other hand, if the observed release from PI for self-descriptive adjectives were no different than that obtained for adjectives describing another person, then there would be a need to reexamine the notion that an articulated self-schema is automatically or spontaneously deployed to uniquely encode personally relevant information.

Because the release from PI technique has not been previously used

to examine the self-reference effect, we conducted a brief pilot study in order to assess the sensitivity of the technique to shifts in ratings of self-descriptiveness. Eight college undergraduates were first asked to indicate how well a list of 150 trait adjectives described them on a scale ranging from 1 (*agree completely*) to 5 (*disagree completely*). The adjective list was completely balanced in terms of positive and negative traits. One week after the ratings task each subject returned for the release from PI experiment. From the ratings provided by each subject, nine (self-descriptive) adjectives rated 1 (*agree completely*) were randomly selected to serve as the target adjectives for the three non-shift trials. Each trial consisted of a brief presentation of three "self" adjectives, a distractor (counting) task to prevent rehearsal, and a memory request. The fourth (shift) trial was similar to this except that the three target adjectives were ones rated 5 (*non-self-descriptive*). We were interested in determining whether a rebound in recall would be evident on the fourth trial relative to the first three trials A matched-pairs one-tailed $t$ test comparing recall in Trial 4 with the average recall of Trials 1–3 confirmed this expectation, $t(7) = 2.41$, $p < .025$. Hence this pilot study indicates not only that the release from PI technique is sensitive to shifts in self-descriptive trait adjectives, but also that the technique requires a relatively small number of subjects in order for significant release effects to be observed. Given the limited objective of this pilot study, however, no attempt was made to control valence confounds between the shift and nonshift trials. Close inspection of the stimuli indicated that the words on the shift trials were often oppositely valenced from the words on the nonshift trials (positive versus negative or vice versa). Consequently, in Experiment 1 stimuli were selected such that words on the shift and nonshift trials were at the same end of a favorability dimension (e.g., all favorable adjectives or all unfavorable adjectives).

## EXPERIMENT 1

### *Method*

*Subjects and design.* Subjects were 146 students at the University of Notre Dame participating to receive extra credit for an undergraduate psychology course. Subjects were assigned to one of eight experimental conditions formed by the factorial combination of the shift variable (stimuli for Trial 4 represented either a shift in dimension relative to Trials 1–3 or no shift), the person variable (self, Reagan), and the direction of the shift variable (e.g., self–not self vs not self–self). Trait adjectives were selected as descriptive of one of four possibilities: self (S), not self (NS), Ronald Reagan (R), not Ronald Reagan (NR). For the shift conditions, the shift was always from an affirmation to a disconfirmation that trait adjectives were self-descriptive or from an affirmation to a disconfirmation

that trait adjectives were descriptive of Ronald Reagan, or vice versa (i.e., S–NS and NR–R were possible shifts but not S–R). Random assignment of subjects to conditions resulted in 21 subjects in the NR–NR (no-shift) condition; 19 subjects each in the NR–R (shift) and the S–NS conditions; 18 subjects each in the R–NR, the R–R, and the S–S conditions; 17 subjects in the NS–S condition; and 16 subjects in the NS–NS condition.

*Procedure.* The experiment was conducted in two phases, with the first phase involving stimulus selection and the second phase involving the memory task. In the first phase, subjects were presented with a 150-item list of adjectives ordered alphabetically. Seventy-five of the adjectives were positively valenced (e.g., active, helpful) and 75 were negatively valenced (e.g., impatient, whiny). Seventy of the subjects were instructed to rate the adjectives in terms of "how well the adjective describes you" on a scale from 1 to 5 (1 = agree completely, 2 = agree somewhat, 3 = unsure, 4 = disagree somewhat, 5 = disagree completely), and 76 were instructed to rate the adjectives in terms of "how well the adjective describes Ronald Reagan" (again using a scale from 1 to 5). Depending on the group, trait adjectives that were rated 1 were assumed to be consistent with the self or Reagan schema, while adjectives rated 5 were assumed to be inconsistent with the relevant schema but perhaps descriptive of some unspecified "generalized other." The adjective-rating task was subject paced with most subjects completing the task within 20 min. Subjects were tested in two large groups. After completing the task, subjects were dismissed and advised that they would be contacted approximately 3 weeks later for a second experimental session.

