Implicit motivational states influence memory: Evidence for motive by state-dependent learning in personality

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Abstract

This article describes three experiments that test the influence of implicit motivational states on learning and memory performance. A consistent pattern of results demonstrated that implicit motivational states are inherently linked to memory and learning processes. First, there is evidence that the strength of implicit motives correlates with the encoding and retrieval of motive-related stimuli. Second, implicit motives interact with arousal states that facilitate selective recall and elaboration of motive-related stimuli. Third, implicit motives interact with arousal states that facilitate, not only selective encoding and recall, but also effort and speed in memory performance. Findings are discussed as evidence for the unique influence of implicit motives on memory within a functional framework.

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1. Introduction

Memory is a fascinatingly complex process with profound implications for psychological functioning. Yet, cognitive capacity is such that we recall only a relatively small sample of our experiences. The processes by which one remembers and forgets may be the cornerstone to understanding most any psychological process. In past research, we have taken a personological and motivational approach to the topic of memory, particularly autobiographical memory (see Woike (2008) for a review). By creating conditions that interact with people's most important motivations, it was possible to identify some of the personal and situational factors that facilitate or hinder memory. A fair amount of research has been conducted on the relationship between personality motivation and autobiographical narratives. But there is much less information on how these motivations influence basic memory processes. The correlations between personality motivation and the content of autobiographical memories suggest that implicit motives play an influential role in memory processes but have not been able to test the possible underlying mechanisms directly.

Currently, the idea that people have motives and intentions outside of their awareness is readily accepted by researchers (e.g., Bana-ji & Greenwald, 1995; Bargh & Chartrand, 1999; Gladwell, 2005; Wegner, 1994) and laypersons alike. Many of these theories put forth by social psychologists have focused on general implicit processes rather than individual variability. There is, however, a program of research that began more than 50 years ago that has systematically identified less conscious motivations in people as stable and enduring differences that are not equivalent to their self-reported intentions and goals (McClelland, Koestner, & Weinberger, 1989; Schultheiss, in press). Implicit motives have been defined and studied as motivational dispositions that operate outside of a person's conscious awareness; and are fundamentally distinct from self-attributed motives measured via self-report questionnaires (McClelland et al., 1989). The program of research was developed from basic principles of motivation (McClelland, 1985). One of the most striking and pervasive findings to emerge from this research is the observation that the correlation between implicit and self-report measures is typically very close to zero (Schultheiss & Pang, 2007). Studies demonstrate validity for the distinction between implicit and self-reported motives showing that they are typically acquired at different developmental stages and correspond to different behaviors (Schultheiss, in press; Woike, 2008).

The differential influence of implicit and self-reported motives on memory has been described in a dual process functional framework (Woike, 2008). According to this model, personality motives at different levels of awareness are differentially activated by the social context to engage memory processes. Implicit motives orient, direct, and select attention (McClelland, 1985), such that people automatically attend to stimuli in the social environment that carries incentives linked to their implicit motives. Generally, implicit motives, like implicit achievement, are linked to intrinsic incentives acquired during early childhood (cf. McClelland & Pilon, 1983), which energize and emotionally involve people in achievement-re-
lated activities. Because implicit motives reflect the desire for such particular affective experiences, people may process information in ways that promote these intrinsic rewards. In particular, implicit achievement may influence attention processes such that people may attend to stimuli from the social environment that are relevant to their implicit motivation. For instance, Schultheiss and Hale (2007) found that people with strong implicit power or affiliation motivation paid more attention to facial expressions indicating dominance and friendliness, respectively. Validation for implicit motive arousal has been found by observing changes in physiological responses such as blood pressure and heart rate, hormone release, and muscle tone (see Schultheiss (in press) for a detailed review of physiological correlates). These physiological responses suggest an automatic readiness or alertness to process motive-related stimuli in the social environment. Researchers have further speculated that each implicit motive maybe linked to a specific hormone pattern that is activated in a motive-relevant context to enhance learning and memory (McClelland, 1985; Schultheiss, in press).

Once motive-related information is encoded it may be rehearsed often because through rehearsal the person may re-experience the pleasure associated with the implicit motive (Woike, 1994b). After many experiences in which the affective-end state is felt in motive-arousing situations, implicit cognitive procedures become linked to intrinsic incentives so that people in implicit motive-arousing states automatically modulate their selective attention, encoding and recall of motive-relevant information. Over time, this automatic processing serves to maintain and facilitate these affective-end states. So people who find themselves in conditions in which they experience affective or motivational arousal congruent with their implicit motivation should be more likely to recall content linked to the particular motive.

Narrative studies have consistently shown relations between specific implicit motives and the content of autobiographical narratives. When people are asked to describe significant and/or emotionally-involving life experiences, those with strong achievement or power motives are consistently more likely to recall experiences about achievement, dominance, and self-mastery, whereas people with strong intimacy motives are more likely to recall experiences pertaining to love, friendship, and social belonging (McAdams, 1982, 1985; McAdams, Hoffman, Mansfield, & Day, 1996; Woike, 1994b; Woike, Gershovich, Piorkowski, & Polo, 1999; Woike, Mcleod, & Goggin, 2003). Data from longitudinal diary studies show the same pattern as autobiographical narratives collected at one point in time (Woike, 1995; Woike & Polo, 2001). That is, when asked to record their daily experiences over a period of time, the content of the daily experiences correlated with people’s implicit achievement and intimacy motives. People with a strong achievement motive recorded many more “most memorable experiences” about achievement and those with a strong need for intimacy recorded many more intimacy-related experiences.

