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Hope of success relates to the memory for unsolved compared to solved anagrams

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Hope of success relates to the memory for unsolved compared to solved anagrams

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Abstract

It is widely believed that unfinished tasks are better remembered than finished tasks, a phenomenon

labelled the "Zeigarnik-Effect". It has been argued that this advantage relies on the persisting tension

inherent in uncompleted intentions. However, this interpretation has been challenged. First, the

memory advantage could not be reliably replicated. Second, a memory advantage can still be observed

when the unfinished status of an uncompleted intention is inherently terminated, rendering the

"persisting tension" explanation unlikely. The goal of the present study was to investigate the potential

memory advantage of interrupted but finished tasks and its relation to the personality disposition

achievement motivation, specifically, hope of success and fear of failure. This goal was motivated by the

hypothesis that the experience of a discrepancy between the anticipation of success and the subsequent

failure would relate to the memory for an unfinished task, and that this discrepancy experience would

be stronger for people high in hope of success. A large sample of adults (>1000 participants) was

presented with twelve anagrams. If they did not solve an anagram within sixty seconds, they were

shown the solution. Afterwards, we measured free recall of the anagram solutions and assessed

achievement motivation. Overall, participants recalled more unsolved anagrams than solved anagrams.

However, only individuals high in hope of success displayed a greater tendency to remember unsolved

anagrams. This study supports the idea that a discrepancy experience rather than persisting tension

coincides memory for unsolved tasks.

Keywords: Intention memory, anagrams, achievement motivation

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In everyday life, we are often confronted with interruptions during tasks, leaving these tasks and

their intended goals unfinished. It is widely believed that this unfinished status would inherently provide

for a memory advantage, a phenomenon labelled the "Zeigarnik Effect". In her seminal study, Zeigarnik

(1927) presented her participants with simple tasks such as knitting and folding paper. Some of these

tasks were interrupted, while others were completed, and subsequently, the results showed better

memory for uncompleted compared to completed tasks. In line with Lewin's (1926) field theory,

Zeigarnik assumed that intentions function similarly to Freudian needs, such that they create a tension

that is relieved only when the intention is fulfilled. Accordingly, the Zeigarnik effect has been assumed to

rely on the persisting tension inherent in uncompleted intentions. However, this interpretation has been

challenged. First, the memory advantage could not be reliably replicated over the years (for an

overview, see MacLeod, 2020; Butterfield, 1964; Van Bergen, 1968). Second, a memory advantage can

still be observed when the unfinished status of an uncompleted intention is inherently terminated

(Baddeley, 1963). Thus, the interruption and its interference with the anticipation of successfully

completing a task may be crucial. As the anticipation of success is a facet of achievement motivation, the

goal of the present study was to investigate the potential memory advantage of interrupted but finished

tasks and its relation to the personality disposition achievement motivation, specifically, hope of success

and fear of failure.

Achievement motivation is seen as a stable disposition to strive for achievement or success

(Atkinson, 1957). Individuals high in achievement motivation tend to be better at problem-solving, work

longer on problems, and have higher expectancies of success (Atkinson, 1957; French & Thomas, 1958).

Achievement motivation is probably the most prominent individual difference associated with the

Zeigarnik effect (Atkinson, 1953; Farley & Mealiea, 1973; Mandowsky, 2007; Moot III et al., 1988; Reiss,

1968; Weiner, 1966). For example, in a study by Atkinson (1953), participants high in achievement

motivation recalled more interrupted tasks, whereas participants low in achievement motivation

exhibited the opposite profile (Atkinson, 1953). Achievement motive has been proposed to consist of

two distinct aspects: An approach motive involving the expectation of reward, called *hope of success*,

and an avoidance motive involving the expectation of punishment, called *fear of failure* (Clark et al.,

1956; McClelland et al., 1953). Individuals high in hope of success typically also anticipate their success,

whereas individuals high in fear of failure doubt their ability to manage to solve a problem (Heckhausen,

1963). Both motive tendencies are mutually independent, and individuals can both strive for success

while avoiding failure (Brunstein & Heckhausen, 2018). Although this association between achievement

motivation and the recall of interrupted tasks has often been linked to stronger tension caused by the

unfinished intention, we suspect another far more central underlying mechanism at play.