Subjects' protocols were then randomly assigned to different groups reflecting the experimental conditions of the memory task, and the stimuli for each subject were selected accordingly. For example, each subject in the self–self condition (no shift on Trial 4) received four sets of three adjectives (one set of three adjectives for each trial), with all of the adjectives being ones that had been given (by that subject) a rating of 1 (*agree completely that the trait adjective is self-descriptive*). In the self–not self (shift on Trial 4) condition, for each subject three sets of self-descriptive adjectives (ratings of 1) were selected for Trials 1–3, while adjectives that had been rated 5 (*disagree completely that the item is self-descriptive*) were selected for Trial 4. This stimulus selection procedure was repeated in a parallel fashion for each subject in all of the conditions. If enough adjectives had not been assigned the appropriate rating (i.e., 1 or 5), the adjectives receiving the next closest rating (i.e., either 2 or 4) were selected. In most cases, however, the number of words assigned the appropriate rating exceeded the number required for the memory task. In these cases, the candidate adjectives were numbered, and a random number table was used to select the target adjectives. In

the construction of the stimulus sets care was taken to ensure that the ratio of positively to negatively valenced adjectives was approximately equivalent to the ratio of positive to negative adjectives that were assigned the critical rating (i.e., depending on the condition, either 1 or 5), and the positive and negative adjectives selected as targets were distributed as evenly as possible across each of the four stimulus sets (that is, it was not the case that all of the positive adjectives were presented in one set(s) and all of the negative adjectives were presented in another set(s)). The target adjectives selected for each subject were printed on 3 × 5 cards, three adjectives per card. Thus, for each subject, a unique set of four stimulus cards was prepared.

Subjects were recontacted approximately 3 weeks after completing the adjective rating task, and they returned to the laboratory for the memory phase of the experiment. For this phase, subjects were tested individually. To signal the beginning of a trial, the experimenter held up a card displaying a star for 2 s. Next, a card with three target adjectives was presented for 2 s, and the subject read the words aloud. The subject then counted backward from 500 by ones. After 15 s of counting, the subject was presented with a card bearing a question mark to signal that the subject should attempt to recall the three target items. The subjects recalled verbally with the experimenter recording the number of correct responses (preservation of order was not required). The subject was allowed 10 s for recall, and a 6-s intertrial interval was observed before proceeding with the next trial. Prior to the four critical trials, one practice trial using three concrete nouns was administered.

*Results and Discussion*

The data were analyzed initially in the standard manner for the release from proactive interference paradigm (e.g., Goggin & Wickens, 1971). The two shift groups for the self-rated adjectives (S–NS and NS–S) were combined to form one self-shift group, and the two nonshift groups (S–S and NS–NS) from the self-rated adjectives were combined to form one control group. The same was done for the Reagan-rated adjectives. The number of words correctly recalled for each of the four groups (self-shift, Reagan-shift, self-control, and Reagan-control) as a function of trials is shown in Fig. 1. As in previous studies (Goggin & Wickens, 1971), a two-factor mixed analysis of variance (ANOVA) with groups as the between-subjects factor and trials as the within-subjects factor was performed on the recall scores from the first three trials. Recall significantly declined as a function of trials, $F(2, 284) = 47.36$, $MS_e = 0.53$ (for all analyses the significance level was set at .05). Neither the main effect of group nor the interaction between group and trials was significant ($F(3, 142) = 1.99$ and $F(6, 284) = 0.10$, respectively). This pattern conforms closely to that usually found in this paradigm (cf. Zechmeister

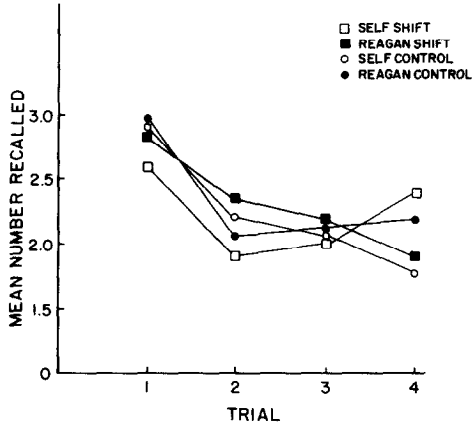


FIG. 1. Mean number of items recalled as a function of group and trial.