Most of the studies so far have investigated autobiographical narratives, which present the end product of selective attention, encoding, rehearsal, organization and retrieval—but they do not provide a direct account of these memory processes. An exception is a series of experiments involving a controlled encoding paradigm in which people read achievement- or affiliation-themed stories (Woike, Lavezzary, & Barsky, 2001). People were more accurate in their free recall and recognition of phrases from the stories that were related to their motivations. These studies offer the first indication that the link between implicit motivation and the recall of motivationally-relevant personal experiences extends to recently acquired knowledge in story format.

In the current studies, we focused on the influence of implicit achievement motivation on memory performance in experimentally controlled memory tasks which allowed for the direct measurement of selective attention, encoding, and elaboration, as well as retrieval accuracy, effort and speed. Controlling and limiting memory input in an experimental design allowed for a more precise identification of the impact of implicit motivation on these processes. Varying experimental contexts enabled us to investigate the influence of implicit motivational arousal states on actual memory processes. The aim was to identify the basic cognitive processes underlying the construction of motivationally-relevant autobiographical narratives.

2. Present studies

Three studies were conducted to identify the mechanisms underlying the link between individual differences in implicit achievement, experimentally induced contextual characteristics and memory performance for achievement-related stimuli. In each study, neutral stimuli were included for comparison; we also measured both implicit and self-reported achievement motives of the participants. The first study investigated the link between implicit achievement motivation and achievement-related stimuli in an experimental variation—a vivid recall procedure—to demonstrate that memory performance is enhanced in a context that provided incentives for implicit achievement. The goal of the second study was a comprehensive demonstration of the importance of implicit achievement and contextual factors for memory processes: We included a vivid recollection procedure as in Study 1, and added response latency and effort measures to assess whether people motivated for implicit achievement would not only recall more achievement-related words in a motive-arousing context, but do so faster and with greater persistence. The final study focused on response latencies by instructing all participants to perform their recall as quickly as possible to demonstrate that individuals highly motivated for implicit achievement in an achievement context recall more quickly than all other participants.

3. Study 1

In Study 1, an experimental manipulation in which achievement motivation was aroused was contrasted with a neutral control condition. There were three different categories of recall variables. Participants were asked to recall (a) prompt words from a list (achievement and neutral). They were also required (b) to generate a word in response to each list word, because we reasoned that not all individuals may have the same cognitive associations of achievement. Participants were furthermore (c) asked to recall the exact pair of the list word and their corresponding generated word. In the condition designed to arouse the achievement motive, it was predicted that the stronger implicit achievement, the more achievement words both given and generated would be recalled. No such relationship is expected for the neutral condition because there were no contextual cues to arouse implicit achievement. No effects were expected for self-reported achievement motivation either.

3.1. Participants

Sixty undergraduate students (age 19–22, 49 females) took part in the study as partial completion of their course requirements for introductory psychology. A demographics questionnaire recorded their ethnicity as approximately 70% White, non-Hispanic, 13% Asian, 10%, Latino/a, and 7% Other.

3.2. Method

Participants were scheduled individually by research assistants. The experiment was conducted using MediaLab, implementing the
basic instructions from the software package. A version of the Picture Story Exercise (PSE), based upon the Thematic Apperception Test (TAT, Atkinson, 1958) was used to assess participants’ implicit achievement motivation. The achievement subscale of the Personality Research Form (PRF, Jackson, 1989) measured their self-reported achievement attitudes, which consists of 16 true/false items like “I enjoy difficult work”. In the PSE, people are required to write down a story after being presented with six picture stimuli that have proven useful in the assessment of implicit achievement motivation (Wooike, 1994a, 1994b, 1995). These pictures included two people sitting on a bench, a man working at a desk, a ship captain and another man, two women working in a laboratory, a male and female trapeze performers, and a man and a woman in a field with horses and a dog. Reproductions of these pictures can be found in Smith (1992, pp. 633–638).

Two undergraduate research assistants were trained with a coding manual for achievement motivation (McClelland, Atkinson, Clark, & Lowell, 1958) to analyze the PSE stories. Adhering to the standard procedure, coders scored each of the participants’ stories, after having achieved at least 90% agreement with the practice materials in the manual. Their inter-rater reliability, computed as the correlation of each participant’s achievement scores, was \( r(60) = .91 \). In case of disagreements in the implicit achievement score, the average of the two coders’ scores was used for the analyses. The range of scores for implicit achievement was 0–19, \( M = 5.43; SD = 4.55 \), and self-reported achievement was 3–16, \( M = 10.35; SD = 3.04 \).

In the second part, participants were randomly assigned to either the neutral condition (\( N = 29 \)) or the achievement condition (\( N = 31 \)). In the neutral condition, they were asked to write down a common, everyday experience, that is, the routine events of a typical day. In the achievement-arousal condition, they were prompted to write down a memory in which they succeeded at or achieved something important, and were asked to describe this event as vividly as possible. Participants were given 10 min to write their memories on the computer. Then, they were given a pre-tested list of 14 neutral and 14 achievement-related words in randomized order. Typical achievement words included those used in Study 1, such as “goals”, “striving”, and “best”, while the neutral category comprised such words as “moment”, “custom”, and “amount”. For each given word they were required to spontaneously generate a word they associated with it, and indicate it in a textbox. When finished with reading and generating words, and after a retention interval of 30 s, participants were first asked to recall the given (or prompt) words, then the generated words, and finally the pairs of prompt and generated words. Participants were guided via computer to enter their responses (a single word/ pair at a time) until they could not recall any further words. After finishing this final part of the experiment, participants were debriefed.