The concept of tensions fails to explain a memory advantage for tasks that have been

interrupted but are inherently finished. Specifically, Baddeley (1963) gave participants anagrams to

solve. If they did not manage to solve them within one minute, they were shown the solution.

Subsequently, the recall of unsolved anagrams was remarkably higher than the recall of solved

anagrams. These results may suggest a memory advantage for unfinished tasks. However, presenting

the anagrams' solutions subsequently finished the tasks, annihilating any intention of solving the

anagrams. Therefore, these findings are not in line with the idea of persisting tension, as the persisting

tension would dissolve after the presentation of the anagram's solution. Instead, it seems that the

interruption itself is of importance, interfering with the anticipation of successfully completing a task.

Hence, we used the approach employed by Baddeley (1963) to investigate the importance of

the experience of a discrepancy between the anticipation of success and the subsequent failure for the

memory advantage of interrupted tasks. We, too, had participants solve anagrams, for which they were

allotted 60 seconds before they were presented the solution. In particular, we expected this memory

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advantage for unsolved anagrams to be more pronounced with higher experienced discrepancy, such as

individuals high in hope of success, as they anticipate more success.

Therefore, we would expect a memory advantage for solutions to unsolved anagrams, as

demonstrated by Baddley (1963). In addition, however, we would argue that memory for unsolved

anagrams should relate to high hope of success only: Higher hope of success would relate to a higher

expectancy of success, resulting in a more substantial experienced discrepancy and better subsequent

recall of unsolved anagrams. Regarding fear of failure, the lower expectancy of success would result in a

weaker experienced discrepancy and, therefore, not be associated with subsequent recall of unsolved

anagrams.

Method

Participants

The sample consisted of 1076 participants, 600 of whom identified as female (56%), 468 as male

(43%), and eight as neither male nor female (1%). Age ranged between 18 and 45 years (M = 23.32, SD =

4.84). Participants were required to be at least 18 and not older than 45 years old. They were recruited

by undergraduate students as part of a research course and were not compensated for their

participation. Data collection occurred between October 2022 and December 2022. Reports were

collected anonymously. The ethics committee of the human science faculty of the University of Bern

approved the study (2021-08-00007).

Materials

We created twelve anagrams using the following German five-letter words: *Paket*, *Trick, Liter,*

Kunst, Motiv, Frage, Rauch, Kleid, Stirn, Tafel, Karte, and *Logik*, all with a medium to high frequency

from the Celex-database (Baayen et al., 1996). Anagrams were created by rearranging the letters of each

word in one of four ways, namely 31524, 35142, 52413, and 42531 (Hunter, 1959). We counterbalanced

the way anagrams were rearranged (three anagrams per rearrangement pattern) and their order of

presentation across participants. For practice, we used three additional anagrams formed with the

German five-letter words *Notiz*, *Motor*, and *Sonne*. They were created using rearrangement orders

which are easier to solve: 12354 for *Notiz* ("NOTZI"), 41235 for *Motor* ("OMOTR"), and 53241 for *Sonne*

("ENONS"). All anagrams were presented on a computer in black font on a white background, using the

Calibri Light font typeface.

To measure achievement motivation, that is, a general tendency to evaluate and act in

situations with a standard of excellence to be met, we used the revised 10-item version of the

Achievement Motives Scale (AMS-R; Lang & Fries, 2006). The scale consists of a 5-item hope of success

scale (Cronbach α = .71 – .80) and a 5-item fear of failure scale (Cronbach α = .76 – .85), and

demonstrated overall good reliability (Taber, 2018). The hope of success scale measures individuals'

preference for and attraction to challenging situations that allows the evaluation of their capability.

Conversely, the fear of failure scale assesses individuals' anxiety and unease in challenging or uncertain

situations, particularly when threatened with task failure. Participants were instructed to rate each item

on a four-point Likert scale (1 = *totally disagree*, 2 = tend to disagree, 3 = *tend to agree,* 4 = *totally*

agree).