& Nyberg, 1982). As usual, Trial 1 performance was nearly perfect, and recall dropped rapidly from Trials 1 to 3, indicating the buildup of proactive interference. Further, the buildup of PI was not significantly different across the experimental and control groups.

The recall scores for Trial 4 were analyzed with a single-factor ANOVA. Recall differed significantly as a function of group, $F(3, 142) = 3.35$, $MS_e = 0.81$. Planned comparisons between each experimental group and its respective control indicated that the self-shift group recalled significantly more than the self-control group, $F(1, 142) = 8.61$, $MS_e = 0.81$, but the Reagan-shift group did not recall more than the Reagan-control group ($F(1, 142) = 1.46$). In fact, recall for the Reagan-shift group was nominally lower than that for the control group (1.9 vs 2.2, respectively).

To explore whether the release from PI found for the self-shift group was symmetrical across both shift directions (i.e., S–NS and NS–S), subsidiary analyses were performed on the individual groups of "self"-subjects (Fig. 2 displays these data). The recall performance of these four groups (S–NS, NS–S, S–S, and NS–NS) across the first three trials was submitted to a two-factor mixed ANOVA. As expected, recall significantly declined across Trials 1–3, $F(2, 132) = 22.28$, $MS_e = 0.55$, and this effect did not significantly interact with group ($F(6, 132) = 1.65$). This indicates that significant proactive interference was observed across Trials 1–3 for each group. Recall did significantly differ, however, as a function of group, $F(3, 66) = 3.03$, $MS_e = 0.60$. Inspection of Fig. 2 reveals that this difference was due in part to differences in recall on Trial 3.

Given the differences on Trial 3, it is questionable whether differences on Trial 4 alone would constitute a release from PI effect. One might argue that in this case a release from PI effect would be manifest only

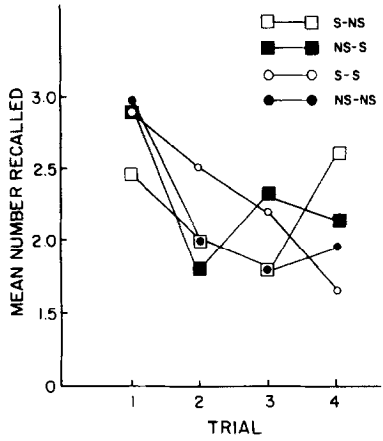


FIG. 2. Mean number of items recalled for the self-groups as a function of trial.

if performance on Trial 4 for a shift group significantly increased relative to Trial 3, while performance on Trial 4 for a control group did not increase relative to Trial 3. Therefore we performed an ANOVA of the recall data for Trials 3 and 4. In this analysis neither the main effect of trials nor the main effect of group was significant ($F < 1$ and $F = 1.77$, respectively). The interaction between trials and group was significant, $F(3, 66) = 3.88$, $MS_e = 0.77$, reflecting the fact that the S–NS group was the only group to show substantial improvement of recall from Trial 3 to Trial 4. All other groups declined or showed only nominal improvement (see Fig. 2). Individual comparisons confirmed this interpretation. The S–NS group recalled significantly more on Trial 4 than Trial 3, $F(1, 66) = 7.69$, $MS_e = 0.77$. The only other increase in recall from Trial 3 to Trial 4 was for the NS–NS control, but this difference was negligible ($F < 1$). Thus, the release from PI for self-shift groups was asymmetrical, with the release found only in the S–NS group. A simple-effects test for the Trial 4 data also produced a pattern consistent with this conclusion. The groups differed significantly in their recall levels, $F(3, 66) = 3.92$, $MS_e = 0.79$, with the S–NS group producing significantly higher recall than the S–S group, $F(1, 66) = 10.96$, $MS_e = 0.79$, and the NS–NS group, $F(1, 66) = 5.33$, $MS_e = 0.79$. The NS–S group did not significantly differ from either the S–S group or the NS–NS group.