### 3.3. Results and discussion

For the analyses, the recalled words were summed to make three types of dependent variables: (a) prompt words (achievement versus neutral), (b) generated words (achievement versus neutral), and (c) prompt-generated word pairs (e.g. recalled achievement prompt plus recalled achievement generated word). Two research assistants independently categorized the generated words as achievement or neutral, agreeing in 96% of all cases, and then solving disagreements through discussion. The summary statistics for the recall variables are in Table 1.

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Sample descriptives of recall variables for Study 1.</th>
</tr>
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<tbody>
<tr>
<td>(( N = 60 ))</td>
<td>M</td>
</tr>
<tr>
<td>Recalled given words (Ach)</td>
<td>7.60</td>
</tr>
<tr>
<td>Recalled given words (Neutral)</td>
<td>2.90</td>
</tr>
<tr>
<td>Recalled generated words (Ach)</td>
<td>2.73</td>
</tr>
<tr>
<td>Recalled generated words (Neutral)</td>
<td>5.04</td>
</tr>
<tr>
<td>Recalled pairs (ach–ach)</td>
<td>1.29</td>
</tr>
<tr>
<td>Recalled pairs (neut–neut)</td>
<td>1.43</td>
</tr>
</tbody>
</table>

Note that all these associations were found only in achievement-arousal conditions. Implicit achievement motivation had no significant influence on recall in neutral conditions. We also examined the correlations between the self-reported achievement.

In the achievement-arousal condition, there was a marginal correlation between implicit achievement and the number of generated words recalled, for both the achievement and neutral word prompts. Fisher r-to-z transformations revealed that the correlation was higher in the achievement condition than in the neutral condition. It appears that in the achievement-arousal condition, implicit achievement motivation facilitated recall for participants’ generated words and prompt-generated word pairs in the achievement condition.

Taken together, these eight participants therefore represented a sub-sample that was less motivated for achievement than both participants in the control, and experimental condition, and may thus have biased the analyses. After excluding these participants, 52 participants remained in the sample, 23 in the achievement, and 29 in the neutral condition.

From this sample, correlations were computed between implicit achievement scores and the recall of prompts, generated words, and word pairs in both the neutral and achievement condition (see Table 2). We did not find correlations between implicit achievement and achievement prompts or neutral prompts in either condition. All significant correlations involved participant generated words and prompt-generated word pairs in the achievement condition.

The average of the two coders’ scores was used for the analyses. The range of scores for implicit achievement was 0–19, \( M = 5.43; SD = 4.55 \), and self-reported achievement was 3–16, \( M = 10.35; SD = 3.04 \).
scores and the recall variables in both arousal and neutral conditions and found no correlations approaching significance.

To provide further support for this initial pattern, regression analyses were computed for the three dependent variables. In all reported regressions, implicit achievement and condition (achievement/neutral) were entered into the first block, and the interaction of these two variables entered into the second block.

There were no effects on the number of recalled achievement or neutral prompts. For recall of achievement-related generated words, there was a significant main effect of condition \((\beta = -.541; t = -2.278; p < .05)\), that was qualified by an interaction effect \((\beta = .446; t = 1.833; p = .073)\), that only marginally explained more variance. Follow-up t-tests revealed no significant differences between individuals high or low in the achievement or neutral condition. A further regression reveals a similar marginal interaction effect for the recall of neutral generated words \((\beta = .467; t = 1.911; p = .062)\). Follow-up t-tests revealed that individuals high in implicit achievement in the achievement condition \((M = 6.23; SD = 2.20)\) recalled more neutral generated words than participants low in implicit achievement in the achievement condition \((M = 3.90; SD = 2.73; t(21) = 2.269; p < .05)\). No further significant differences were found.

A regression on the recall of pairs consisting of both achievement prompts and achievement-related generated words reveals a main effect of condition \((\beta = -.502; t = -2.239; p < .05)\), that was qualified further by an interaction effect of implicit achievement and condition \((\beta = .580; t = 2.562; p < .05)\), with a significant increment in explained variance (change in \(R^2 = .149, F(3,51) = 3.972, p < .05\)). A follow-up t-test did not reveal any significant differences between the experimental and the neutral condition in the number of recalled pairs consisting of achievement prompts and achievement-related generated words. However, a further t-test shows that individuals high in implicit achievement in the achievement condition \((M = 1.54; SD = 1.13)\) recall significantly more such pairs than individuals low in implicit achievement in the achievement condition \((M = 0.50; SD = .527; t(17.821) = 2.932; p < .01)\). No further differences were obtained.

A similar main effect of condition \((\beta = -.460; t = -1.931; p = .059)\), and interaction effect was found for pairs consisting of neutral prompts and neutral generated words \((\beta = .524; t = 2.145; p < .05)\), but without a significant increment in explained variance. Follow-up t-tests investigating differences between individuals high in implicit achievement in the achievement condition and all other individuals did not reveal any significant differences.