Procedure

Participants were tested individually. Before beginning the experiment, they were given the

following instruction in German: "Your task now is to solve anagrams. You will be presented with strings

of letters with which you have to form a meaningful word by rearranging the letters. Following this

instruction, you will see a few examples". Next, participants were presented with the three practice

trials. We did not limit the time for the completion of practice trials. After completing the three practice

trials, testing began with the words, "Good! Now we will start with the actual testing". Participants were

then presented with the twelve anagrams in sequence. If the participant managed to solve the anagram,

or after 60 seconds elapsed, the participant was given the anagram's solution with the words "the

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solution was [WORD]", and proceeded to the next anagram. If the participant had managed to solve the

anagram, the time to solve the anagram was recorded, and they were likewise shown the solution with

the words "the solution was [WORD]". After presenting all twelve anagrams, the participant was

instructed to recall as many solutions as possible with the instruction, "Which of the solutions do you

remember?". We recorded the solutions and the order in which the solutions were recalled. At the end,

participants filled out the AMS-R to measure achievement motivation.

Analyses

First, we analyzed the number of anagrams solved and recalled. We tested for differences using

a paired sample t-test. Further, we investigated the relation of hope of success and fear of failure to

anagram recall using a generalized linear mixed model.

Results

General Analysis

Participants solved a total of M_{solved} = 7.90 (SD_{solved} = 2.29) anagrams, with a minimum of Min_{solved}

= 0 and a maximum of Max_{solved} = 12. They recalled a total of $M_{recalled}$ = 4.15 ($SD_{recalled}$ = 1.55) anagrams,

with a minimum of $Min_{recalled}$ = 0 and a maximum of $Max_{recalled}$ = 11. In total, participants recalled more

solved anagrams, M = 2.50 (SD = 1.64), than unsolved anagrams, M = 1.64 (SD = 1.12). As participants

solved more anagrams on average than failed to do so, we computed percentages recalled of solved and

unsolved anagrams, resulting in an average recall of 45.34% of unsolved and 31.15% of solved

anagrams. A paired sample t-test confirmed that participants recalled more unsolved anagrams than

solved anagrams, t(1029) = 13.12, p < .001, d = .41, 95% CI [0.35, 0.47].[1]

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[1] There were no significant gender differences in anagram solving performance, total recall, and recall of unsolved and solved anagrams. Further illustrations of the relationship between retrieval performance, hope of success, fear of failure, and age can be found in the supplementary materials.

Hope of Success and Fear of Failure

Next, we investigated the influence of hope of success and fear of failure on the recall of anagram solutions. The average hope of success score was M_{HS} = 10.91 and SD_{HS} = 2.45, with a minimum of Min_{HS} = 0 and a maximum of Max_{HS} = 15. The average fear of failure score was M_{FF} = 6.75 and SD_{FF} = 3.58, with a minimum of Min_{FF} = 0 and a maximum of Max_{FF} = 15. Reliability was computed using the R package *ltm* (Rizopoulos, 2007), was acceptable for the hope of success scale, Cronbach α = .78, 95% CI [.75, .80], and good for the fear of failure scale, Cronbach α = .86, 95% CI [.85, .87].

We used a generalized linear mixed model to analyze the data, with the anagram recall as a binary outcome variable with a logit link function and whether the anagram had been solved, hope of success scores, and fear of failure scores as predictors. Interaction terms between solving the anagram and hope of success, as well as solving the anagram and fear of failure scores, were also included to account for potential moderating effects. We included the subject, the anagram, and the anagram position in the presentation order as random effects. Analyses were conducted using the function *glmer* from the R package *lme4* (Bates et al., 2015). The model's total explanatory power was R^2 = .35, and the part related to the fixed effects alone was R^2 < .01 (see Figure 1).