*Subsidiary analyses.* To ensure that the obtained release from PI was due to the self-descriptive properties of the adjectives and not to a shift in an evaluative dimension (positive-negative), we attempted to select the adjectives such that an approximately equal proportion (within each condition) of negatively and positively valenced adjectives comprised each trial. We used a dichotomous scale (positive, negative) to determine

the evaluative dimension of each adjective, leaving open the possibility that more fine-grained differences in the evaluative dimension between words on Trials 3 and 4 could be responsible for the observed release from PI effects. Moreover, as noted above, the proportion of negatively and positively valenced words for each trial (within a particular condition) was only approximate, especially for the not self–self (NS–S) group, as it was often difficult to find negatively valenced self-descriptive adjectives for Trial 4. Thus, to definitively rule out the possibility that systematic changes across trials in an evaluative dimension were responsible for the release from PI effect, we analyzed likability ratings on the stimulus adjectives used for each particular subject. We first briefly describe the method for collecting the ratings, and then we report the analysis of those data.

Eighty subjects, none of whom participated in Experiment 1, were given the same list of 150 trait adjectives that subjects in Experiment 1 had initially responded to. Following Anderson (1968), subjects rated the likableness of each adjective on a scale from 0 (*least likable*) to 6 (*most likable*). For each adjective the mean rating was computed. These mean ratings were then used to index the likableness of the particular stimulus adjectives presented to subjects in the release from PI portion of Experiment 1.

For the S–NS shift group, there was a significant difference in the likableness of the target words between Trials 1–3 (mean = 4.46) and Trial 4 (mean = 3.61), $t(18) = 3.85$. A similar comparison for the NS–S shift group showed that the difference in likableness of the traits between Trials 1–3 (mean = 1.44) to Trial 4 (mean = 3.76) was also significant, $t(16) = 7.35$. For the Reagan-shift groups there was little difference in likableness of the target traits between Trials 1–3 and Trial 4 (means = 4.33 and 4.34, respectively, for the R–NR shift group;[1] means = 2.22 versus 2.65, respectively, for the NR–R shift group), although the difference for the NR–R shift group was statistically significant, $t(18) = 2.87$.

The shift in the likableness of the adjectives did not completely parallel the release from PI effects. The above results show that the valence difference between Trials 1–3 and Trial 4 was more pronounced in the NS–S than the S–NS group, yet release from PI was observed only in the S–NS group. Also, the valence difference between Trials 1–3 and Trial 4 was significant for the NR–R group, yet no release from PI was found for this group (memory performance nominally declined from Trial 3 to Trial 4 for the NR–R group). Thus, one might argue that the release from PI in the S–NS group was due to a shift along the self-dimension

[1] The target stimuli for five subjects were not available at the time these analyses were computed. Thus, the mean valences for the R–NR group are based on the target stimuli from 13 of the 18 subjects in the group.

and not due to the shift in valence. However, release from PI when stimulus items change on evaluative dimensions is well documented (Wickens, 1970, as well as our pilot work described earlier). Thus, further work is needed in which the likableness of the target adjectives is better controlled across trials. Experiments 2 and 3 were conducted for that purpose.

## EXPERIMENT 2

In this experiment we attempted to clarify the locus of the release from proactive interference obtained in Experiment 1 for the self-encoding groups. Care was taken to select stimulus adjectives for each subject such that likableness would vary minimally across trials. If the release from PI effects in Experiment 1 were reflective of the role of the self in memory, then similar effects should obtain in the present study. Alternatively, if the release from PI effects were due to shifts in likableness of the target adjectives (and/or some other related factor), then no release from PI should be observed in this experiment.

### *Method*

Subjects were 66 students at Indiana University at South Bend participating to earn extra credit for an introductory psychology course. Nineteen subjects were randomly assigned to the S–S no-shift condition, 17 were assigned to the NS–S shift condition, 16 were assigned to the NS–NS no-shift condition, and 14 were assigned to the S–NS shift condition. The selection of adjectives for the shift (Trial 4) and nonshift (Trials 1–3) trials was identical to the procedure used in Experiment 1 with the added stipulation that the valence for likableness (positive or negative) be similar across all four trials. Following the random selection of shift and nonshift adjectives (as per condition), the mean likableness rating for the set of 12 adjectives was calculated, along with the standard deviation. If the likableness score of a given adjective was greater than one standard deviation above or below the mean, then the adjective was discarded and replaced by one satisfying the valence inclusion criteria. For the S–NS group the mean likableness rating for adjectives on Trials 1–3 was 4.35 and for adjectives on Trial 4 was 4.15. For the NS–S group the respective means were 1.36 and 1.55.