As predicted, relationships were found between implicit achievement and the memory performance variables only in the context that aroused implicit achievement. Although there was no relationship between implicit achievement motivation and the number of achievement prompts recalled, there were significant correlations between and implicit achievement and the number of achievement and neutral generated words. Strongest indicator of the influence of implicit achievement-arousal states on memory was the correlation between implicit achievement motivation and the achievement prompt-generated word pairs. This association demonstrates that motive-arousal states facilitate elaboration of recently acquired information related to the motive, and that this elaborated information is retained in memory better than other types of information. The achievement prompts served as memory probes to access each person’s idiographic knowledge base for achievement. Why did not people remember the achievement prompts but remembered neutral generated words? The prompts seemed to have triggered people’s own knowledge base for achievement which was more familiar and more accessible than the recently acquired knowledge contained in the prompts. Finding absolutely no relationships between implicit achievement and memory performance in the neutral condition clearly points to the importance of an arousing context in the influence of implicit motives and memory performance.

### 4. Study 2

The second study used an experiment design similar to Study 1 to further demonstrate the influence of implicit motivational states on memory performance. Participants were presented with either a motive-arousing context related to their implicit motivation for achievement, or a neutral one. In addition to the assessment of the number of words recalled, we included measures of effort and response latency. Specifically, there were three hypotheses. First, those with a strong implicit achievement motive in the arousal condition were expected to recall more achievement-related words. Second, it was predicted that this group would also show evidence of increased effort in recalling a longer, more exhaustive list of achievement words. Finally, those with a strong implicit need for achievement in the arousal condition were expected to recall achievement stimuli faster than others.

#### 4.1. Method

In total, 104 students between the ages of 19 and 23 \((M = 19.8, 86\ females)\) participated in the experiment; their ethnic distribution was the same as in the previous study. All parts of the experiment were conducted on the computer as previously described. In this study, we furthermore employed MediaLab to record response latencies.

In the first part of the experiment, participants did the PSE and the PRF in a randomized order as in Study 1. Again, two research assistants trained to code for implicit achievement motivation scored each of the participants’ stories. Their inter-rater agreement was \(r(103) = .89\). Implicit achievement scores \((M = 4.93; SD = 3.54; random from 0 to 12)\) and explicit achievement scores \((M = 10.52; SD = 3.15; ranging from 2 to 16)\) are virtually the same as in the previous studies. A manipulation check revealed that participants followed the instructions as intended. All participants in the experimental condition provided memories with achievement imagery, while no memories in the control condition showed signs of achievement.

In the second part, participants were randomly assigned to either the neutral condition \((N = 41)\) or the achievement-arousal condition \((N = 63)\). Then they were presented with the randomized list of achievement-related and neutral words used in Study 1. When participants were asked to recall these prompts after a retention interval, their response latency for each entry was recorded. After finishing this final part of the experiment, participants were debriefed.
4.2. Results and discussion

4.2.1. Testing hypothesis 1: Recall frequency

It was predicted that individuals with a strong need for implicit achievement in the motive-arousal condition would recall more achievement-related words than those low in implicit achievement in the same state, and those in the neutral condition, irrespective of their implicit achievement score. No effects for neutral words, and self-reported motives were expected as they are unrelated to the achievement-arousal condition. On average, participants recalled 5.06 achievement words (SD = 1.98), and 2.22 neutral words (SD = 1.52). Only a weak, statistically not significant relationship between implicit achievement scores and the number of recalled achievement words in the experimental condition (r(63) = .22; p = .15) could be obtained. In a Fisher r-to-z transformation, however, it was found to be marginally larger than the corresponding correlation in the neutral condition (r(41) = -.16; z = 1.72; p = .08). The relationship between neutral words and implicit achievement scores did not reach significance either in the experimental (r(63) = .03), or neutral condition (r(41) = -.25).

To investigate the hypothesized interaction effect of implicit achievement and arousal condition on the number of recalled achievement words, a linear regression analysis was conducted. In the first block of the regression, z-standardized scores of implicit achievement and condition (achievement/neutral) were entered. The second block comprised the interaction of the two variables. As predicted, no main effects for implicit achievement or condition could be found. The interaction of implicit achievement and condition did not reach significance (β = .139; t = 1.411; p = .138), and there was no significant increment in explained variance (change in R² = .055, F(1,103) = 1.991; p = .16). However, simple slope tests (Cohen, Cohen, West, & Aiken, 2003; for the procedure, see O’Connor (1998)) revealed that slopes corresponding to high (but not to medium or low) implicit achievement scores (t = 2.202; p < .05) differ significantly from zero (see Fig. 1); no other relationship was significant. In other words, slope tests show that participants in the achievement-arousal condition recalled more achievement-related words the more they were motivated for implicit achievement.

4.2.2. Testing hypothesis 2: Effort

To investigate the role of implicit achievement for the number of recalled achievement words further, the distribution of recalled achievement words was examined by position of recall. Participants in the study recalled on average seven words, which is in correspondence with the average amount a person can hold in memory (Miller, 1956). People who are highly motivated for implicit achievement in a context that aroused their motive recall more achievement-related words, implying that they employ more attention and cognitive effort the recall these words. In addition to simply recalling more, they may try harder and longer to recall achievement-related words than other participants. We therefore expected participants high in achievement in a matching context to be more persistent and thus to recall more achievement-related words beyond the eighth recall position, that is, beyond the point that the average person stops their memory search. A Chi-square test for achievement words recalled beyond position eight revealed that indeed individuals high in achievement in an achievement-arousing context (N = 27) recalled more achievement-related words beyond position eight than other participants (N = 77; χ² = 14.09; p < .01). In other words, such individuals not only recall more achievement words in general, but they also recall these words in circumstances that require extra effort.