[Figure 1]

The main effect of solving the anagram was not significant, B = 0.19, 95% CI [-0.28, 0.67], *p* = 0. 428; β = -.19, 95% CI [-0.24, -0.15]. The main effect of hope of success was significant and positive, B = 0.05, 95% CI [0.02, 0.08], *p* = 0.002; β = .04, 95% CI [<-.01, .09], whereas the main effect of fear of failure was not significant, B = 0.01, 95% CI [-0.01, 0.03], *p* = 0.330; β = .02, 95% CI [-.03, .06]. The interaction between solving the anagram and hope of success was significant and negative, B = -0.05, 95% CI [-0.09, -.01], *p* = 0.009; β = -.06, 95% CI [-.10, -.01]. Individuals high in hope of success recalled a higher percentage of unsolved anagrams than those with low scores in hope of success. The interaction

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between solving the anagram and fear of failure was not significant, B < -0.01, 95% CI [-0.03, 0.02], *p* =

0.510; β < -.01, 95% CI [-0.06, 0.03].

Discussion

The goal of the present study was to investigate the potential memory advantage of interrupted

but finished tasks and its relation to the personality disposition achievement motivation, specifically,

hope of success and fear of failure. This goal was motivated by the hypothesis that the experience of a

discrepancy between the anticipation of success and the subsequent failure would relates to the

memory for an unfinished task, and that this discrepancy experience would be stronger for people high

in hope of success. This hypothesis can be considered as an alternative to the hypothesis that lingering

tension is responsible for the memory advantage of uncompleted compared to completed intentions

(i.e., the Zeigarnik effect), which has been found most reliably among participants with high

achievement motivation. In order to exclude the possibility that lingering tension could be the cause for

the memory advantage in the present study, we used a paradigm that compared interrupted but

finished tasks vs. uninterrupted finished tasks. This is in contrast to typical Zeigarnik studies in which

interrupted and unfinished tasks are compared to uninterrupted and finished tasks. We measured

participants' recall of solved and unsolved anagrams and investigated these findings in relation to

achievement motivation for hope of success and fear of failure separately, as we expected the memory

advantage to relate to hope of success predominantly. Accordingly, we found a significant memory

advantage for unsolved anagrams compared to solved anagrams. However, a further analysis revealed

that the memory for unsolved anagrams recalled was better only in individuals high in *hope of success*.

Previous research on the memory for interrupted tasks yielded remarkably inconsistent results

(Butterfield, 1964; MacLeod, 2020; Van Bergen, 1968). Of these studies, Baddeley's (1963) study stands

out as it demonstrates a striking advantage for interrupted tasks. Critically, however, these findings are

distinct from other research on interrupted tasks, as interrupted tasks are essentially finished through

the presentation of the anagrams' solutions. Therefore, the memory advantage of interrupted tasks

cannot be attributed to the persisting tension of solving the task in this study. Rather, our findings

support the notion that the discrepancy between the expectancy to solve anagrams and the actual

performance resulted in better recall. Only individuals high in hope of success demonstrated better

recall for anagram solutions of unsolved anagrams than solved anagrams.

Notably, however, in this paradigm, the duration spent working on solving anagrams is

confounded with the analysis (Pachauri, 1935; Walsh, 1940, 1942). Although there could be a correlation

between the duration spent working on an anagram and its subsequent retrieval in this study, this

analysis is confounded by the interruption and completion of the task. Unsolved anagrams always lasted

60 seconds, whereas the duration of solved anagrams varied. Thus, the effect of task duration cannot be

disentangled from the effect of task completion. For solved anagrams, however, previous research

suggests that anagrams requiring more time to reach their solution tend not to be recalled better than

quickly solved anagrams (Foley et al., 1989; Zacks et al., 1983).

Some limitations need to be taken into consideration, however. Effect sizes were generally

small, and explained variance by the fixed effects alone in the study was low. However, the small effect

sizes and low variance explained by fixed effects could be attributed to the minimal intervention

approach used. By merely limiting the time for anagram resolution, the impact on outcomes was

naturally less pronounced. Hence, large samples are needed to detect such small effects. Moreover, we

used a self-report measure to assess hope of success and fear of failure. The use of a self-report

measure may thus not accurately reflect participants' motivation or be subject to social desirability bias.

However, using self-report measures required considerably less time, which was favourable for the test

economy. Assessing achievement motivation independently from the task at an alternate time could

have been beneficial in reducing the direct impact of task involvement on these motivational measures.