The experimental procedure was identical to that of Experiment 1, with the following exception. The distractor task of the memory phase of the experiment involved counting backward by threes from a 3-digit number. For each trial a different 3-digit number was presented.

### *Results and Discussion*

The mean recall scores for each trial as a function of group are displayed in Table 1. The scores were tabulated by assigning a point for each word correctly recalled and a point for recalling the words in order (thus, for each trial, 4 was the highest possible score).[2] The recall performance of the four groups for the first three trials was submitted to a two-factor mixed ANOVA (for all analyses, the $\alpha$ level was set at .05). Recall

[2] A point for correct order was possible only if all three words were recalled.

TABLE 1
MEAN RECALL SCORES AS A FUNCTION OF TRIALS AND GROUP (EXPERIMENT 2)

| | Trials | | | |
|---|---|---|---|---|
| Groups | 1 | 2 | 3 | 4 |
| Control | | | | |
| S–S | 3.4 | 1.9 | 1.8 | 1.3 |
| NS–NS | 3.2 | 2.6 | 1.8 | 2.0 |
| Shift | | | | |
| S–NS | 2.9 | 2.2 | 2.0 | 1.9 |
| NS–S | 3.5 | 2.1 | 1.5 | 2.1 |

*Note.* S = adjectives rated as describing the self; NS = adjectives rated as not describing the self (see text for complete explanation).

significantly declined from Trials 1 to 3, $F(2, 124) = 37.13$, $MS_e = 1.13$, and this effect did not significantly interact with group ($F = 1.13$). Recall also did not significantly differ across groups ($F < 1$). Thus, proactive interference was consistently observed across Trials 1–3.

To test for release from PI effects, we performed an ANOVA on the recall data for Trials 3 and 4. No significant effects were obtained (largest $F = 1.11$). As can be seen from Table 1, changes in recall from Trial 3 to Trial 4 were minimal, regardless of group. Thus, there was no indication that self-features were automatically encoded and utilized in memory. Before discussing this result, we present another experiment to establish the reliability of the present findings.

## EXPERIMENT 3

One difference between Experiments 1 and 2, aside from differential control of shifts in likableness of target adjectives, is the population from which subjects were sampled. Subjects in Experiment 1 were sampled from an academically selective university with a national student body, whereas subjects in Experiment 2 were sampled from a branch campus of a state university with less selective admission standards (cf. McDaniel & Pressley, 1984). There is some evidence that demographic variables influence the kinds of trait adjectives endorsed as being descriptive of the self (Mueller & Ross, 1984), perhaps reflecting differences in the self-schema across cohort groups. Consequently, there may be a possibility that the release from PI effects in Experiment 1 reflected sample-specific encoding effects. Thus, in Experiment 3, participants were sampled from the same university as in Experiment 1, but unlike Experiment 1, target adjectives were selected such that likableness did not change from Trial 3 to Trial 4.

TABLE 2
MEAN RECALL SCORES AS A FUNCTION OF TRIALS AND GROUP (EXPERIMENT 3)

| | Trials | | | |
|---|---|---|---|---|
| Groups | 1 | 2 | 3 | 4 |
| Control | | | | |
| S–S | 2.89 | 2.50 | 2.20 | 1.67 |
| NS–NS | 2.93 | 2.00 | 1.81 | 1.93 |
| Shift | | | | |
| S–NS | 2.76 | 2.00 | 2.00 | 1.90 |
| NS–S | 2.78 | 2.11 | 1.78 | 1.83 |

*Note.* The control groups are from Experiment 1. S = adjectives rated as describing the self; NS = adjectives rated as not describing the self (see text for complete explanation).

### *Method*

Subjects were 39 introductory psychology students at the University of Notre Dame participating for extra course credit. Twenty-one subjects were randomly assigned to the S–NS shift group and 18 were assigned to the NS–S shift group. The control groups from Experiment 1 were used to gauge release from PI in the shift groups.