4.2.3. Testing hypothesis 3: Speed of recall

The experimental task was not introduced to participants specifically as a reaction time task, because such an instruction might have acted as an achievement incentive for both the achievement and neutral conditions. Participants were free to pace themselves, although they were reminded to respond to the questions quickly. Accordingly, response latencies varied. To identify outliers, exploratory data analyses (with box-and-whiskers-plots, see Hoaglin, Mostellerand Tukey (1983) and Tabachnick and Fidell (2007)) were conducted on the response latencies for each participant. Of the 758 total reaction times, altogether 64 individual response latencies were identified as extreme outliers in the “outer fences” of the boxplot (i.e. more than three times the quartile deviation, see Diehland Staufenbiehl (1997, p. 717 ff.), and were excluded to prevent statistical distortions in further analyses. No participant was excluded based on this procedure, just specific reaction times. Then, median reaction times separate for neutral and achievement-related words were computed for each individual. The Median reaction time was Md = 3.36 (with a range of 1.11-22.52) for achievement-related words, and Md = 2.78 (with a range of 0.85-14.03) for neutral words.

As predicted, there was a negative relationship between implicit achievement scores and the median reaction time of achievement words only in the experimental condition (r(63) = -.35; p < .05), not in the control condition (r(41) = .19), nor for neutral words in either condition (r(63) = -.19; r(41) = -.12, respectively). In addition, this predicted relationship was found to be significantly different from the corresponding correlation in the neutral condition (z = .03; p < .01).

To investigate whether this interaction effect is unique to achievement-related words, we repeated the above regression (and slope tests) on the number of recalled neutral words, but could neither detect any main effects of condition or implicit achievement, nor an interaction effect of the two, which is consistent with our assumptions. To rule out any unpredicted effects of explicit achievement, we conducted a linear regression analysis with z-standardized explicit achievement scores and condition in the first, and the interaction of the two in the second block, followed up by simple slope tests to examine potential interaction effects. The regression revealed no significant main or interaction effects, and slope tests confirmed this finding.
A linear regression analysis was carried out to examine the hypothesized interaction effect of $z$-standardized scores of implicit achievement and the arousal condition on the speed of recall of achievement-related words. To ensure that distributions of response latencies were not different across conditions, and within high and low implicit achievement, Levene Tests for the equality of variances were computed, revealing no significant differences in the variance of reaction times. For the regression, implicit achievement motivation and condition (achievement/neutral) were entered into the first block, and the interaction term of implicit achievement and condition was entered into the second block, with the median reaction time for achievement words as the dependent variable.

In line with our assumption, a significant interaction of implicit achievement and condition on the reaction time of achievement-related words ($\beta = -.288; t = -2.688; p < .01$) was obtained, with a significant increment of explained variance (change in $R^2 = .081, F(1,84) = 7.23, p < .01$). As predicted, no main effects of implicit achievement or condition were found.

Simple slope tests were carried out to analyze this effect (see Cohen et al. (2003) and O’Connor (1998)), revealing that slopes corresponding to high (but not low or medium) scores in implicit achievement ($t = -2.15; p < .05$) are significantly different from zero (see Fig. 2). In other words, individuals recalled achievement-related words faster, the more they were motivated for implicit achievement and were presented with an achievement inducing experimental condition. In line with our predictions, no further slope tests reached significance.

To explore for any unpredicted effects, further regression analyses were carried out. First, no significant main or interaction effects were found in a regression of implicit achievement and condition (achievement/neutral) on the median reaction time of recalled neutral words. As well, a second regression with explicit achievement and condition (achievement/neutral) on the median response latency of recalled achievement-related words or neutral words did not reveal any significant effects. In both cases, slope tests did not reveal any significant relationships.

In conclusion, evidence was found only for the predicted interaction of implicit achievement motivation and arousal condition: Individuals high in the implicit need for achievement that are in a condition arousing their motivation recall achievement-related words slightly faster than all others.

Supporting our hypothesis, people with a high implicit need for achievement in an achievement-arousing context recalled more achievement-related words. We found evidence for this pattern by ruling out several alternative options. Replicating the findings of the previous study, we did not find any effects for self-reported achievement. All three hypotheses received support: Individuals with a strong implicit need for achievement in contexts that engage their motivation recalled more motive-related stimuli, exhibited more recall persistence and do so slightly faster.

5. Study 3

In the final study, we set out to clarify the effect found in Study 2 that individuals high in implicit achievement in an achievement context recalled achievement-related words faster than all other individuals. The pattern could indicate that a match between motivational disposition, context and task characteristics not only results in an increased recall performance, but also in an improved recall speed. To test whether implicit motivation and contextual characteristics are linked to the speed with which motive-relevant material is recalled, we employed the same experimental design as in Study 2, in which participants were presented with either an achievement-arousing or neutral context, and then presented with a randomized list of neutral and achievement-related stimuli. In contrast to Study 2, all participants were instructed to recall these words as fast as possible. First, as shown in the previous studies, we assumed that those individuals with a strong implicit achievement motive in the achievement-arousal condition would recall more achievement-related words, although this effect might be weaker than in Study 2 due to the different instructions (speed of recall versus general recall). Second, we expected that this same group of individuals to recall achievement-related words significantly faster than all other individuals.

5.1. Method

A total of 127 students between the ages of 19 and 22 ($M = 19.5, 112$ females) participated in the experiment; their ethnic distribution was the same as in the previous studies. Like in the previous studies, all parts of the experiment were conducted on the computer, additionally using MediaLab to record response latencies (see Study 2).