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Conclusions

In conclusion, a memory advantage for unsolved anagrams compared to solved anagrams could be observed, particularly among individuals high in hope of success. Conversely, recall did not show any significant association with fear of failure. The finished status of unsolved anagrams suggests that the experience of discrepancy between anticipating success and subsequent failure are key factors contributing to the better recall of interrupted tasks. In other words, the memory advantage of interrupted tasks is not a product of lingering tension, but rather the result of a discrepancy between expected and actual performance.

Author Contributions

R. Ghibellini and B. Meier wrote the manuscript and approved the final manuscript for

submission.

Declaration of Conflicting Interests

The authors declared that there were no conflicts of interest with respect to the authorship or

the publication of this article.

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Supplementary Material

The Supplementary Material is available at: qjep.sagepub.com

Data Accessibility Statement

The data from the present experiment are publicly available at the Open Science Framework

website: https://osf.io/xb6aq/.

Open Science statement

This study was not preregistered.

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Figure Captions

Figure 1

Association of Achievement Motivation and Memory Performance: (A) Hope of Success and (B) Fear of

Failure Scores Predicting the Recall of Solved and Unsolved Anagrams

Note. Shaded areas display 95% confidence intervals.

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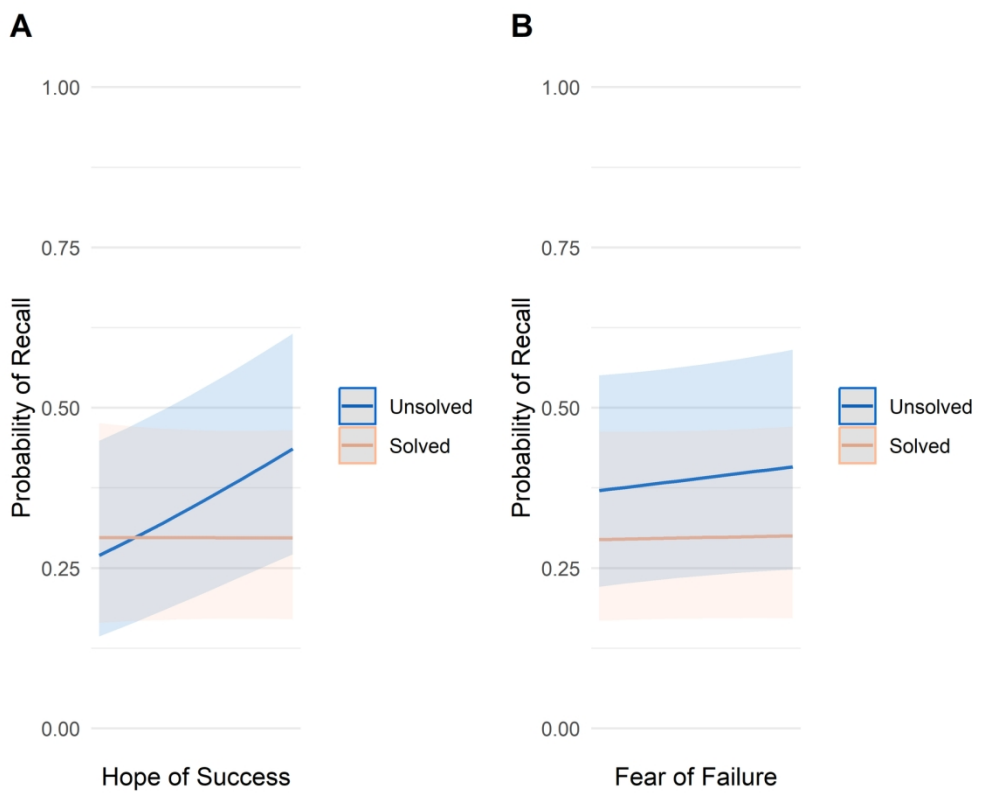51
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Figure 1
Association of Achievement Motivation and Memory Performance: (A) Hope of Success and (B) Fear of Failure Scores Predicting the Recall of Solved and Unsolved Anagrams
Note. Shaded areas display 95% confidence intervals.

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