The procedure was similar to that of Experiment 1, except that the stimulus set for each subject was selected so that the likableness of the adjectives for Trial 4 was not different from the likableness of adjectives used on Trials 1–3. For the S–NS group, average likableness ratings of the target adjectives were 3.98 and 3.86 for Trials 1–3 and Trial 4, respectively. For the NS–S group, the average likableness ratings were 1.7 and 2.0 for Trials 1–3 and Trial 4, respectively. Likableness was based on ratings collected from an independent group of subjects attending Notre Dame (see Experiment 1).

### *Results and Discussion*

The mean recall scores for the shift groups along with the recall scores from the corresponding control groups of Experiment 1 are displayed in Table 2 (for neither experiment was a point awarded for correctly ordered recall). An ANOVA of the Trial 1–3 data found a significant decrement in recall across trials, $F(2, 140) = 25.95$, $MS_e = 0.60$ ($\alpha$ level set at .05). There was no significant effect of group nor a group × trials interaction.

An ANOVA of the data for Trials 3 and 4 found no significant effects, indicating that there was no release from PI in the shift groups. For both shift groups, performance on Trial 4 was nearly the same as on Trial 3 (see Table 2). Thus, as in Experiment 2, when likableness of the targets

across trials is controlled, there is no evidence that shifts in the self-descriptiveness of trait adjectives causes release from PI.

## GENERAL DISCUSSION

The results of the present investigation suggest that self-descriptive trait adjectives are not automatically encoded along a self-reference dimension, at least in the context of a short-term memory task. This conclusion must be tempered, of course, by the attendant difficulties with accepting the null hypothesis (but see Greenwald, 1975). Several points should be noted in this regard, however. First, robust proactive interference effects were obtained, thus allowing for the possibility of release effects. Yet mean recall on Trial 4 in Experiments 2 and 3 was in some cases (two out of four shift groups) not even in the direction of release of proactive interference. Second, in our pilot work, we obtained release from PI due to shifts in an evaluative dimension using far fewer subjects than in the main experiments. Moreover, if the self-referent dimension is involved in encoding, its impact is much less than encoding of other attributes. Thus, inasmuch as the release from PI technique is a projective indicator of memory encoding that reveals unconscious and/or automatic processes, it appears that subjects do not spontaneously or unintentionally deploy the self-schema to encode self-relevant trait adjectives. This finding is in contrast to the suggestion that the self maintains a "watching brief" (Rogers, 1981) for self-relevant events or is otherwise involved in automatic memory processing (Bargh, 1984), but it is not inconsistent with the possibility that self-reference encoding may convey mnemonic benefits in some encoding contexts (e.g., Keenan & Baillet, 1980; Markus, 1977; Rogers et al., 1977). The important point from the present study is that the self-schema is not necessarily deployed *automatically* for the processing and retention of self-referent words.

Alternatively, one might interpret the results as being consistent with the view that the self is an important cognitive structure that affects encoding of self-referent words in terms of principles that apply generally to human memory. For example, proactive interference was consistently obtained for self-relevant words, suggesting that the words were being processed along a similar (perhaps self) dimension. Also the suggestion in Experiment 1 that valence changes might produce release from proactive interference may suggest that evaluative attributes are integrated into a self-structure, and are therefore readily extracted. While this view merits further attention, this view does not clearly account for the failure to obtain release from proactive interference due to changes in the self-descriptiveness of the adjectives. Moreover, note that similar degrees of proactive interference obtained for non-self and self-words; this finding also seems difficult to reconcile with the above alternative. Indeed, the current experiments, along with Klein and Kihlstrom's (1986) recent work

using a levels of processing approach, suggest a reevaluation of the view that the self is a special memory structure.

## REFERENCES

Anderson, N. H. (1968). Likeableness ratings of 555 personality-trait words. *Journal of Personality and Social Psychology*, **9**, 272–279.

Bargh, J. A. (1984). Automatic and conscious processing of social information. In R. Wyer & T. Srull (Eds.), *Handbook of social cognition* (Vol. 3, pp. 1–43). Hillsdale, NJ: Erlbaum.

Bower, G. H., & Gilligan, S. G. (1979). Remembering information related to one's self. *Journal of Research in Personality*, **13**, 420–432.