As in the previous studies, the experiment began with the PSE and the PRF in a randomized order. Again, two research assistants trained to code for implicit achievement motivation scored each of the participants’ stories. Their inter-rater agreement was $r(126) = .88$. Implicit achievement scores ($M = 3.88; SD = 3.55$; ranging from 0 to 15) and explicit achievement scores ($M = 10.35; SD = 2.92$; ranging from 2 to 15) are highly similar to those in previous studies. Participants responded to the experimental instruction with memories rich in achievement imagery, and individuals’ memories in the control condition were void of achievement imagery.

As in the previous studies, participants were randomly assigned to either the neutral condition ($N = 65$) or the achievement-arousal condition ($N = 62$) in the second part of the experiment, and were afterward presented with the randomized list of achievement-related and neutral words. In contrast to the previous studies, participants were then instructed to recall these words “as fast as possible”, both in the neutral and the achievement condition, and both the number of recalled words (achievement/neutral) and their corresponding response latencies were recorded. Participants were debriefed after this final task.

![Fig. 2. Interaction effect of implicit achievement and condition the median reaction time of achievement words in Study 2.](image-url)
5.2. Results and discussion

5.2.1. Testing hypothesis 1: Recall frequency

An inspection of the correlations revealed a tendency that participants’ implicit achievement scores were related to the number of recalled achievement words in the experimental condition \((r(62) = .21; \ p = .10)\), but not to the number of recalled neutral words \((r(62) = -.04)\), or either word categories in the control condition \((r(65) = -.12; r(65) = -.02)\). Furthermore, the correlation between implicit achievement scores and the number of recalled achievement words in the experimental was found to be marginally different from the one obtained in the neutral condition \((z = 1.85; p = .06)\). In order to investigate the hypothesized interaction effect of implicit achievement and arousal condition on memory performance, a linear regression analysis was computed, with \(z\)-standardized scores of implicit achievement and condition (achievement/neutral) entered in the first, the interaction of the two variables in the second block, and the number of recalled achievement words as the dependent variable. No main effects of condition or implicit achievement were obtained. In line with our hypothesis, a marginal interaction of implicit achievement and condition was detected \((\beta = .307; \ t = 1.807; \ p = .073)\); with the increment in explained variance approaching significance \((\text{change in } R^2 = .026, F(1,124) = 3.264, p = .073)\). Follow-up slope tests \((\text{Cohen et al., 2003; O’Connor, 1998})\) reveal that slopes corresponding to high \(\text{(not low or medium)}\) scores in implicit achievement approached marginal significance \((t = 1.604; p = .111; \text{see Fig. 3})\). This tendency could imply that individuals in the achievement-arousal condition recalled more achievement-related words, the more they were motivated for implicit achievement. However, this non-significant interaction effect should be interpreted with caution. On the one hand, it could be argued that the focus of the task (on speed of recall instead of number of recalled words) may have attenuated the effect previously found in Study 2. On the other hand, effects on the number of recalled achievement words were motivated for implicit achievement. However, this non-significant interaction effect should be interpreted with caution. On the one hand, it could be argued that the focus of the task (on speed of recall instead of number of recalled words) may have attenuated the effect previously found in Study 2. On the other hand, effects on the number of recalled achievement words were marginally different from the one obtained in the neutral condition \((z = 1.85; p = .06)\). In order to investigate the hypothesized interaction effect of implicit achievement and arousal condition on memory performance, a linear regression analysis was computed, with \(z\)-standardized scores of implicit achievement and condition (achievement/neutral) entered in the first, the interaction of the two variables in the second block, and the number of recalled achievement words as the dependent variable. No main effects of condition or implicit achievement were obtained. In line with our hypothesis, a marginal interaction of implicit achievement and condition was detected \((\beta = .307; \ t = 1.807; \ p = .073)\); with the increment in explained variance approaching significance \((\text{change in } R^2 = .026, F(1,124) = 3.264, p = .073)\). Follow-up slope tests \((\text{Cohen et al., 2003; O’Connor, 1998})\) reveal that slopes corresponding to high \(\text{(not low or medium)}\) scores in implicit achievement approached marginal significance \((t = 1.604; p = .111; \text{see Fig. 3})\). This tendency could imply that individuals in the achievement-arousal condition recalled more achievement-related words, the more they were motivated for implicit achievement. However, this non-significant interaction effect should be interpreted with caution. On the one hand, it could be argued that the focus of the task (on speed of recall instead of number of recalled words) may have attenuated the effect previously found in Study 2. 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Follow-up slope tests \((\text{Cohen et al., 2003; O’Connor, 1998})\) reveal that slopes corresponding to high \(\text{(not low or medium)}\) scores in implicit achievement approached marginal significance \((t = 1.604; p = .111; \text{see Fig. 3})\). This tendency could imply that individuals in the achievement-arousal condition recalled more achievement-related words, the more they were motivated for implicit achievement. However, this non-significant interaction effect should be interpreted with caution. On the one hand, it could be argued that the focus of the task (on speed of recall instead of number of recalled words) may have attenuated the effect previously found in Study 2. On the other hand, effects on the number of recalled achievement words were relatively modest in Study 1 and 2, too. It could therefore be that the concerted influence of implicit achievement and context characteristics fluctuates at the level of a marginal effect. As expected, further regression analyses and slope tests revealed no effects for neutral words, and no influence of explicit achievement.

5.2.2. Testing hypothesis 2: Speed of recall

It was predicted that individuals with a strong implicit need for achievement, in the achievement-arousal condition would recall achievement-related words significantly faster than those low in implicit achievement in the same context, and all participants in the neutral condition. No effects for neutral words and self-attributed motives were expected, because they are unrelated to the specific arousal condition.

To account for extreme reaction times, exploratory data analyses \((\text{with box-and-whiskers-plots, see Hoaglin et al. (1983) and Tabachnick and Fidell (2007)})\) were conducted on the response latencies for each participant to identify potential outliers. Because this task was explicitly introduced as a reaction time task, outliers are expected to be fewer in number than in Study 2, in which individuals were free to work at their own speed. Of a grand total of 940 reaction times, altogether 49 individual response latencies were identified as extreme outliers in the “outer fences” of the boxplot \((\text{i.e. more than three times the quartile deviation, see Diehl and Staufenbiehl (1997, p. 717 ff.)})\), and were excluded from further analyses. No participant was excluded, merely specific reaction times. Like in Study 2, median reaction times for neutral and achievement-related words were computed for each individual, with \(M_d = 2.79\) \((\text{with a range of } 1–33.58)\) for achievement-related words, and \(M_d = 2.81\) \((\text{with a range of } 0.79–20.35)\) for neutral words.

As expected, a significant negative relationship between implicit achievement scores and median response latencies was found only in the experimental condition \((r(62) = -.253; p < .05)\), a relationship that was highly different from the one obtained in the control condition \((r(65) = .22; \text{ns}; z = -2.69; p < .01)\). No significant relationship between neutral words and implicit achievement scores was found for the neutral \((r(65) = .12)\), or experimental condition \((r(62) = -.10)\).

To investigate the hypothesized interaction effect of implicit achievement and arousal condition on the speed of recall of achievement-related words, a linear regression analysis was conducted. \(z\)-standardized scores of implicit achievement motivation and condition (achievement/neutral) were entered into the first block, and the interaction term of implicit achievement and condition was entered into the second block, with the median reaction time for achievement words as the dependent variable. No main effects of implicit achievement or condition were obtained, but the expected interaction effect of implicit achievement and condition on the reaction time of achievement-related words was detected \((\beta = -.224; t = -.2519; p < .05)\), with a significant increment of explained variance \((\text{change in } R^2 = .049, F(1,123) = 6.346, p < .05)\). Slope tests \((\text{Cohen et al., 2003; O’Connor, 1998})\) show that only slopes corresponding to high implicit achievement scores \((\text{but not low or medium scores})\) were significantly different from zero. In other words, individuals recalled achievement-related words faster when they were in the achievement-arousal condition, and the more they were motivated for implicit achievement \((\text{see Fig. 4})\).

As expected, no effects for explicit achievement and condition on the reaction time of achievement-related words were found in regression analyses or slope tests. A further regression \((\text{with follow-up slope tests})\) with implicit achievement and condition as predictor variables, and reaction time of neutral words did not yield any significant findings at all, which strongly suggests that the observed interaction effect is unique to achievement-related words.

6. General discussion

People remember and forget in ways that are not under their conscious control. It is important to understand these processes and identify their parameters. Three studies found a consistent
pattern of results linking implicit motivational states to better learning and memory performance. First, there was evidence that the strength of implicit motives is directly linked to the magnitude of encoding and retrieval of motive-related stimuli. Second, implicit motives interact with arousal states that facilitate selective recall and elaboration of motive-related stimuli. Finally, implicit motives interact with arousal states that facilitate, not only selective encoding and recall, but also effort and speed in memory performance.

Implicit motives are enduring preferences to experience particular affective-end states. People tend to be less aware of their implicit motives by shown in their lack of correlation with self-reports. Implicit motives are aroused in situations that provide intrinsic incentives for particular affective-end states. People want to experience the emotion of the implicit motive (e.g., the feeling of succeeding) rather than the external reward (e.g., an A on their transcript). We reasoned that if this is really occurring outside of awareness, as the research suggests, then implicit motives might be linked to cognitive procedures that automatically create information processing events that lead to these desired affective-end states. These implicit cognitive procedures may become linked to intrinsic incentives after many experiences in which the affective-end state is felt in motive-arousing situations. In this way, implicit motives modulate selective attention, encoding, and elaboration, as well as recall accessibility, effort, and speed. We view this as a form of motive by state-dependent learning.

It is important to note that people who said that were high achievers by endorsing statements like (“I always strive to do my best”) did not show superior memory performance in any of the studies. It was only those with a strong implicit need for achievement who consistently showed superior memory performance. It appears that implicit motivation sensitizes people to motive-related stimuli in their environment after they have vividly recalled an autobiographical experience related to achievement. Achievement motivation estimated via self-report is not responsive to this induction. Thus, the findings support the idea that implicit and explicit motives are differentially activated or engaged by a unique set of incentives. Autobiographical research has shown that these motives influence both what and how autobiographical events are remembered. Specifically, implicit motives modulate encoding and recall of emotional experiences, vivid memories, and event-specific knowledge through non-conscious organizing strategies that facilitate affective-end states (e.g., Woike, 1995; Woike, 1994a). Self-reported motives modulate encoding and recall of events linked to self-concept stability and change, as well as routine experiences and general event scripts that represent typical self-attributed behaviors that facilitate the attainment of current goals (e.g., Woike, 1995; Woike et al., 2003).

We chose to use achievement motivation as the implicit motive in the studies because, as our past research has found, implicit achievement can be easily aroused via the vivid recollection exercise used in all three studies and memory performance can be measured via computer. Computers tend to be conducive to achievement and task-related concerns. It might be more difficult to develop an experimental paradigm to engage or arouse, say the need for intimacy, and then collect recall data via computer. People may use computers more frequently to achieve their work-related goals and use in-person interactions to meet their needs for intimacy. On the other hand, using only achievement, limits to some degree the generalizability of our findings—it might not be that all implicit motives are linked to basic memory processes in the same way. Yet, the research on implicit motives and the content of autobiographical narratives shows the same motive-related themes for achievement, power, intimacy and affiliation.