Ferguson, T. J., Rule, G. R., & Carlson, D. (1983). Memory for personally relevant information. *Journal of Personality and Social Psychology*, **44**, 251–261.

Friedman, A., & Pullyblank, J. (1982, November). *Remembering information about oneself and others: The role of distinctiveness*. Paper presented at the Psychonomic Society Annual Convention, Minneapolis, MN.

Goggin, J., & Wickens, D. (1971). Proactive interference and language change in short-term memory. *Journal of Verbal Learning and Verbal Behavior*, **10**, 453–458.

Greenwald, A. G. (1975). Consequences of prejudice against the null hypothesis. *Psychological Bulletin*, **82**, 1–20.

Greenwald, A. G. (1981). Self and memory. In G. Bower (Ed.), *The psychology of learning and motivation* (pp. 201–233).New York: Academic Press.

Greenwald, A. G., & Pratkanis, A. R. (1984). The self. In R. Wyer & T. Srull (Eds.), *Handbook of social cognition* (Vol. 3, pp. 129–178). Hillsdale, NJ: Erlbaum.

Guttantag, R. E. (1985). Memory and aging: Implications for theories of memory development during childhood. *Developmental Review*, **5**, 56–82.

Hull, J. G., & Levy, A. S. (1979). The organizational functions of the self: An alternative to the Duval and Wicklund model of self-awareness. *Journal of Personality and Social Psychology*, **37**, 756–768.

Karylowski, J., & Buczek, M. (1984, August). *Cognitive representation of self and others: Words and images*. Presented at the 92nd Annual Convention of the American Psychological Association, Toronto.

Keenan, J. M., & Baillet, S. D. (1980). Memory for personally and socially significant events. In R. S. Nickerson (Ed.), *Attention and performance VIII* (pp. 651–669). Hillsdale, NJ: Erlbaum.

Klein, S. B., & Kihlstrom, J. F. (1986). Elaboration, organization, and the self-reference effect in memory. *Journal of Experimental Psychology: General*, **115**, 26–38.

Kuiper, N. A., & Derry, P. (1981). The self as a cognitive prototype. In N. Cantor & J. Kihlstrom (Eds.), *Personality, cognition, and social interaction* (pp. 215–232). Hillsdale, NJ: Erlbaum.

Kuiper, N. A., & Rogers, T. B. (1979). Encoding of personal information: Self-other differences. *Journal of Personality and Social Psychology*, **37**, 499–512.

Lord, C. G. (1980). Schemas and images as memory aids: Two modes of processing social information. *Journal of Personality and Social Psychology*, **38**, 257–269.

Maki, R. H., & McCaul, K. D. (1985). The effects of self-reference versus other reference on the recall of traits and nouns. *Bulletin of the Psychonomic Society*, **23**, 169–172.

Markus, H. (1977). Self-schemata and processing information about the self. *Journal of Personality and Social Psychology*, **35**, 63–78.

McCaul, K. D., & Maki, R. H. (1984). Self-reference versus desirability ratings and memory for traits. *Journal of Personality and Social Psychology*, **47**, 953–955.

McDaniel, M. A., & Pressley, M. (1984). Putting the keyword method in context. *Journal of Educational Psychology,* **76,** 598–609.

Mueller, J. H., & Ross, M. J. (1984). Uniqueness of the self-concept across the life span. *Bulletin of the Psychonomic Society,* **22,** 83–86.

Rogers, T. B., Kuiper, N. A., & Kirker, W. S. (1977). Self-reference and the encoding of personal information. *Journal of Personality and Social Psychology,* **35,** 677–688.

Rogers, T. B. (1981). A model of the self as an aspect of the human information processing system. In N. Cantor & J. Kihlstrom (Eds.), *Cognition, social interaction and personality* (pp. 193–214). Hillsdale, NJ: Erlbaum.

Wickens, D. (1970). Encoding categories of words: An empirical approach to meaning. *Psychological Review,* **77,** 1–15.

Wickens, D. (1972). Characteristics of word encoding. In A. Melton & E. Martin (Eds.), *Coding processes in human memory* (pp. 191–215). Washington, DC: Winston.

Zechmeister, E. B., & Nyberg, S. E. (1982). *Human memory.* Monterey, CA: Brooks/Cole.