What did we discover about arousal states and memory? In all three studies, we used the vivid recollection exercise (Woike, 1994b) which is a tried and true procedure to arouse implicit motivation. Consistent with the research on the development of the implicit motive measures we found in the manipulation checks that those with a fair amount of implicit achievement motivation as assessed by the PSE, were also more susceptible to the arousal manipulation. But, self-reported achievement had no effect on responsiveness to the arousal procedure. This calls to mind the issues on general state dependent learning (e.g., Godden & Baddeley, 1975). Implicit motive-arousal states may be viewed as more specific types of general affective state that are inductive to learning. After many experiences in which the specific affective-end state is felt in motive-arousing situations, implicit cognitive procedures become linked to intrinsic incentives so that people in implicit motive-arousal states automatically modulate their selective attention, encoding and recall of motive-relevant information. Over time, this automatic processing serves to maintain and facilitate the attainment of these affective-end states. So people who find themselves in conditions in which they experience affective or motivational arousal congruent with their implicit motivation should be more likely to recall content linked to the particular motive. Activating achievement motivation activates learning and memory processes for achievement topics.

In Study 2, we used the vivid recollection procedure to arouse implicit achievement motivation—and in addition to the assessment of the number of words recalled, we included measures of effort and response latency. We found that people with a high implicit need for achievement in an achievement-arousing context recalled more achievement-related words than others. To estimate effort, we compared the distribution of achievement-related words across the order of recall and found that people with a high implicit need for achievement under conditions of motive arousal, not only recall more words, but recalled them across a wider range of positions. Cognitive capacity dictates that, on average, people recall about seven words maximum on these kinds of memory tasks. In Study 2, we saw that people with a high implicit need achievement in the achievement-arousing condition recalled the median reaction time of achievement words in Study 3.

![Fig. 4. Interaction effect of implicit achievement and condition the median reaction time of achievement words in Study 3.](image-url)
context go the “extra mile” by recalling more achievement-related words beyond the eighth position. We also uncovered a modest link between implicit achievement and recall speed, with—again—those highly motivated for implicit achievement in an achievement-arousing context outperforming others. This is especially remarkable, because the instructions of the experiment did not even suggest that participants respond as quickly as possible. Shorter response latencies may indicate better accessibility to this recently acquired information.

Thus, the final study clarified the marginal effect found in Study 2 that individuals high in implicit achievement in an achievement context recalled achievement-related words faster than all other individuals. To test whether implicit motivation and contextual characteristics are linked to the speed with which motive-relevant material is recalled, we employed the same experimental design as in Study 2. But, in contrast to Study 2, all participants were instructed to recall the words as fast as possible. First, those individuals with a strong implicit achievement motive in the achievement-arousal condition recalled more achievement-related words, although this effect might be weaker than in Study 2 due to the different instructions (speed of recall versus general recall). Second, this same group of individuals recalled achievement-related words significantly faster than all other individuals. Thus, all participants were instructed to recall as fast as possible, and even then, high-achievement individuals outperformed all others.

The data pattern in Study 3 seems to reflect a trade-off between speed and accuracy. If we ask people high in the need for implicit achievement to recall the words in a very general way, we observe a strong effect of the number of words and a smaller effect for reaction time; but if we ask them to recall as fast as possible, we find a strong effect for reaction time and a smaller effect for the number of recalled words.

Thus, there is consistent evidence that, in motive engaging situations, the implicit need for achievement plays a critical role in memory performance. It leads to a heightened awareness of achievement-related stimuli, which makes the information more likely to be encoded and later recalled. People will also be more likely to elaborate on the achievement-related information that they are given and then recall it—suggesting better accessibility of achievement-related knowledge generally. Implicit achievement-arousal conditions appear to create cognitive engagement in achievement-related material: people make more effort to recall achievement-related information. Moreover, implicit achievement-arousal influences accuracy and speed of recall of recently acquired achievement-related information.

If it was not for all the prior research on the link between autobiographical memory and implicit motivation, one might question the ecological validity of these studies. After all, what does remembering a list words have to do with memory processes in everyday life? Autobiographical stories might be more interesting. Narratives of autobiographical experiences represent the final product of memory-related information processing, but they offer comparatively little insight into the actual processes from which they have emerged. This, and a lack of experimental control in past studies of autobiographic narratives, made it difficult to discern whether the data represent actual differences in information processing, differences in life experiences, or in writing style. In the current studies, we dissected naturally-occurring, potentially memorable events by controlling and limiting memory input to simple words. We employed experimental designs that allowed for precise identification of the impact of implicit motives and implicit motivational arousal states on basic memory processes underlying the construction of autobiographical narratives. Thus, it appears that the relations between implicit motives and the content of autobiographical memory generally reflect how actual memory processes are influenced by motivation. An autobiographical memory represents the end result of a series of information processing events determined by different personality motivations and their interaction with the social environment.

Acknowledgments

This research was funded by a grant from the National Institute of Mental Health (R01-MH064657) to Barbara A. Woike. Thanks are extended to the following people for their research assistance: Emily Kramer, Kalindra Smith, Sabrina Schaffer, Julie Rappoport, Jenna Slutsky, Allison Cramer, and Zeynep Sener.

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